Global Telemedicine and eHealth Updates: Knowledge Resources

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Editors
Malina Jordanova and Frank Lievens

ISfTeH
International Society for Telemedicine & eHealth
Preface

The fifth volume of the series “Global Telemedicine and eHealth Updates: Knowledge Resources”, is now in your hands.

With 144 papers from 50 countries, the book presents a collective experience of experts from different continents all over the world. Papers reveal various national and cultural points of view on how to develop and implement Telemedicine/eHealth solutions for the treatment of patients and wellbeing of citizens.

Year after year the series “Global Telemedicine and eHealth Updates: Knowledge Resources” provide a glimpse and summarize the most recent practical achievements, existing solutions and experiences in the area of Telemedicine/eHealth.

Brought to life by contemporary changes of our world, Telemedicine/eHealth offers enormous possibilities. The technological solutions are available and ready to be implemented in healthcare systems. If carefully implemented, taking into account the needs of the community, Telemedicine/eHealth is able to improve both access to and the standard of healthcare, and thus to close the gap between the demand for affordable, high quality healthcare to everyone, at any time, everywhere, and the necessity to control the increase in healthcare budgets worldwide.

Telemedicine/eHealth is already a must, a fantastic challenge for the future, but it must be based on cooperation and coordination at all possible levels. It requires networking and planning, readiness to learn from others, and avoiding re-inventing the wheel. The main challenge is to be sure that available options are used optimally and in a coordinated manner as to ascertain that the desired effects do come true and the resources are indeed not diverted away from basic needs.

We are convinced that this book will provide useful information to those who are preparing to introduce Telemedicine/eHealth in their regions or countries. It will allow them to rely on the experience of others and will make them aware of the benefits and problems that were encountered during and after implementation of systems or services, and as such help them to avoid mistakes and reduce potential problems.

Yet, it is necessary to underline that:

- The content of the book is divided in chapters covering various areas of eHealth;
- Chapters and papers in each chapter are listed alphabetically;

...
The original style of the authors was respected as much as possible;

In the content, after the title of papers a maximum of 3 to 4 co-authors are listed, while the rest are marked as “et al”;

“How”, “Where”, “When” and especially “How Much” – are only part of the questions that authors are trying to answer.

We hope that everyone involved in Telemedicine/eHealth will find this book not only interesting, but most valuable as well.

Enjoy your reading!

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Benefits of Free/Libre Open Source Software in Health Care (FLOSS-HC)
Creation of an Integral Distributed Teleophthalmology System

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Abstract: Information and Communications Technologies (ICT) have opened new possibilities for information exchanging in the healthcare environment. New ways of medical assistance become possible, including remote medical assistance, promoting the increase of cohesion between the trinomial: patient, general practitioner and specialized physician. In this context, teleophthalmology can be defined as the application of ICT in the ophthalmology care of the patients, and it covers some facets as making diagnosis, monitoring disease evolution, preventive and teaching activities. This article describes the experience of applying teleophthalmology workflows in the public healthcare system of the province of Ávila, Spain.

Introduction

Telemedicine could be defined as the application of Information and Communication Technologies (ICT) in activities related to healthcare. It has three dimensions: telecommunications, information sciences and healthcare services.

In this context, teleophthalmology can be defined as the application of ICT in the ophthalmology care of the patients, and it covers some facets as making diagnosis, monitoring disease evolution, preventive and teaching activities.

As a result of social-demographic conditions of Castilla y León region (old people living in a big extension where some areas are difficult to access), it is essential to create a teleophthalmology environment to perform early pathology detection screening programs for avoidable blindness prevention.

Objectives

The main objective with this project is to create a complete teleophthalmology system that allows establishing programs for diagnostic coordination between primary care and specialized physicians. This system
should guide and aid physicians starting from the image acquisition until final report creation.

One of the main milestones of the project is to develop a computer-aided diagnosis tool for eye fundus images based on open-source tools.

Design

A new CADx (Computer-Aided Diagnosis) tool is going to be designed: Ginkgo CADx [1]; this tool will be integrated with the Electronic Medical Record (Jimena) using HL7 standard for sending medical records. DICOM will be used to transfer and store clinical studies.

Tele-ophthalmology workflow is composed of five steps:

1. Creating teleophthalmology appointment. General practitioners are responsible of appointment scheduling based on an established protocol (e.g. diabetic people with more than 60 years). Appointment is created in primary care electronic record system: Medora.

2. Image acquisition and inter-appointment creation. These processes are realized with the hospital's Electronic Health Record (EHR): Jimena.
   - Once patient is selected, practitioner has to choose the kind of inter-consultation required (Diabetic Retinopathy DR, Hypertension HTN, Age-related Macular Disease AMD or others) and the priority. Application provides a specialized form template for each kind of patient with specific variables codified in LOINC.
   - Image acquisition is made without pupil dilation, and mydriasis will be induced only if quality of images is not enough to perform an analysis. The criteria for number of images is 9 images of each eye for diabetic patients, 3 images of each eye for HTN patients and one of each eye for AMD patients [2-5]. Images are converted to DICOM using Ginkgo CADx dicomization workflow.

3. General practitioner report creation. General practitioner that has passed a training course is able to make reports and commit an inter-consultation.
   - Firstly a list of pending report is shown; practitioner opens one of the reports. Then collected data and thumbnails of mosaic images generated by Ginkgo CADx will be shown.
   - If practitioner clicks over any thumbnail, Ginkgo CADx is opened in ophthalmologic viewer mode. Program acquires images from PACS server and opens those allowing user to
- use specific tools like mosaic navigation, virtual aneritra images, zoom, measure tools...
- Once images are reviewed, practitioner has to fulfill the report: description of the injuries detected on the eyes, main and secondary diagnosis, DR severity, macular edema severity, HTN scale, AMD scale, option to set if patient has to be forwarded to specialized attention, recommendations and subjective observations.

1. Ophthalmologist review. Ophthalmologist supervises non committed reports made by general practitioners. Ophthalmologist can open forms described before and also use Ginkgo CADx features. Once report is committed in the EHR application, it is automatically available to other professionals.

2. Data review. Jimena offers the possibility of looking up reports; view images and obtain a complete report in PDF format.

Figure I: Overview of teleophthalmology system

Methods and Materials

There is a retinographs network installed in primary care centers connected with a centralized Electronic History Record (EHR) system called Jimena. Finally a Picture Archive and Communication System (DCM4CHEE) are available in the environment.
Results and Conclusions

This scheme has been successfully established and tested in Ávila province, capturing more than 70,000 retinal scans from more than 6,000 patients. These images have been diagnosed coordinately by primary-care and specialized physicians. In conclusion, a robust teleophthalmology system has been developed based on open-source tools and international standards and it is ready to be integrated in other medical environments.

Table I: Some statistics of the teleophthalmology system

| Number of reports registered in the system | 6350 |
| Number of primary care centers participating in the program | 11 |
| Overall size of images stored in PACS | 150 Gb |
| Average size of DICOM studies | 24 Mb |

Acknowledgments

The authors wish to thank Sacyl (Sanidad Castilla y León) for their funding contribution and their support. The department of IT of the Ávila Hospital and general practitioners of the province of Ávila are acknowledged for their support and advice.

References


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Carlos Barrales is a senior medical computing consultant at MetaEmotion. He is specialized in computational geometry, visualization and medical integration standards. He is an expert in VTK and ITK frameworks and currently leads the Ginkgo CADx and HydraDICOM development. His research interests are in scientific visualization and geometry processing.
Embracing eHealth: Free and Open source (FLOSS) Opportunities in Kenya

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Abstract: Information is a vital resource for health care and Free and open source software (FLOSS) has emerged and is promising in improving access to healthcare information cheaply and reliably. However, its application is limited and poorly supported in many countries. The study aims at establishing challenges of adoption of FLOSS in implementing e-health solutions in Kenya and its potential benefits. It is based on two exploratory research studies done in Kenya, on FLOSS use and e-health readiness among the Health Facilities in Kenya. Data was collected and analyzed to indicate the degree of readiness in terms of facilities, infrastructure and skill levels of staff and consumers of the information. Findings of the study indicate that the penetration of FLOSS, in the country is poor and not supported by both the Government and big industry players. Secondly, the main motivation for commercial users is to reduce the costs of business. FLOSS applications are used as backend systems because of its strengths and fact that support staffs have requisite skills to maintain them. The ordinary users prefer proprietary software because of perceived ease of use. On the eHealth readiness, findings indicate unpreparedness of the health sector to adopt ICTS in facilitating the access to information. Government intervention is at its infancy and requires a lot of boost in policy formulation, training and in partnering with key players. The main challenges are illiteracy, rigidity and lack of infrastructure. In conclusion, there is a great relationship between the adoption of e-health and degree of government investment in form of infrastructure, policy formulation and implementation and on education.

Introduction

Free/Libre Open Source Software refers to any software which may be copied and used freely and at minimal costs. FLOSS has become a viable alternative to proprietary software development in several business areas. However in Africa, the use of FLOSS in health care and in business is still rare. There is no documented study that has been done on the state of FLOSS in Kenya’s Health sector. In Europe, parts of Asia and the Americas the application of eHealth and in particular the use of FLOSS in eHealth has taken of and its development is at different levels [1-2]. FLOSS has many
advantages to governments, institutions, and individuals [3]. If well implemented and supported, it would help in bridging the digital divide in health care [1, 6].

The study is based on two studies done separately on the state of ICTs in Kenya. First phase looked at FLOSS adoption generally. The second phase targeted eHealth readiness in five districts that make up the larger Embu County. Both studies were exploratory based on surveys done by interviews and questionnaires applied to the stake holders.

State of FLOSS in Kenya

Kenya’s ICT policy is currently developing and adequate measures to ensure that Open Source Software is considered as a viable choice when procuring software for public use. There is slow growth in the adoption of FLOSS and presently, the market share of FLOSS is small. This is due to lack of support by the government and the big industry players. This has led to many potentially profitable and socially beneficial ventures not being undertaken or abandoned midstream in the application of FLOSS [4-5]. This signifies an immense economic, social as well as a technological loss for Kenya when compared to other countries that have been able to capitalize on the FLOSS development industry and in the process accrued immense benefits [1]. Many young people with a background in computing are embracing the FLOSS approach and trying to reform the accepted practice of acquiring unlicensed software.

State of eHealth in Kenya

Public health care faces many challenges in many counties; these include isolation, lack of funding, lack of skills, political manipulation, and infrastructure [7, 9]. Many of these can be mitigated by the use of ICTs and in particular the use and adoption of eHealth systems [6, 8]. Kenya’s Health sector is developing and slowly automating and integrating health systems. The initially separate attempts of individual private sector entities and a few public facilities are now being integrated as pilot projects to provide eHealth services to the public. The government has partnered with the development partners to extend, deploy and maintain these platforms. There is however minimal use of FLOSS.

Table I: The main reasons why FLOSS or Proprietary software is used in the in the organization

<table>
<thead>
<tr>
<th>Software Type</th>
<th>Main reasons for use are</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open source software</td>
<td>Cost/ cheap/free</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Virus free</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Availability of support</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 1 indicates the main reasons people use either proprietary or FLOSS. The main reasons why the FLOSS is not preferred are: difficulties in learning, i.e. non user friendly especially to the non technical users, lacks support and have compatibility problems with most proprietary applications. It is however preferred because of low cost or free licenses resilience to viral attacks. Proprietary software is considered acceptable mainly because unlicensed versions are easily available in Kenya. Its user friendly and there is availability of support. Generally the main reasons for adopting proprietary and FLOSS are perceived customer satisfaction and cost saving respectively.

Other reasons according to the users are due to lack of a ready skill base and lack of vendors and trainers and because of its meager market share especially in desktop market. On the server side FLOSS is supported by the techies and is preferred because of its resilience to viral attacks, cheap in the long run and the fact that the software does not need (expensive) reliance on the vendors. Since proprietary software is available at low cost (albeit pirated/unlicensed) forms has also helped in discouraging penetration of FLOSS. The study indicated that use FLOSS in organizations reduces the cost of IT investment. However, such cost savings are not passed to the users in ways that would address unequal access to IT (digital divide).

eHealth status in Embu County

The second phase of the study was done to determine the eHealth readiness in the country. Samples of the Embu county districts were selected and data collected, analyzed, a snapshot of which is presented below. The data indicated dire state of affairs as far as the eHealth status is concerned. One hundred and ten (110) respondents participate, representing 120 out of 144 Health Institutions (H.I) in the county of Embu. They included nurses, clinical officers and health administrators.
Table 2: Distribution of Facilities and Their Use in the Districts

<table>
<thead>
<tr>
<th>Type of Institution</th>
<th>Siakago and Mbeere District</th>
<th>Embu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of H.I</td>
<td>No. PC</td>
</tr>
<tr>
<td>FBO</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Government</td>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>Private</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGO</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>10</td>
</tr>
</tbody>
</table>

Analysis

The first study established that adoption of FLOSS is mainly at the micro and meso level, i.e. individuals or small organizations and large institutions respectively adopted FLOSS, similar to findings of studies [4-5]. The study identified that health facilities had common challenges of infrastructure, lack of funding to train and maintain a fairly literate staff base to support these eHealth systems. It was also established that the lack of policy framework exacerbated the problem of eHealth unpreparedness. The skill levels of the staff were also not accentuated to appreciate eHealth.

Implementing FLOSS in developing countries has many hurdles. Some are general, while others are specific to some countries. Generally there is strong resistance to change to FLOSS. Many new FLOSS users view it as inferior software. This often a biased judgment based on their experience compared with proprietary software. Proprietary software producers need to adhere to International Standards or completely opens up their own standards [4].

Support is necessary from the western nations on implementation of FLOSS and in fighting of unlicensed software. Finally, organizations working with developing countries must adopt FLOSS as a standard as they communicate with their counterparts in the developing world to spur the development potential and adoption of FLOSS in Africa and Kenya.

These problems are mirrored in the Kenya health sector. eHealth is picking up (notably with the recent release of the national eHealth strategy) but still requires lots of support from all. Western nations are already piloting eHealth projects e.g. the District Health Information System (DHIS) which is now nationwide in public facilities. The private sector eHealth facilities are slightly ahead of the public health institutions because easy access to resources. To improve application of FLOSS in health care, a coordinated action of stakeholders is needed.
References


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How to Make Use of a Wiki for Knowledge and Information Management in an Imaging Department

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Abstract: Using a wiki software system to organize knowledge and information flow in an effective way. High quality, efficiency and cost-effectiveness in an imaging department demand optimal work flow. Knowledge and information management are core tasks to achieve these goals [1]. While systems like PACS (Picture Archiving and Communication System) and RIS (Radiology Information System) facilitate efficient patient related work flow in a fully digitalized imaging department, there is no common tool to manage institutional knowledge and related information. This tutorial illustrates an easy way to create a wiki knowledge base, which organizes knowledge and information in an effective way with a minimum of technical effort.

Introduction

High quality, efficiency and cost-effectiveness in an imaging department demand optimal work flow. Knowledge and information management are core tasks to achieve these goals [1]. While systems like PACS and RIS facilitate efficient patient related work flow in a fully digitalized imaging department, there is no common tool to manage institutional knowledge and related information. "The Internet, and most notably the Web 2.0 movement, is introducing some overwhelming changes in our society. Research and teaching in the hospital setting will join this current and take advantage of these tools to socialize and improve knowledge management” [2]. This demonstration explains how to use open source software using the wiki paradigm in an imaging department. The software allows easy creation and editing of any number of interlinked Web pages, using a text editor within the web browser. Furthermore it’s a full sized storage, and search software that stores all types of specific information the radiologist needs.

Procedure Details

The purpose of this project is to demonstrate how radiological knowledge may be condensed in a wiki to improve the quality of service. Facts and information can be condensed to knowledge through five steps. Fig.1 shows the process.
Getting the right information to the right radiologist at the right time by a wiki can improve user centered networked health care.

As Johann Wolfgang von Goethe said: "You only see what you know!"

Xwiki [3] is a useful tool for knowledge and information management. The full functional open source Web 2.0 wiki system provides:

- Integration of a high-performance text search engine that is also capable of searching attachments such as PDF or MS-Word documents;
- WYSIWYG (What You See Is What You Get) text editor. Wiki link engine with parent and child links guiding to related information;
- Possibility to create and update content which allows for collaborative work of a great number of web authors;
- Categorization of content by users broadening the taxonomy scheme;
- Extensions software that makes the wiki also an application platform as well as a document server.

Conclusion

This tutorial illustrates an easy way to create a wiki knowledge base in an imaging department that organizes knowledge and information in an effective way with a minimum of technical effort.

Acknowledgment

Thank you to the Open Source community for their valuable contribution.
References


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MECES (www.diagnomx.eu) – An Open Access, Secure, And Multi Language Medical Communication System

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Abstract: Herein, theory of and practical experiences with the user friendly, Medical Electronic Expert Consultation System (MECES, www.diagnomx.eu) are described.

Theoretical considerations: The demands of an adequate communication system that acquires and transfers medical information can be fulfilled by use of open access sources and tools.

Development and implementation: MECES uses a common forum framework. Implemented tools include handling of virtual slides, interactive image magnification and navigation, private data protection, creation of medical reports, mobile access, on-line discussions, and automated multi-language translation.

Experiences: The system has been tested for over 100 cases, between developing and developed countries, and private practices. It is a multi functional tool applicable for different medical tasks, and for teaching or continuous education.

Perspectives: At present MECES is a high performance medical communication system. In future it will be expanded with our general medical information systems (ELIAS, Electronic Information Archiving System), with automated measurement system (EAMUSTM), and automated diagnosis assistant system (ADIAS).

Introduction

Communication is the transfer of information between several vertices which can act as source or receiver or both [1-2]. Electromagnetic signals are transformed into human understandable information, which includes speech and images. Certain boundary conditions form the framework of the network. They are related to the required performance and define the user groups [3-4].
Medical communication is also embedded in a framework of limitations, such as financial conditions, available technology and reliability, human performance, demands of the society, behavior of patients, and access to disease recognition and treatment places [5-9]. Successful telemedicine has to take into account these conditions [10].

What is the theoretical background and which conditions have a successful telemedicine network to meet? These questions will be answered in the following, hopefully to the reader’s satisfaction.

Theoretical Considerations

Human communication depends upon interactions between individual knowledge and information “environment” which can be assessed actively or passively [3, 11].

One can try to describe general conditions of successful communication in medicine, and to derive practical rules that permit to:

1. Forecast the development of communication systems;
2. Estimate the mandatory conditions for success;
3. Implement tools that obey or include the proposed regulations;
4. Measure the obtained results.

Any proper medical communication includes a consistent and reliable recognition of the patient’s health condition (diagnosis) and therapeutic action “at the patient’s place”. As direct consequence telemedicine can be only as good as the medical actions on-site. This statement is of importance when applying telemedicine in developing countries, especially if it is aimed to improve the medical service.

The second derivative is that both diagnosis and therapy have to be at the “same medical level” if the costs should be minimum. High investment in diagnosis is wasted if the consecutive therapy is not available [5-6, 12-15].

A successful telemedicine should include both speech and vision. In online modus speech is the appropriate communication medium [3, 16-17]. Chat could be a replacement of speech transfer, however combined transfer such as video conferencing is preferable [18-19].

Communication requires an understanding between source and receiver, i.e. standards [20-22]. Common standards are language, security keys, picture archiving and communication system (PACS), Digital Imaging and Communication in Medicine (DICOM), Institute of Electrical and Electronics Engineers (IEEE), medical guidelines, and others [13, 20].

Medical communication aims to release of the doctors’ work burden which can be obtained by automated measurement systems such as EAMUSTM (www.diagnomx.eu/eamus) [13, 20, 23-24]. Medical information addresses different knowledge at different locations and times.
Open access systems appear to generate a new era in social behavior, so-called social forums (facebook, etc.) or dictionaries and lexica (www.dict.leo.org, www.wikipedia.org).

Implementation of an Open Access Medical Forum (MECES)

The described theoretical framework explains the implemented features, which in MECES combine the following issues (see also Fig. 1):

1. Communication aim {risk <> diagnosis <> therapy <> follow up}
2. Information area {pathology <> radiology <> endoscopy <> …}
3. Information carrier {image <> speech <> table <> function}
4. Information type {primary <> expert <> literature}

These tasks can be fulfilled by internal structures with fixed communication pathways, external information nodes such as Skype, applets, and image measurement systems (EAMUSTM), and that run under different operating systems (Unix, Windows, Android, etc.) [25].

These requirements have been integrated into the Medical Electronic Communication Expert System (MECES) that uses a common forum framework written in php language. The framework permits the creation of medical cases with secured private data. Still images and virtual slides can be uploaded. Connection to specific servers allows information modification, analysis of image quality, and image measurements (EAMUSTM), access to the National Institute of Health (NIH) library, or scientific journals (www.diagnosticpathology.org). Both on-line (chat, videoconferencing) and off-line communication (email, SMS, etc.) are included. Still images are viewed by a specific viewer, VS by the vendors’ viewers. Medical reports are created on demand. Automated multi-language translation is in its test phase.

Experiences with an Open Access Communication System (MECES)

The present stage and future expansion of MECES are shown in Fig 2. The system has been tested for tissue – based diagnosis in more than 100
cases. Most of the cases have been acquired in developing countries. Others have been used for board examination.

The performance of the system was judged to be good – very good. No breakdowns or other handicaps have been noted so far.

**Perspectives**

MECES is an internally hierarchic organized distributed dynamic communication network in medicine, and fulfils all demands of innovative communication, data distribution, flexibility and technology development in medicine to our experiences. It can be adjusted to additional business such as medical continuous education or scientific publication. Indeed, an operative connection with the open access scientific journal diagnostic pathology will create new tools accessible for education, and routine work. The basic strategy perches on distributed communication with flexible edges and specialized nodes, in accordance with the communication rule that information increase can be only attained from different (distributed) sources and not from the same source [1]. In other words MECES is a suitable tool to assist both the individual patient and the medical community to improving the patient’s health condition and the medical knowledge in general.

**References**


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Moodle Report: The Cornerstone between Teaching Activities and Students' Performance

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Abstract: Moodle report helps understanding the correlation between students’ activities and students’ learning performance.

Introduction

Moodle [1] is an open source e-learning platform, also known as a Learning Management System (LMS), which is used as a tool to host online courses. It allows for all online learning activities to be tracked [2], a feature we have used to find out if there is any relationship between learning activities and students’ performance. The data used in this analysis, was extracted from the 2011 English version of the electronic Short Course on Antiretroviral Treatment (eSCART). The eSCART is an online tutor-guided course, lasting four months, that runs once a year in English and once in French. The content is generated using eXe Learning software, and then organized into 13 modules published on Moodle. Prior to the start of the course, students, physicians working in the field of HIV/AIDS care in resource limited settings, receive a DVD containing a back-up of all the lectures, this allows them to access some heavy files offline if needed.

In order to get the students acquainted to the Moodle system an introductory week is foreseen before the lectures start. Each module requires regular participation of the students to forum discussions linked with each topic. However, their online participation is not only limited to interactions on the discussion forum, they are also required to participate in a group assignment on “how to conduct a literature search”, complete quizzes, assignments and some social activities.

A Learning Management System for distance education is crucial for Quality assurance, in order to monitor the learning activities for analysis and corrective actions [3].

We examined the relation between the time spent on learning activities and the performance of the students.

Material and Methods
At the end of 2010, 38 students were selected to follow the English version of eSCART. Moodle version 1.9 was used to trace the learning activities. To calculate the time spent online for each activity, the Course Report, Use Time Based Progress Report plug-in made by Valery Fremaux, was installed [4].

A survey at the end of the course was conducted to estimate the time students spent offline for each module. Thirty-two students (84%) submitted a percentage breakdown of the total time they spent studying online and offline. We have matched data retrieved from the Moodle database with the results of this questionnaire completed by the students.

Information from the survey and data from Moodle were merged to create a single dataset. This dataset was analyzed using STATA 11.

Results

Figure 1 below shows that there is a significant correlation (p-value: 0.002) between the total time (online + offline) the students spent for all the learning activities, including social and group work, and their performance (measured as final grade).

We were particularly interested in the use of self-assessments. The more time students spent on self-assessments the higher their final grade (p-value: 0.009) (Figure 2). Interestingly, in modules that have several assessments, we see a decline in the use of self-assessments as the module advances.

Figure 1. Total time spent in days on activities vs final grade
On the other hand, there are two modules, with only one self-assessment, and the LMS showed that they received relatively few visits (virology and tuberculosis). This requires further analysis of the reasons why.

Conclusions

The time students spent on all the activities impacted on their overall performance.

Self-assessments are an important tool, but it is important to place the relevant information in the first exercises, because interest in these decreases as students progress through the exercises.

Analysis of data in a LMS helps to improve the course design and to inform the participants in advance on how much time they need to spend on the course online or offline.

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References


Biomedical Informatics
A Multi-Modal Biosignal Based Approach to Stress Detection

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Abstract: Organizations typically assume that their employees will benefit from and should be dependent upon the utilization of computer based technology on a daily basis. That Human-computer interaction (HCI) may induce stress for a variety of reasons is also well known. Typically, HCI based applications are not equipped to manage user stress – as most applications were designed and developed before these issues became relevant. Stress is known to reduce productivity and related issues that impact the organization and staff members negatively. Having an integrated mechanism that can detect stress would seem to be a very useful tool that could be the starting point for providing solutions that aim to relieve stress in the HCI aspect of the workplace. This study investigates the deployment of a biosignal (EEG, ECG, GSR, respiration, etc.) based approach for the detection of stress during HCI.

Introduction

Computer users often get stressed in their day to day dealing with their machines. For instance, a user may be confused when navigating through a complex application and because of time constraints, may feel under stress/pressure. Another interesting scenario which may induce stress is when a person is trying to hack into a computer system. Both scenarios induce stress, but for very different reasons. This study was designed to determine if stress can in fact be reliably measured using a range of biosignals (i.e. EEG, ECG, EMG, GSR, respiration), and further, whether each stress class yields a unique signature. From the biosignals, a set of features are extracted, and instantiated with values that yield a signature for a given user. These signatures were developed by exposing the users to various types of stress inducing environments. By instantiating values for features within two stress inducing scenarios relative to control conditions, the system is able to determine on a per user basis, what type of stress they are currently feeling. Integrating this ability into the IT infrastructure may provide a mechanism that will be able to maintain stress levels within tolerable limits.
Experiment

We conducted a study to measure the effect of stress on several biosignals. The study was to ask subjects to hack a user password giving some knowledge of the user profile in a certain time limit. The fastest subject to hack the password would get a monetary reward. All the subjects were male university students between the age of 18 and 20. Each Subject was seated in quite room with normal lighting. The subject was seated on a comfortable chair and uses a laptop to execute the experiment. The subject were fitted with an Emotiv headset to measure the Electroencephalography (EEG) signals, sensors from a Vilistus system to measure Electrocardiography (ECG) mounted on the chest, Blood Volume Pulse (BVP) mounted on the left ear, Galvanic Skin Response (GSR) mounted on the palm of the left hand, Electromyography (EMG) mounted on the face around the eyes and respiration mounted above the diaphragm.

After the subject is prepared, he was given a briefing about the system steps and we record a few minutes of data then the experiment starts. The experiment was divided to the following phases:

1. Reading: User reads and article for 2 minutes;
2. Transcriptional Writing: User is shown a split screen, on the top side the user sees the article he already read and the bottom part he is requested to type it, task should take 5 minutes;
3. Login: Authenticating the subject with his university account;
4. Reading: User reads an article about how to guess a user password for 2 minutes;
5. Hacking: The subject is provided with a fake user profile that contains various information about a person such as name, date of birth, hobbies, mobile number and address. The subject is also presented with a standard login screen to try to guess the password. We assume in our case that the username is already known. The subject would try to hack the user password in a total of 5 minutes. During the first minute the system provides not feedback to the user except weather the entered password is correct or not. In the second minute the system starts to show the subject the number of correct characters in each attempt to enter the password and the positions of the correct characters without putting the characters themselves on the screen. There is a ten character slot area on the screen we show asterisks in the corresponding location. At minutes three the system shows on the screen half the correct characters guessed by the user at minute two and continues to behave as minute two. At the last two minutes with each attempt the system reveals the correctly guessed characters. There is a time visible at all
times counting from five minutes downwards updated every second. At
the last minute the counter turns red.

6. **Authentication:** After the subject finishes the hacking phase, an
authentication login box is shown where the user is required to enter the
username and password of the user he is trying to hack. If the subject
failed to guess the password in the allotted time, the system will show
the password for him.

After the data was collected it was stored and imported to Matlab for
preprocessing. In this paper we discuss the effect of task completion
induced stress versus the stress associated with deception – via a password
hacking exercise. The basic task of this study was to determine whether
stress during machine-person interaction could be induced and detected. If a
user was deemed to be stressed during machine interaction, then this would
signal an alarm. If the stress occurred during the authentication phase –
prior to any computer related task, then the system should deem this attempt
as suspicious and raise the appropriate alerts. Furthermore, from a more
general perspective, having knowledge of the stress level of computer users
is a very valuable tool. There are several types of stress – one of which is
termed ‘task completion,’ the typical type of stress most of us have
experienced at one time or another. The specific question addressed in this
study is whether task completion stress is distinguishable from a deception
based stress response. To this end, we asked a collection of 6 subjects to
undergo a series of activities that were stress inducing, both in the context
of task completion and deception. While the subjects interacted with the
application, GSR, ECG, and EEG data was collected continuously for a 15
minute experiment. The results of this experiment are presented in the next
section.

**Analysis and Results**

The HRV was obtained using a method which determines the distance
between the peaks of each heart beat, which is a derived feature obtained
from ECG data that correlates positively with general stress levels. The
peak of the QRS wave is sought for all heart beats, and the time between
peaks is measured (variation in beat-to-beat interval). Variations in beat-to-
beat intervals is recorded and used to access the physiological stress the
subject may be experiencing [1-2]. The experiment of induced hacking was
designed to simulate the expected stress levels associated with a time
based/deception task and it is reasonable therefore to assume that the
subject will experience stress. Table I indicates that indeed, both the task
completion test (Phase II in table 1) and the deception/hacking task (phase
IV in Table 1) both indicate a positive change in HRV.
Table 1. Heart rate variability presented as the average across all subjects for each experimental phase. HRV was measured as the coefficient of variation (CV) for the last 100 heart beats in each phase.

<table>
<thead>
<tr>
<th>Phase I</th>
<th>Phase II</th>
<th>Phase III</th>
<th>Phase IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3%</td>
<td>1.1%</td>
<td>0.5%</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

Furthermore, the EEG data also indicate that stress induced changes in the spectral power of the alpha band was evident in both task completion and the hacking/deception task (data not shown). The task completion task (timed typing) was statistically different from the control, but less than that for the deception/hacking task. These results demonstrate that HRV and basic power spectral analysis from EEG derived data can indeed, under the right experimental conditions, provide direct evidence of stress induction during machine-person interaction [3]. These results demonstrate that not all stresses are alike – that task completion and deception – at least as defined in this study, yield unique and measurable signatures using standard biosignal recordings and post-processing pipelines, all performed in real-time.

References


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Applying Machine Learning To Predict the Progression of HIV Infection Using CD₄

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Abstract: The South African Department of Health listed HIV/AIDS as being one of the top four health priorities in the country. HIV infection can be effectively managed with antiretroviral drugs but close monitoring of the disease progression is vital. One of the best available surrogate markers for HIV progression is the use of CD₄ cell counts. Determining if a patient’s CD₄ count is less than 200 is important in CD₄–guided treatment of HIV. In developing countries, the measurement of CD₄ requires many complex and expensive flow cytometric procedures which burden the minimal resources available. Machine learning may also be used to predict CD₄. The aim of this study was to apply neural networks to produce a classification mathematical model that can predict a measure of CD₄ at an individual HIV-1 positive patient level. The dataset used for the training and testing of the neural network contained protease or reverse transcriptase genome sequences, CD₄ counts and viral loads, and was obtained from the Stanford HIV drug resistance database (http://hivdb.stanford.edu/). These de-identified datasets are publically available. The input into the neural network consisted of viral load, genome sequence and number of weeks the CD₄ count was taken from baseline CD₄. The output of the neural network classification model was either that the CD₄ count was greater than 200 or less than 200. The neural network model produced an accuracy of 81%, sensitivity of 78%, and specificity of 84%, positive predictive value of 74% and negative predictive value of 86%. Results obtained from this study indicate that a measurement of CD₄ can be successfully predicted using machine learning. Predicting if a patient’s CD₄ count is less than 200 is possible using protease and reverse transcriptase genomes, viral load and number of weeks from baseline measure. Future work should include using other machine learning techniques and importantly using standard of care data as predictors in the model.

Introduction

The current trend in patient healthcare is personalized medicine were treatment is individualized, rather than a response to set physical presentations. Thus, access and interpretation of personal patient information is vital, in order to provide a sustainable and useful medical
service. HIV infection can be effectively managed with antiretroviral (ARV) drugs but close monitoring of the disease progression is vital. Laboratory [1, 2] and clinical [3, 4] markers of disease progression can monitor HIV infection.

One of the best available surrogate markers for HIV progression is the use of CD₄ cell count information [5, 6]. In developed countries and areas where there is a low rate of HIV infection, CD₄ count is recognized as a standard measure of immunodeficiency in HIV positive patients [7]. In developing countries, the measurement of CD₄ requires many complex and expensive flow cytometric procedures, which burden the minimal resources available [6].

Machine learning may also be used to predict CD₄ information. Machine learning is an artificial intelligence computer science technique that tries to find a mathematical model that maps between inputs and outputs of a domain problem. There are two stages of using machine learning techniques. These are creating the mathematical model by learning mappings between given input and output. The second stage is using the model to predict an output, given unseen input.

The aim of this study was to apply machine-learning techniques to produce a mathematical model that can predict a measure of CD₄ at an individual HIV-1 positive patient level, i.e. whether a patient’s CD₄ count is less than 200. This amounts to using machine learning to create a classification mathematical model.

Material and Methods

Separate patient datasets containing protease (PR) or reverse transcriptase (RT) genome sequences, CD₄ counts or viral loads were obtained from the Stanford HIV drug resistance database (http://hivdb.stanford.edu/). These de-identified datasets are publically available.

Protease genome sequences, CD₄ count, viral load and the number of weeks from the baseline measure of CD₄ for each patient sample was determined by joining individual datasets using sample identifier (unique number that identifies a sample) and date. This was also done for reverse transcriptase, creating two datasets to apply the machine learning techniques on. The protease dataset consisted of approximately 4500 data elements, while the reverse transcriptase dataset contained approximately 2500 sequences. Each protease sequence consisted of 99 amino acids from position 1 to 99, and each reverse transcriptase sequence comprised of 201 amino acids from position 40 to 240. The sequences were processed such that at any position a 1 represented an amino acid mutation and a 0 represented no mutation.
Input into the machine learning model consisted of viral load, genome sequence and number of weeks the CD4 count was taken from baseline CD4. The outputs of the machine learning model are shown in Equation 1.

\[
\text{Classification} = \begin{cases} 
1, & \Delta CD_4 < 200 \\
0, & \Delta CD_4 \geq 200 
\end{cases}
\] (1)

Results

Accuracies, sensitivities, specificities, positive predictive value (PPV), and the negative predictive value (NPV) for neural network models is shown in Table 1. Accuracy was defined as the percent of correct predictions. Sensitivity was calculated as the number of predicted patients whose CD4 counts were greater and equal to 200, compared to all patients whose CD4 counts were greater and equal to 200. Specificity was determined by calculating the number of predicted patients whose CD4 counts were less than 200 compared to all patients whose CD4 counts were less than 200. Positive predictive value is defined as the proportion of patients with CD4 less than 200 who are correctly diagnosed, similarly for negative predictive value.

Table 1: Showing the Accuracies, sensitivities, specificities, positive predictive value (PPV), and the negative predictive value (NPV) for neural network model

<table>
<thead>
<tr>
<th></th>
<th>Accuracy /%</th>
<th>Sensitivity /%</th>
<th>Specificity /%</th>
<th>PPV /%</th>
<th>NPV /%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR</td>
<td>77</td>
<td>76</td>
<td>81</td>
<td>74</td>
<td>83</td>
</tr>
<tr>
<td>RT</td>
<td>85</td>
<td>80</td>
<td>87</td>
<td>74</td>
<td>90</td>
</tr>
<tr>
<td>Average</td>
<td>81</td>
<td>78</td>
<td>84</td>
<td>74</td>
<td>86</td>
</tr>
</tbody>
</table>

Discussion

Results obtained from this study indicate that a measurement of CD4 can be successfully predicted using machine learning. Predicting if a patient’s CD4 count is less than 200 is possible using protease and reverse transcriptase genomes, viral load and number of weeks from baseline measure.

Accuracy was defined as the percent of correct predictions. Sensitivity was calculated as the number of predicted patients whose CD4 counts were greater and equal to 200, compared to all patients whose CD4 counts were greater and equal to 200.
greater and equal to 200. Specificity was determined by calculating the
number of predicted patients whose CD\(_4\) counts were less than 200
compared to all patients whose CD\(_4\) counts were less than 200. Positive
predictive value is defined as the proportion of patients with CD\(_4\) less than
200 who are correctly diagnosed, similarly for negative predictive value.

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count using total lymphocyte count: A sustainable tool for clinical decisions during
Building OBR-based OWL Ontology for Viral Hepatitis

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Abstract: Ontology of Biomedical Reality (OBR) is a recent framework for building biomedical Ontologies to facilitate inferences across the boundaries in anatomy Ontology, pathology Ontology, etc. Liver viruses are the most dangerous cause for liver problems, because they last for a long time and lead to serious complications (liver inflammation, etc.). The viral hepatitis includes a variety of different viruses: hepatitis A, B, C, and D. In this paper, Viral Hepatitis Ontology is developed using OBR framework for the A, B, C and D viruses, which are the most widely spread among males and females. This Ontology is represented in the Web Ontology Language (OWL) that has become recently the standard language for the semantic web. By developing the Viral Hepatitis Ontology, both Intelligent Systems and Physicians can share, reason, and exploit this knowledge in different ways.

Introduction

Medical Ontologies are interested in solving problems such as the reusing and sharing of patient data or the transmission of these data and the need of semantic-based criteria for purposive statistical [1]. There are medical Ontologies developed to facilitate this purpose. The Open Biomedical Ontology (OBO) is the library of medical Ontologies in different medical domains [2]. The Ontologies in OBO are designed to serve as controlled vocabularies for expressing the results of biological science [3]. NCBO's BioPortal is an open repository of biomedical Ontologies that provides access via Web browsers and Web services to Ontologies [4]. In addition, there are many research works have been achieved to build specific domain Ontologies for different diseases. For example, Vanja, Danijela and Goran [5] developed the OBR-Scolio application Ontology for the pathology domain of spine. Abdel-Badeeh and Marco [6, 7] built domain Ontologies for lung and breast cancers. In this paper, a Viral Hepatitis Ontology for Liver is developed using the Web Ontology Language (OWL). In addition, this Ontology is integrated with the recent (OBR) framework [8].

Methodology of Viral Hepatitis (VH) Ontology
The proposed methodology includes three phases: VH Ontology Extraction, VH Ontology Validation, and VH Ontology Representing in OWL. In what follows, a brief account is given for each phase.

The VH Ontology Extraction Phase
In this phase, we have extracted the needed knowledge from several medical sources such as Domain Experts, a Medical Book [9], and set of Trusted Medical Webs [10, 11 and 12]. The bottom-up approach has been followed in this research to build the VH Ontology. In this respect there are 18 distinct symptoms and 15 distinct signs caused by the Viral Hepatitis diseases (A, B, C and D). Also, there are 16 laboratory-findings can be used to differentiate between those Viral Hepatitis diseases. (a) The Mapping between the VH Diseases and their symptoms/signs/laboratory-findings step maps each Viral Hepatitis disease to its corresponding symptoms, signs, and laboratory-findings i.e. as shown in table 1 and table 2. (b) The Classifying the VH Diseases and symptoms/signs/laboratory-findings step. We have classified the Viral Hepatitis Results into three main classes: Symptom, Sign and Lab Result, which are then have classified into subclasses as shown in figure (1).

<table>
<thead>
<tr>
<th>Symptom</th>
<th>HAV</th>
<th>HBV</th>
<th>HCV</th>
<th>HDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fatigue</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Headache</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Loss of Appetite</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nausea</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pain in area of liver</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sore Muscle</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Vomiting</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Jaundice</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Itching</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Joint aches</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Malaise</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Aching Limbs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sore Bones</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sore Joint</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Excessive Tiredness</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sore Throat</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 1 Symptoms vs. VH Diseases

<table>
<thead>
<tr>
<th>Sign</th>
<th>HAV</th>
<th>HBV</th>
<th>HCV</th>
<th>HDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Low Grade Fever</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Rash</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Urine is Dark</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Weight Loss</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Confusion</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dehydration</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Difficulty Concentrating</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Grade or Clay Colored Stools</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Irritability</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Alcohol Intolerance</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Chills</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dry eyes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sickness</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 2 Signs vs. VH Diseases
The VH Ontology Validation Phase

In this phase, the domain experts have been consulted to review the results of both VH Diseases and Symptoms/Signs/Laboratory-findings Mapping step and VH Disease and Symptoms/Signs/Laboratory-findings Classification step. The domain experts have validated the classification trees generated from those steps by editing some of terminologies, and by rephrasing some of the classes’ names. Also, they have added other classes to those classification trees to be fit in the OBR framework.
The VH Ontology Representing in OWL Phase

To represent the Viral Hepatitis Ontology in OWL, two steps have been followed: representing the classes and relations of the Viral Hepatitis Result Classification Tree in OWL, and representing the classes and relations of the merged Viral Hepatitis Diseases Classification tree with OBR in OWL. The protégé-OWL editor has been exploited to implement this phase. Figure (2) Shows the complete OWL classes of the Viral Hepatitis Diseases Classification Tree with OBR.

Conclusion

In this paper, OBR-based OWL Ontology for Viral Hepatitis (A, B, C and D) was developed. The bottom-up approach has been exploited in designing this Ontology. Because the Viral Hepatitis A, B, C and D viruses are the most widely spread among males and females, this Ontology can be shared, and exploited in different ways by both Intelligent Systems and Physicians. The Ontology is represented in Web Ontology Language (OWL) that has become recently the standard language for the semantic web. The protégé-OWL editor was used to implement the Ontology.

References

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Collaborative Development of Dermatovenereology Ontology

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Abstract: The following paper describes the ontology creation process of dermatovenereology domain. Ontology is a hierarchically structured knowledge base, which can be used for educational needs or as a basis for an expert system. The ontology developed within this research is both advisory/consulting and educational service. It reviews more than 2500 symptoms of 277 diseases. It is not just a hierarchy, but it also comprises specificity of symptoms and patient medical history. This ontology can improve the quality of diagnosis in dermatovenereology being used as the aid in the decision making process.

Introduction

Intellectual (or expert) system (ES) multiplies experts experience in different domains. Medicine is one of the most popular domains for creating and using ES [1]. Knowledge base takes the central part of every intellectual system structure. One of the most popular knowledge representation models is ontology.

Nowadays ontology models are the most popular as they systematize and visualize knowledge. Ontology is defined as “a hierarchically structured set of terms for describing a domain that can be used as a skeletal foundation for a knowledge base" [2]. It "defines the basic terms and relations comprising the vocabulary of a topic area, as well as the rules for combining terms and relations to define extensions to the vocabulary" [3]. Being a powerful knowledge tool, ontology has a number of advantages, such as: systematic – representing an integral view of the domain; uniform – meaning that knowledge is organized in visual hierarchical structures, which make perception easier; scientific – which allows to spot missing logical relations and to complete the view; universal – meaning that
descriptions, written in a standard declarative language can be converted to knowledge formats of different systems.

In this paper we present the stepwise approach to ontology engineering and describe the experience of ontology developing for dermatovenereology. Developed ontology is not only the hierarchy of symptoms and diseases. This knowledge structure also contains their description as well as represents interconnections, relations and dependencies between them, and outlines their specificity. And what is more, it takes into account patient medical history.

Ontology Design

Ontological engineering inherits the practical and theoretical results of knowledge engineering, which has history of about forty years. To create our ontology we used the step-by-step algorithm for ontology (uncountable) make up, that was proposed in the work [4]. It includes four stages.

**Identification of strategy, goals and boundaries:** Firstly, the ontology purpose and the dimension of required knowledge should be determined. It is essential to know the type of the future ontology and the granularity level of its concepts.

**Development of glossary or identification of meta-concepts:** This critical and time-consuming stage includes the collection of the content corresponding to the study domain.

**Specification and categorization:** When the most relevant domain concepts and objects are collected, the main levels of abstraction can be defined. The next step is to reveal the high-level hierarchy among the concepts and to represent it visually on the detected levels.

**Orchestration:** This term implies the harmonization of the structure [5]. This finalizing step includes the refinement and updating of the visual ontology structure. The aim is to exclude contradictions, excessiveness, and synonymy. The ultimate goal is to form and develop a beautiful or harmonious ontology. It is believed that the beauty of the ontology makes perception and understanding of the knowledge it contains much easier [4]. This is extremely important as it is going to be used directly by people for educational and teaching needs. The aspect of ontology that is designed for this purpose is its cognitive ergonomics [6].

Dermatovenereology Ontology

*Domain description*

In developed countries the development and introduction of intellectual medical expert systems is caused by recognition of medical error problem. It was prompted by sharp increase in number of judicial claims to doctors,
who were supposed to harm the health of their patients, rather than help them. 30% of these lawsuits were the results of diagnosing errors. Taking into account the fact that professional errors in medicine mostly depend on subjective factors, one can see that the way to solve this problem is to create and widely use the intellectual systems supporting decision making process.

This ontology was created in order to represent the knowledge collected on the dermatovenereology domain. The aim of this knowledge base is to help medical practitioners in diagnosing skin diseases. It will be also useful for students and interns during the educational process.

Development of ontology

We used the algorithm described above to create the ontology for diagnosing skin diseases. As mentioned above, at the first step of ontology building we decided on taxonomy type. It implies a process of classification based on supertype-subtype relationships. But this is not pure taxonomy as other types of connections are used, e.g. ‘is a symptom of’. Then we extracted and collected concepts and objects of the domain. To accomplish it we used last editions of world-famous handbooks on the dermatovenereology [8-9]. We got two collections – the list of 227 most widely spread diseases and the list of more than 2500 symptoms and their properties. The next step of our work was to build a hierarchy of symptoms. They were summarized and grouped in classes. Then we came to the orchestration step. As the ontology is not only the program but an application as well, it should be organized the way convenient for a human to retrieve and perceive knowledge stored in it. We followed guidelines for creating cognitively ergonomic ontology proposed in work [6] and rearranged the structure of our ontology according to the rules of harmony for knowledge engineer: “Harmony = conceptual balance + clarity”. The detailed explanation of this formula can be found in the work [6].

The most valuable and innovative part of this ontology is interconnections between symptom and disease concepts. These links give an opportunity to diagnose the illness using only the list of the symptoms the patient has.

This feature was implemented via the connection of type ‘is a symptom of’. Each link of this type has a property ‘specificity’, which takes one of the three values: high, middle, low. Highly specific symptoms of a disease are a salient feature of this disease only. Symptoms of middle specificity may occur in several diseases. And low specific symptoms are uncharacteristic of this disease. If all symptoms a patient has are highly specific for some disease, it is possible to diagnose it with the high level of confidence.

Summary and Future Work
The paper has described the process of creating ontology in a specific medical domain – dermatovenereology. Created ontology not just simply replicates the hierarchical structure of symptoms and diseases, but reflects specificity of symptoms in relation to different diseases.

An expert system is going to be built on the base of the developed ontology, so that it would aid dermatovenereologist during the diagnosis process. The ontology is also going to be used for education of medical students as a domain knowledge representation model, since the ontology is not just a technical instrument but a powerful mind tool as well. For this purpose a visual interface of the developed ontology is going to be created.

References


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Dynamic Context Aware Access Control Model for the Areas with Shortage of Healthcare Professionals

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Abstract: Although access control is considered as a well known and used concept in various domains, its usage for the areas with the limited number of professionals is considered minimal. In this paper we present a dynamic context-aware access control model by extending the traditional role-based access control model with location, and other, information. The presented model aims at improving security of patient’s Electronic Healthcare Records (EHRs) for the areas with the shortage of healthcare professionals.

Introduction

In recent years, various domains, ranging from Insurance[1] to Ubiquitous Computing [2], have been using location, and other, information to provide context-specific services to their customers. For Ubiquitous Computing, for example, location information has been widely used to remotely monitor elderly anytime anywhere and provide tailored services for each person based on the person’s condition. An example of such a mobile health monitoring system for the elderly is proposed by [3].

Apart from monitoring elderly from the comfort of their homes, which is much common in Ubiquitous Computing [4], in the healthcare domain, location information is mainly used to control access to sensitive records. This main role of location information, to healthcare domain, can be categorised further into three subtasks, these are: controlling access to sensitive healthcare information [5], establishing the level of trust to the domain and deriving emergency level of access [6].

In order to control access to sensitive patient’s information, an access control policy should be defined in such a way that it takes into consideration location and other contextual information while making access control decision [7]. An example of such a policy that aims to control access to the records would be, “a nurse should have access to the sensitive records of the patient if s/he is scheduled on the same
department as to where the patient is admitted and no bigger role than nurse is currently working in the department”.

For the establishment of the level of trust to the domain, a reasonable policy should deny access to sensitive patient’s information to anyone trying to access records from untrustworthy areas. Furthermore, a realistic policy for the healthcare domain should allow different levels of access to the records depending on the contextual information gathered. Let’s say for example, two professionals with the same role (nurse, for example), one in the reception area and the other in the ward, should have different levels of access to the patient’s records.

With its numerous uses, location information, which is defined as to where the user is accessing information services from [8], is considered as one of the powerful and yet useful concepts in various domains [9]. This paper presents a dynamic context aware access control model that dynamically grants permission to users based on current context. The proposed mechanism, which is aimed at improving security of patient’s EHRs in areas with shortage of healthcare professionals, extends the traditional RBAC [10] model, while retaining its advantages (such as ability to define and manage complex security policies). The model dynamically adjusts Location Assignment and Permission Assignment based on location, and other contextual, information gathered.

The rest of this paper is organised as follows. Section 2 presents an overview of the background work where various access control models are discussed. Section 3 presents the dynamic Role-And-Context Based Access Control model, which is an extension of the traditional Role-Based Access Control model. Section 4 presents the conclusion and future work.

Background

In computing, access control refers to security features that control which principals (can be persons, processes and machines) have access to which resources.

Several access control models [10-13] have been developed to ensure the security of sensitive information. Among the common models include Mandatory Access Control (MAC), Discretionary Access Control (DAC) Role-Based Access Control (RBAC), Team-Based Access Control (TMAC), and Attribute-Based Access Control (ABAC).

From these and other models, RBAC, which associates users to roles and roles to permissions, has proved to be more popular and is considered as an efficient way of assigning access rights to users while at the same time ensuring data security [12]. Despite its popularity, RBAC is criticised for its difficulty in setting up an initial role structure and for its inflexibility in
rapidly changing environments like healthcare [12]. Additionally for the areas with the shortage of healthcare professionals, in this paper we argue that, the usage of traditional RBAC, in the healthcare domain, might result in lack of services to patients. To cater for such environments, RBAC needs to be extended with dynamic contextual attributes, and for this paper location information is mainly proposed. Section 3 presents the dynamic Role-And-Context Based Access Control model.

RAC-BAC Model

As highlighted in related work section, the approach adopted for this work involves re-modelling and extending the traditional RBAC model with contextual information, and to be more precise this work is much more focused on modelling location information.

The extended model from the traditional RBAC model, as presented in figure 1, introduces the notion of Location Assignment (LA), which is a relation between Location and Role. The model dynamically adjusts Location Assignments and Permission Assignments based on contextual information gathered. In our approach, each user of the system is assigned a

![Figure 1 Proposed Access Control Model](image-url)
temporary role depending on location, and other information, from where access to records is made. Rather than only addressing access control requirements for the general healthcare environment [8], the presented model, which can be used in various applications, is considered appropriate for controlling access to sensitive records in areas where there is a limited number of professionals.

Additionally, as traditional RBAC lacks the ability to support expression of access control that refer to the condition of the system [14, 15] then with this model, the idea is to use both dynamic (such as, user’s location), and static (such as, user ID) contextual information for authorisation constraints while making access control decisions.

Conclusion and Future Work

Although access control is a well known and used concept in various domains, its usage for the areas with the limited number of professionals is considered minimal. In this paper we have presented an approach for extending the usage of location information, in the healthcare domain, to improve the security of patient’s records for the areas with the shortage of healthcare professionals. As for future work, the presented model will be formally defined and a prototype system will be developed before its evaluation.

References


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Intelligent Technologies and Methodologies for Medical Knowledge Engineering

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Abstract: Intelligent technologies and methodologies provide approaches, methods, techniques, and tools that can help solving diagnostic and prognostic problems in a variety of medical domains. This paper presents some of the intelligent methodologies for managing and engineering knowledge in medical knowledge-based systems. The paper covers the following techniques: (a) case-based reasoning; (b) data mining; (c) rough sets and (d) ontological engineering. Some applications at the Medical Informatics and Knowledge Engineering (MEKI) Research Unit at Ain Shams University are discussed as well.

Introduction

Medical knowledge-based Systems (MKBSs) are concerned with the construction of intelligent software that performs diagnosis and makes therapy recommendations. The first process in the designing of MKBSs for any task is to build a “knowledge base”. In order to act intelligently, a computer must have knowledge about the domain of interest. The knowledge of the domain must be collected, organized and codified. This process is called “knowledge engineering’ and it is the most difficult and time-consuming stage for the development of any of MKBS. However, knowledge representation is one of the main topics of the knowledge engineering and now we have a variety of such techniques; e.g. logic, trees, production rules, semantic networks, frames, scripts, cases and ontology. These techniques share two common characteristics. First, they can be programmed with computer languages. Second, they are designed so that the facts and other knowledge contained within them can be manipulated by an “inference mechanism”, the other major part of the MKBS. Such mechanism uses search and pattern matching techniques on the knowledge base to answer questions and draw conclusions [1].

Knowledge Engineering Methodologies and Techniques

1. Case-Based Reasoning (CBR) Methodology

CBR means reasoning from experiences or “old cases” in an effort to solve problems, critique solutions, and explain anomalous situations. CBR,
as a computational method, assumes a memory model for representing, indexing and organizing past cases and a process model for retrieving and modifying old cases and assimilate in new ones [2]. CBR solves new problems by adapting solutions that were used for previous and similar problems. In support of CBR processes, a lot of knowledge structures are necessary [2]. CBR addresses the problems found in rule-based technology, namely: knowledge acquisition, performance, adaptive solution, and maintenance. CBR has already been applied in a number of biomedical applications.

2. **Ontological Engineering Approach**

Ontology provides a common vocabulary for researchers who need to share information in specific domain. Some of the reasons to create an ontology are, (1) to share common understanding of the structure of information among people or software agents, (2) to enable reuse of domain knowledge, (3) to make domain assumptions explicit, (4) to separate domain knowledge from operational knowledge and (5) to analyze domain knowledge. Ontologies may be categorized according to the domain they represent. *General ontologies* represent knowledge at an intermediate level of detail independently of a specific task. *Domain ontologies* represent knowledge about a particular part of the world. Finally, ontologies designed for specific tasks are called *application ontologies*. At present, there are many applications in biomedical domain [3, 4].

3. **Rough Sets**

Rough set theory was proposed as a new approach to vague concept description from incomplete data. The rough set theory is one of the most useful techniques in many biomedical problems. This theory provides a powerful foundation to reveal and discover important structures in data and to classify complex objects. One of the main advantages of rough set theory is that it does not need any preliminary or additional information about data [5].

4. **Intelligent Data Mining and Knowledge Discovery**

Intelligent data mining methodology aims to extract useful knowledge and discover some hidden patterns from huge amount of databases which statistical approaches cannot discover. Knowledge discovery in databases (KDD) process involves the following processes; (a) using the database along with any required selection, preprocessing, sub-sampling, and transformations of it, (b) applying data mining methods to enumerate patterns from it, and (c) evaluating the products of data mining to identify the subset of the enumerated patterns deemed knowledge. The data mining
components of the KDD process is concerned with the algorithmic means by which patterns are extracted and enumerated from data (e.g. rough sets, fuzzy logic and neural networks). Data mining is supported by a host that captures the character of data in several different ways, e.g. clustering, regression models, classification, summarization, link analysis and sequence analysis [6].

Some Applications at MIKE Research Unit at Ain Shams University

1. **Expert Systems for Heart Diseases Diagnosis**

   In [7, 8] we have developed two versions of expert systems for heart diseases diagnosis. The first one uses the rule-based reasoning while the second one uses case-based reasoning. The system’s knowledge base of the first version is composed of 24 facts and 65 rules for 24 heart diseases. The system is implemented in Visual Prolog and has been tested for 13 real experiments (patients). The experimental results have shown 76.9% accuracy in estimating the right conclusion. In the CBR version, the knowledge is represented in the form of frames and built the case memory for 4 heart diseases namely; mitral stenosis, left-sided heart failure, stable angina pectoris and essential hypertension. The system has trained set of 42 cases for Egyptian cardiac patients and has been tested by another 13 different cases. Each case contains 33 significant attributes resettled from the statistical analysis performed to 110 cases. The system has been tested for 13 real cases. The systems are able to give an appropriate diagnosis for the presented symptoms, signs and investigations done to a cardiac patient with the corresponding certainty factor. It aims to serve as doctor diagnostic assistant and support the education for the undergraduate and postgraduate young physicians.

2. **Mining Patient Data Using Rough Sets Approach**

   In [6], a rough set-based medical system for mining patient data for predictive rules to determine thrombosis disease was developed. The system aims to search for patterns specific/sensitive to thrombosis disease. The rough sets were applied on medical data base of 20 MB. The results show that the number of attributes that describe the thrombosis disease was reduced from 60 to 16 significant attribute. In addition the system extracts some useful decision rules which can help young physicians to predict the thrombosis disease.

3. **Case-Based Reasoning for Diagnosis of Cancer Diseases**

   The system’s knowledge base was constructed from actual case histories and includes 70 cancer patient cases; some are real Egyptian cases and some from virtual hospitals on the internet. The Computational model uses rule-
based inference to give diagnostic decision and new case is stored in case library. Patient cases are retrieved in dialogue with similarity matches using the nearest neighbor matching technique. Further details of the system’s technical aspects can be found in [9]. The system provides recommendation for controlling pain. It can be used as a tool to aid and hopefully improve the quality of care given for those suffering intractable pain. The system is very useful in the management of the problem, and assists the young physicians to check their diagnosis.

4. **Web-Based Breast Cancer Ontology**

The breast cancer ontology was encoded in OWL-DL format using the Protégé-OWL editing environment [10]. The knowledge was collected from: Medicine Net, World Health Organization [8], breastcancer.org, ehealthMD and National Comprehensive Cancer Network. In this ontology we have two main super classes; (a) Medical Things which has sub classes Diseases, Medical_Interventions, Pathological_Category, References, and (b) People which has the sub classes; men and women (see Fig.1). The main benefits from this ontology are to allow finding and locating information about breast cancer needed for interested users and domain experts.

![Figure 1: The developed breast cancer ontology](image-url)

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Conclusions

Knowledge engineering offers robust computational techniques for accumulating, changing, updating, managing and representing knowledge. Data mining techniques (e.g. rough sets, case-based reasoning) enable users with learning mechanisms that help to induce knowledge from raw data. Furthermore ontological engineering offers a promising way to develop efficient medical knowledge-based systems capable to facilitate knowledge sharing, refine, search, and reuse.

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Machine Learning for Processing Myocardial Perfusion SPECT Images

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Abstract: Myocardial perfusion SPECT imaging is an established noninvasive method for the functional assessment of coronary artery disease. Visual interpretations of perfusion scintigrams require experienced readers and are associated with inter observer variability. Thus, intelligent machine learning (ML) methods have been developed to support decisions with quantitative image analysis. This study discusses three ML approaches, namely; expert systems, neural networks and case-based reasoning for processing the myocardial SPECT imaging.

Introduction

SPECT is a nuclear medicine tomography imaging technique using gamma rays. It is able to provide threedimensional information. This information is typically presented as cross-sectional slices through the patient [1]. For diagnostic of nuclear medicine, SPECT imaging performed after stress reveals the distribution of the radiopharmaceutical, and therefore the relative blood flow to the different regions of the myocardium. Diagnosis is made by comparing stress images to a further set of images obtained at rest. On the other side and from the informatics point of view, ML techniques, such as expert systems (ES), neural networks (NN) and case-based reasoning (CBR) had been applied to improve the diagnostic accuracy of automated interpretation of myocardial perfusion images [2]. The following sections discuss the usage of the Neural Networks (NN), Expert Systems (ES), and Case Based Reasoning (CBR) techniques in processing the SPECT images.

Deploying Neural Networks on SPECT Imaging Data

NNs represent a computer-based decision method that has proved to be of special value in pattern recognition tasks. From this point comes the interest to evaluate the feasibility of using NN for interpretation of diagnostic images. Radiological images as well as nuclear medicine and magnetic resonance imaging, contain large numbers of pixels. In [3], Dan Lindahl et
al. developed methods to reduce the data volume of the images were implemented. Thereafter, NNs were trained to detect coronary artery disease (CAD). This study demonstrated that NNs can be used to classify myocardial perfusion images regarding presence and locality of CAD. The performances of the networks were similar to or better than those of two human experts. These results indicate that NNs could be used to assist clinicians in achieving a correct interpretation and, thereby, improve the diagnostic accuracy of medical imaging.

Deploying Expert Systems on SPECT Imaging Data

ES is a system contains sets of decision rules that are structured like tree branches with questions, conditions and hypotheses that must be answered or satisfied. Each answer directs the analysis down a different branch to another set of questions. The brief description of the different steps used to detect coronary artery disease in Perfusion SPECT images. In [5], Ernest Garcia et al. developed a rule-based ES (PERFEX) for the interpretation of myocardial perfusion SPECT studies. The results obtained from PERFEX were compared with those of nuclear medicine expert readers and with independent results from coronary angiography. The results show that PERFEX is almost as accurate as nuclear medicine expert readers in detecting and localizing CAD when coronary angiography is used as the gold standard.

Deploying Case Based Reasoning on SPECT Imaging Data

Based on CBR methodology [7, 8], case memory is demonstrated and each case includes patient information, e.g. sex, age, segmental values of the relative thallium-201 activity obtained by polar map analysis of the scintigraphic images (84 integer values) and 15 integer values representing the results of coronary angiography specifying the location and the severity of stenotic lesions in the 15 segments of coronary arteries. In addition to deploying a variety of features, several classification techniques have been applied across a range of SPECT imaging datasets. In these methods, the similarity calculation is based on a pixel by pixel comparison of two images. CBR was applied to the 2D polar map representation of the regional tracer uptake obtained from perfusion images [7, 8].

Analysis and Discussion

NN systems differ from ESs since they do not require complicated programs for formation of rules based on capturing the knowledge of one or more experts. NN systems are able to form those rules by a learning procedure using pairs of training input data and desired output data.
might be a better in the event of difficulty in preparing enough patterns to train it. Therefore, the process of learning can be an advantage of the NN. A potential disadvantage of NNs is that once they are created, their method of function is difficult to describe in a way that can be comprehended by humans, making it impossible for the user to figure out how the program arrived at a given conclusion. CBR is similar to NNs in that they use a large set of cases with known diagnoses to arrive at a conclusion. However, they omit the NN training step and instead give a diagnosis by finding the most similar case in the case memory.

Conclusion

This study discusses three machine learning approaches, namely; NN, ES, and CBR for the assessment of coronary artery disease based on analysis of myocardial SPECT perfusion scintigrams. The paper analyzes the main results of the recent published research in this respect. This work suggests that machine learning based approaches to classification can offer clinical quality diagnostic accuracy, and can do so in an automated fashion. The net result is an automated SPECT imaging classifier that is both accurate and fast, which will be a welcome addition to a busy cardiology department.

References


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Modeling Extraction of Temporal Knowledge from Patient Records

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Abstract: This paper describes the automatic processing of medical texts in order to extract important patient characteristics, thus turning the free text description into a structured internal representation. Shallow text analysis is implemented due to the medical language complexity. The paper sketches the information extraction process and discusses the role of domain knowledge in text analysis.

Review of Literature

Processing of patient symptoms and diagnosis treatment data

The system CLEF (Clinical E-Science Framework) extracts data from clinical records of cancer patients [1]. AMBIT acquires Medical and Biomedical Information from Text MiTAP (MITRE Text and Audio Processing) monitors infectious disease outbreaks and other global events [2]. The system caTIES (Cancer Text Information Extraction System) processes surgical pathology reports. Other recent systems are HITEx (Health Information Text Extraction), an open-source NLP system and cTAKES (clinical Text Analysis and Knowledge extraction system).

Building of Medical Ontologies

Information Extraction is applied for construction of ontology in pneumology in the PertoMed project. The approach is based on terminology extraction from texts according to the differential semantics theory - distributional analysis and recognition of semantic relationships by lexico-syntactic patterns. ODIE (Ontology Development and Information Extraction) is a software toolkit which codes document sets with ontologies or enriches existing ontologies with new concepts from the document set. It contains modules for Named Entity Recognition, co reference resolution, concept discovery, discourse reasoning and attribute value extraction.
Project Methodology

The methodology used in this project to transfer patient records between sites is dependent upon semi-standard SQL-based RDBMS and a common portion of the data model described above. Simple programs unload patient data from the relational tables into text script files that can be run at the receiving site to update their database. This methodology requires a minimum of program development and user expertise, but relatively extensive standardization. It is our position that this standardization is worth the effort in order to reap the demonstrated benefits of information density, efficiency, and ease of communications. Whether such standardization is politically or logistically possible in the current healthcare information systems context is not in the scope of this paper, although it is now a key theme of healthcare informatics [3]. The transfer methodology has the following steps.

Sending Database Task Steps

- Extract patient information from each table of the sending database;
- Create a text script file to update the receiving database;
- Compress and encrypt the script file with a password;
- Log the transaction.

Receiving Database Task Steps

- Uncompress and un-encrypted the script file;
- Run the script against the receiving database;
- Log the transaction.

The database at each site must have a portion of their data model in common. Each site may have additional (non-shared) tables and additional (non-shared) attributes in the shared tables, but they must have a core of tables and attributes exactly in common. Because of this flexibility, the only real tool restriction with this shared model is the requirement of a RDBMS from any major vendor. The extraction program (Step 1) is very simple. Every table in the model is queried for any rows linked to a particular patient ID (and possibly in a particular date range). This requires a simple SQL query for each table in the model. All of this data is written to a single text file that becomes a SQL script for updating the receiving database. The script file (Step 2) is a sequence of SQL queries that are automatically run one after another. For example, the following 'insert' statement would be one of many in the script (one for each table in the shared model).

```
INSERT INTO RECtable.PROBLEM
VALUES( 1,2,3,4,5,6,7,8,9,10,11)
5,"HPE",","44,10002,1993-06-10,"O",,\$1ong,
```

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Note that this implementation of the 'insert' command supports bind variables. Each bind variable (such as ':1') corresponds by position with the comma separated block of text delimited with the forward and backward slashes. Every line of this text block is inserted as a record into the receiving table with this one SQL statement. This is a very non-standard feature across RDBMSs and would require the most development and coordination efforts. Imports, exports, and the SQL Data Definition Language (DDL) are the most non-standard elements of RDBMSs and SQL. Both sites in this demonstration project used Gupta's SQLBase database server and therefore did not deal with this standardization problem. This required development for multivendor interoperability and is minor compared to methods that do not share a data model, common SQL Data Control Language (DCL), and relational database implementation. The script resulting from these two steps is a (human readable) text file that is sent by the sending site. The receiving site simply runs this script file against the database that is updated with the transferred patient(s') data.

All linked information and referential integrity are preserved because the data model is replicated at each site. Compression and encryption of the script file (Step 3) can be performed with any applicable utility. The only requirement is that both the sending and receiving sites have the same program. Password access to the encrypted file secures the patient data to the limits of the encryption scheme and the security procedures of the provider sites. We used the shareware utilities PKZIP and PKUNZIP for this step. This utility may not be very secure and therefore not adequate for real operations, but it precisely demonstrates the concept. The sender's log file (Step 4) records any standard information that each site requires such as the identification of the sender and any notes relating to the transfer. This log may update a table on the sender's database and a copy of this log is sent with the data to the receiver. The receiving site must uncompress and un-encrypt the script file (Step 5) and run the script against their database (Step 6). In the case of Gupta's RDBMS, Step 6 is accomplished simply by using a Run Script' option that sequentially executes any SQL statements in a script file. This utility is offered by many vendors and would be a relatively simple utility to add to any RDBMS. The sender's log file can automatically update the receiver's log table (Step 7), documenting the transaction. A crucial factor in sharing patient data is a common data dictionary for healthcare terminology. This is a difficult problem and this
methodology allows a relatively simple way to share a standard data dictionary between sites [4-5]

Conclusion

The article describes current results in extraction of patient status data from medical text. It shows the complexity of medical text processing which is due to the complexity of the medical domain and the particularities of the medical texts written in specific, well-established style [6]. The role of explicitly-declared domain knowledge is shown; it supports the information extraction algorithms by providing constraints and inference mechanisms.

References


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Ontology-Based Knowledge Representation for Liver Cancer

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Abstract: Ontologies are now ubiquitous in many intelligent information-systems enterprises; they are used in e-health and in various tasks of biological and medical sciences. This paper presents the process of building web-based liver cancer ontology. The main goals behind building this ontology are to allow finding and locating information about liver cancer needed for interested users and domain experts and providing a semantic representation of liver cancer information over the web. This ontology is encoded in OWL-DL format.

Introduction

Liver cancer is the third most common cancer in the world. Liver cancer is much more common in developing countries within Africa and East Asia. In some countries, it is the most common cancer type [1]. From the ontological engineering point of view, ontologies were developed in intelligent information technology and artificial intelligence communities to facilitate knowledge sharing, reuse and a robust knowledge representation technique [2-3]. There are very few ontologies in cancer disease; some of these ontologies are developed by the authors for lung and breast cancers [4-5]. This paper introduces the process of developing the liver cancer ontology.

Developing of Web-Based Liver Cancer Ontology

Sources of Medical Knowledge
The Liver Cancer Ontology

Liver cancer ontology was built by Protégé-OWL editor [8-9]. Primary liver cancer is cancer that begins in the liver. The subtypes of primary liver cancer are named for the type of cell from which they develop. There are three subtypes of primary liver cancer namely, Hepatocellular carcinoma, Cholangiocarcinoma, Angiosarcoma. For more information about the medical description see [1]. The liver cancer is described in terms of its risk factors, symptoms, diagnosis, staging and treatment [6].

Staging

Staging is a way of describing a cancer, such as where it is located, if or where it has spread, and whether it is affecting the functions of other organs in the body. One tool that doctors use to describe the stage is the TNM system. This system judges three factors: the tumor itself, the lymph nodes around the tumor, and if the tumor has spread to the rest of the body. The

Figure 1: The liver cancer class hierarchy
results are combined to determine the stage of cancer for each person. There are four stages: stages I through IV (one through four). The stage provides a common way of describing the cancer, so doctors can work together to plan the best treatments. TNM is an abbreviation for tumor (T), node (N), and metastasis (M). Doctors look at these three factors to determine the stage of cancer [6].

Liver Cancer Ontology Classes

Figure 1 shows the Class hierarchy of the liver cancer ontology. From this figure it can be seen that, the liver cancer ontology has three main classes; Disease, Medical Intervention and References. The Disease class contains the LiverCancer class with its types. The Medical Intervention class contains the Staging, Diagnosis and Treatment classes. The References class contains the Symptoms, Stage, Risk Factors and TNM_System classes. Each one of these classes may have its own subclasses according to the structure of the liver cancer. Figure 1 shows the class hierarchy of the liver cancer ontology.

Instances of the Classes of Liver Cancer Ontology

In the liver cancer ontology, the diagnostic tools of the liver cancer are described as instances of the class Diagnosis. Figure 2 shows the instances of classes as described in the liver cancer ontology. The classes M, N and T are defined as enumerated classes. Each one of these classes is described in terms of its instances (no more instances can be added to any of these classes).

| Diagnosis: Angiogram, Biopsy, Blood_tests, CT_scan, MRI, Physical_exam, Ultrasound_test |
| Staging: Bone_scan, CT_scan_of_the_chest, PET_scan |
| Treatment: Ablation, Chemoembolization, Chemotherapy, Cryoablation, Hepatectomy, Hepatic_arterial_infusion, Targeted_Therapy, Immunotherapy_therapy, Liver_transplant, Proton_beam_therapy, Radiation_Therapy, Radioembolization, Stereotactic_radiosurgery, Surgery |
| Risk. Factors: Aflatoxin, Alcohol, Cirrhosis, Hemochromatosis, Hepatitis_B, Hepatitis_C, Iron_storage_disease, Obesity_and_diabetes |
| Symptoms: A lump or a feeling of heaviness in the upper abdomen, Fever, Loss of appetite and feelings of fullness, Nausea and vomiting, Weight loss, Pain in the upper abdomen on the right side, Swollen abdomen, Weakness or feeling very tired, T: TX, T0, T1, T2, T3a, T3b, T4 |
| N: NX, N0, N1 |
| M: MX, M0, M1 |

Figure 2: The instances of the classes of the liver cancer ontology
Summary and Conclusions

This paper presents the process of developing liver cancer ontology. This ontology was built using the Protégé-OWL editing environment; the first choice of most of the ontology builders; it has a great user interface that eases the process of building or editing ontologies. This ontology is encoded in OWL-DL format which is the most recent development in standard ontology languages, endorsed by the World Wide Web Consortium (W3C) to promote the Semantic Web vision. This ontology can be used by experts or medical researchers who want the liver cancer knowledge to be represented in a semantic way that allows reasoning capabilities.

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Predicting a Single HIV Drug Resistance Measure from Three International Interpretation Gold Standards

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Abstract: The Human immunodeficiency virus, tuberculosis and malaria together form a triple burden of disease for resource poor countries like those in Africa. The management of HIV is further complicated due to inevitable antiretroviral drug resistance. Electronic computerized interpretation algorithms may be used to determine ARV drug resistance. Some studies suggest that these interpretation algorithms produce different resistance measures even if applied to the same resistance profile. The aim of this study was to investigate the possibility of combining the interpretation of three gold standard interpretation algorithms using a Bayesian weighted voting method in order to produce a single resistance measure. REGA, Agence Nationale de Recherches sur le SIDA (ANRS) and HIV-db are widely used as the gold standards in interpretation algorithms. The Bayesian based voting combination increased the accuracy of the resistance profile prediction compared to phenotype, from 58% to 69%. From the result obtained, it is evident that combining the gold standard interpretation algorithms may increase the predictive ability of the individual interpretation algorithms.

Introduction

There are currently almost 5.6 million infected with HIV in South Africa, which is approximately 11% of the South African population [1]. It is also estimated that there are almost 500 000 patients who exhibit AIDS-defining conditions [2]. Although there is currently no cure or vaccine for HIV infection, it can be managed by highly active antiretroviral therapy. The management of HIV is, however, complicated due to antiretroviral drug resistance. Without effective ARV treatment patients are susceptible to opportunistic infections. Electronic computerized algorithms [3] may be used to determine ARV drug resistance. Computer-based genotype interpretation algorithms usually determine mutations in the patient’s pol gene region, and use this information to determine the ARV drugs to which patients are resistant to.
Computer-based algorithms are usually based on experts’ understanding of the domain, available datasets that are used for machine learning and understanding of published literature. This has led to the creation of many different interpretation algorithms, which produce different resistance measures even if applied to the same resistance profile.

The aim of this study is to combine the interpretation of three gold standard interpretation algorithms using a Bayesian weighted heuristic method in order to produce a single resistance profile.

Methods

REGA, Agence Nationale de Recherches sur le SIDA (ANRS) and HIV-db are widely used as the gold standards in interpretation algorithms. REGA was developed by the laboratory for clinical and evolutionary virology, Rega institute for medical research, Katholieke Universiteit Leuven. It classifies ARV resistance according to three levels, susceptible, intermediate and resistant. Susceptible indicates that for a given resistance profile, a particular ARV drug will be effective in managing the HIV infection. Intermediate indicates that the ARV drug is partially effective, and if the ARV is not effective the resistance profile is classified as resistant. REGA also incorporates the idea of a genotypic susceptibility score that is assigned to each drug for each of the three levels. Resistance to the therapy is confirmed when the sum of the individual genotypic susceptibility scores are lower than a pre-determined cutoff.

The HIV-db program was developed by the Division for Infectious Diseases, Stanford University Medical Center, Stanford University. The expert system itself generates a resistance profile using Boolean-based rules and also includes penalties. HIV-db classifies HIV resistance according to five levels: susceptible, potential low-level resistance, low-level resistance, intermediate resistance, and high-level resistance.

The French National Agency for AIDS Research AC11 Resistance group developed the ANRS algorithm based on statistically determining the relationship between genome mutations and virological outcomes of patients failing ARV therapy. The ANRS classification of resistance is similar to REGA.

In order to combine the gold standard interpretation algorithms, genotype-phenotype datasets that consisted of 2928 protease gene and 1981 reverse transcriptase gene sequences were obtained from the Stanford HIV drug resistance database (http://hivdb.stanford.edu/). This database contains publicly available de-identified HIV drug resistance data.

The gene sequence was fed into the online HIValg V6.0.11 program hosted by Stanford University.
This web application takes as input the gene sequence, determines mutations that occur in the genome, and gives resistance profiles of that sequence by applying the REGA, HIVdb and ANRS algorithms to it.

The predicted output resistance profile for each sequence was linked with its original amino acid sequence and its associated phenotype IC\textsubscript{50} score. With respect to this study, the IC\textsubscript{50} scores were treated as a true measurement of drug resistance. Based on the ranges of the IC\textsubscript{50} score, an actual resistance measurement was determined.

The outputs of HIVdb, Rega, ANRS were combined to obtain a single resistance profile using the Bayesian-based weighted voting algorithm techniques. Excel was used to create the mathematical model that performed the combination.

Results

Accuracy was calculated in order to determine the effectiveness and to compare the gold standard interpretation algorithms and the weighted voting algorithm. Accuracy is defined as the percentage of resistance profiles that have resistance measures as identified by the IC\textsubscript{50} score. The accuracy obtained by each gold standard interpretation algorithm and weighted voting algorithm is shown in Table One.

Table 1: The accuracy of the HIV-db, REGA, ANRS, and Bayesian weighting algorithm in predicting phenotype

<table>
<thead>
<tr>
<th>Interpretation Algorithm</th>
<th>Accuracy / %</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV-db</td>
<td>58.6</td>
</tr>
<tr>
<td>REGA</td>
<td>57.8</td>
</tr>
<tr>
<td>ANRS</td>
<td>58.7</td>
</tr>
<tr>
<td>Bayesian weighting algorithm</td>
<td>69.3</td>
</tr>
</tbody>
</table>

Discussion

The key finding of this study was that it is possible to combine the gold standard interpretation algorithms in such a way as to improve their individual predictive ability. The Z-test between each gold standard and Bayesian weighting algorithm produces a p <0.0001, indicating a statistically significant difference in the accuracies.

This prototype study should be extended in order to create a more efficient and effective algorithm. A dataset with a greater number of data elements should be used and other techniques to combine the gold standard interpretation algorithms should be considered. Possible options include...
machine learning algorithms, such as, support vector machines, multilayer perception neural networks and genetic programming. Thought should be given to designing this tool in such a manner that it may be integrated into an electronic medical record and a mobile interface design. This will serve as preliminary attempts to combine the fields of practicality defined medical informatics, bioinformatics and even telemedicine.

References


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Software for Transfusion Laboratory Practice

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Abstract: Electronic communication network is an umbrella term, which is generally related to communication by computer and modern information and communication technologies. Those structures allow the workflow of information at different times and from different locations using e-mail lists, electronic forums, online conferences, etc. The exchange of information over the Internet is the main component of network communications, but also technological achievement that changed the lives of medical and health experts every day. A lab information system ("LIS") is a class of software that receives, processes and stores information generated by medical laboratory processes. These systems often should interface with instruments and other information systems such as hospital information systems (HIS). A LIS is a highly configurable application which is customized to facilitate a wide variety of laboratory workflow models. In practice, there are as many variations of LISs as there are types of lab work. Disciplines of laboratory science supported by LISs include hematology, chemistry, immunology, blood bank (Donor and Transfusion Management), surgical pathology, anatomical pathology, flow cytometry and microbiology. This article covers developed clinical lab information system, which is specialized for hematology and blood transfusion.

Introduction

According to medical standards in Hematology, the database included in a specialized software for the activity of LTH must ensure that electronic processing and information for recipients in terms of diagnosis and immune-hematological transfusion therapy with blood and blood components - distribution, storage, use and scrapping, obsolescence of use - is completely secured. Its parameters are determined by the Law for Blood, Blood Donation and Blood Transfusion (LBBDBT), Chapter V, Article 36 [1].

The National Center for Hematology and Transfusion makes a data base, which includes information on:
- Donors and recipients;
- Results of laboratory tests;
- Each unit of donated blood and blood components;
• Activities for collection, testing, processing, labeling, documentation, distribution, storage and use of blood and blood components;
• Destruction of each unit of blood and the reasons for this.

The specific activity of National’s Heart Hospital LTH in numbers is: 10000 immune-hematological studies of 4,500 patients and 7,000 transfusions of blood and blood components to more than 1600 patients, requiring transfusion therapy.

There are several different national and international software solutions for LTH, but they are not fully applicable to the scope and activities of the blood donation and blood components production of the current Laboratory. National Heart Hospital works successfully with specially designed HIS, with certain characteristics and integrating it into an external would create difficulties in the process of installing, interconnections, and support itself. Creating new model, based on the functioning HIS and in recital with its requirements is the best option.

The software includes a structured database, containing patient’s information on immune-hematological research and transfusion therapy with blood and blood components, as well as a database for storage of blood components, and interfaces for accessing data through Internet portal to provide differentiated access for users of the data.

The software also includes:
• Three functional modules, corresponding to the order of carrying out activities in Laboratory of Hematology. The pathway of documenting and sharing responsibilities, authority and organizational communication in LTH;
• Functional dynamic data-base of recipients of blood and blood components in accordance to the requirements of LBBDBT.

It consists of three main modules:
Module "Laboratory and Research" - different sections correspond to the already established working model, documented in the specialized medical journals. Each form is developed according to Ordinance № 29 and is introduced as screens in our model, with print option:
• Registration of patients;
• Blood-group corresponds to menu “Blood groups”;
• Research antibodies - corresponds to “Antibodies menu”;
• Investigation of antigens - meets the journal “Antibodies”;
• Testing for compatibility-“Compatibility Matches” journal.

Module Expedition

1. Introducing blood and blood components in the warehouse receipt;
2. Expedition of blood and blood components in clinics and wards across;
3. Wasted blood and blood components.

The third module - Module Patients - is localized both in LTH and clinics. It contains patient’s information, clinical indications, respectively course of treatment for transfusion, consent for transfusion, blood transfusion with priority.

Among the three modules there are dynamic links that are internal-only for LTH, internal- only for the hospital’s HIS and external with appropriate levels of authorized access.

Fig. 1 presents one of the basic documents that work in the Laboratory. Colored in yellow boxes indicate data that will be taken by the HIS in the hospital.

**Conclusion**

Data protection is guaranteed by three separate parameters - username, password and a personal digital signature.

The system is designed to be easily integrated into existing control Hospital Information...
System at the National Heart Hospital. It is provided maximum accessibility: both work in a local environment, and access through an Internet connection.

Organization and requirements of innovatory unit have to be secured and nucleus, namely "Patient Management", which provides complete patient record, ability to search records and data.

The proposed solution provides collected and processed information in a knowledge base that guarantees its customers the necessary statistical information. The solution provides copyright forms and methods of searching, and numerous data references.

According to the task, represent authors' model is identical to the paper copy, which operates daily in the laboratory.

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Distance Consultations, Home Care & Telemonitoring
A 3D Accelerometry - Based Fall Detection System for the Elderly: Realistic False Alarm Rate and Sensitivity

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Abstract: Falls are a major concern for health in the ageing population. We have evaluated the quality of a fall detection system based on a body-worn 3D accelerometer (actibelt®). Our algorithms have a sensitivity to detect falls in laboratory conditions of 100% and have a false alarm rate of 17 false alarms per month, with the potential to be reduced down to at most 3 false alarms per month in continuous use. actibelt® technology is ready for use in fall detection systems.

Introduction

Approximately 28-35% of people aged of 65 and over fall each year [1-3] increasing to 32-42% for those over 70 years of age [4-6]. The frequency of falls increases with age and frailty level. Older people who are living in nursing homes fall more often than those who are living in community. Approximately 30-50% of people living in long-term care institutions fall each year, and 40% of them experienced recurrent falls [7].

A major problem is that half of the elderly who fall at home become helpless and require assistance to get up. That could be avoided by automatically calling for help when a person is unable to summon assistance. Current commercially available alarm systems suffer from problems with usability, lack of sensitivity and high false alarm rates.

Aim of the study was to assess the quality of an accelerometry-based system for fall detection with high user acceptance, high sensitivity and low false alarm rate. The fall detection algorithm must run in real-time on the microcontroller of the low-power, lightweight robust and unobtrusive accelerometer. Ideally, no special infrastructure should be needed to link the fall detector to a broader telemedical platform.

System Design - The general overview of the proposed fall detection device integrated into a broader multi-tier telemedicine platform is illustrated in figure 1.
The focus of this paper lies in a critical part of any such system: the sensitivity and false alarm rate of the fall detection algorithm. Together with the usability aspect of the activity monitor these are known to be the key success factors for fall detection systems. To satisfy the condition that the algorithm runs in real-time for an extended period of time in the microcontroller of the monitoring device and to guarantee a high user acceptance, a low power activity monitor (3D, 100Hz) integrated in a belt buckle, the actibelt® [8-10], is used as key part of the sensor tier of the hierarchy.

Subject database - historical data base: During the last 6 years, the Sylvia Lawry Center for Multiple Sclerosis Research (SLC) has built a database with more than 100,000 hours of standardized accelerometry recordings from healthy individuals and patients. In total, 2415.9 hours (100.7 days) of continuous weekly acceleration measurements corresponding to ADLs (Activities of Daily Living) in free living conditions were used for the validation.

Prospective Data Collection: For the development and improvement of the fall detection algorithm a series of fall-like activities and simulated fall events were performed by two healthy individuals (2 male; age: 46 and 79 yrs; height: 1.84 and 1.74 m) in a controlled laboratory setting at the SLC. Both subjects were informed about the aims of the activity measurement and had given written informed consent.

Subject Database - Trial protocol: The trial protocol consists of a series of 16 real falls in laboratory conditions and 7 “fall-like” activities which should not trigger an alarm. The experiments were performed on a sofa and on a crash pad. Falls were performed in three directions: backwards, forwards and sideways, starting both from a walking and a standing position and were selected to mimic typical real world situations.
Fall Detection Algorithm

The preprocessing of the raw data was performed according the filtering methods described by Karantonis et al. in [11], using for denoised a median filter \((n = 3)\). Then, in order to get the acceleration component that will give us the body inclination the output is low pass filtered. By comparing the magnitude of the acceleration vector produced by the body movement with a certain threshold we determine a possible impact against the ground.

The body inclination component is used to differentiate between standing/sitting position and lying orientation.

To distinguish between resting phases and activity phases the sum of the windowed standard deviation of the signal was calculated for a window length equal to 50 samples and afterwards compared to a preset threshold. We found that with a threshold of 1.9 g for the acceleration magnitude, 49.8 degrees for the angle and 3.0 g to distinguish best between activity and inactivity. We developed some “run rules” to further enhance the performance, e.g. we found that an interval of 3 seconds after the impact instant is enough for the tilt signal to stabilize in case a fall occurs. An event is then only classified as a fall, if the person was in a non-standing position before the acceleration peak and the quantity of movement, calculated as the sum of the windowed standard deviation, does not pass the threshold 3.0 g.

Validation Method

In order to evaluate the performance of our fall detector, the algorithm was ran first over the whole test battery of fall-like activities and simulated fall events and, second, over the continuous acceleration data set of ADLs recorded in a free-living environment.

The output of the first analysis yields an estimation for the sensitivity of the algorithm on the basis that the fall scenarios covered in the experiment protocol are highly representative of a real fall, whereas the free-living activity recordings give an upper limit for the false alarm rate (it is unknown whether some real alarms were within the ones detected as such) in an entirely realistic scenario.

The sensitivity of the algorithm given these data was 100%. The false alarm rate is seen in Table 1.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Mean age (yrs)</th>
<th>Hours recorded</th>
<th>UL-raw</th>
<th>UL-cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort 1</td>
<td>10.5</td>
<td>688.1</td>
<td>135</td>
<td>127.7</td>
</tr>
<tr>
<td>Cohort 2</td>
<td>32.3</td>
<td>732.1</td>
<td>26.6</td>
<td>11.8</td>
</tr>
<tr>
<td>Cohort 3</td>
<td>70.2</td>
<td>995.7</td>
<td>17.4</td>
<td>2.9</td>
</tr>
</tbody>
</table>
UL-raw/UL-cure: upper limit false alarm rate without/with data duration (falls per months). Cohort 1 consists of young children with diabetes, cohort 2 consists of healthy individuals and cohort 3 consists of older women with osteoporosis. False alarm rate decreases with age.

Discussion

We have developed a promising methodology to detect falls using a body worn sensor that has high sensitivity and an acceptable rate of false alarms. It is a particular strength of the current study to have provided a strict upper limit for the realistic false alarm rate using historical accelerometry data. Future work will aim at further decreasing the number of false alarms by improving algorithms to detect artifacts, sensor fusion and suppression mechanisms on the smart phone. The lack of data from real life falls restricts the ecologic validity of our result of 100% sensitivity.

References

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A Framework for Business Continuity Management in Home-Care Context

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Abstract: Demographic changes and the influence of modern Information and Communication Technology (ICT) have modified practices in the health care sector. However, the use of these technologies may induce system failure with significant impacts on patient safety. Thus, continuity of services remains a critical area of concern. In this context, we propose an approach based on Business Continuity Management (BCM) to ensure the ability to operate in spite of unforeseen events and to quickly recover from any type of business interruption.

Introduction

The increase of the demand for home-care services is an international field of interest. The use of the Information and Communication Technology (ICT) solutions allow to enhance the quality and safety of Health Care.

These trends are strong incentives for e-Health research. A number of research projects [1], have been undertaken to propose solutions to the issues of mobility, communication, remote monitoring, timely access to patient specific information, and involving patients more actively in their own care process. The introduction of new technologies in practices induces system failures [2], and then possible harmful effects, such as delay in appointments, problems with data transmission of patients’ records, etc.

Even if the previously mentioned projects largely deal with the benefits of their solutions, they do not consider constraints in using ICT in the health sector. No plans are proposed in case of failure of the solutions, and few considerations of organizational business interruptions are taken.

This paper present a Business Continuity Management methodology (BCM) for home-care organizations to ensure the ability to operate in spite of unforeseen events and quickly recovering from any type of business interruption.
Business Continuity Management

Organizations have to continually serve their customers in spite of disruptive incidents [3]. In this way the BCM is “a holistic process that identifies potential threats to an organization and the impacts to business operations, it provides a framework for building organizational resilience with the capability for an effective response“ [4]. BCM is a decision-making process that includes the concepts of business resilience, long term performance and value preservation [3]. It incorporates treatments and controls to continue essential business processes, once an outage event has occurred [5] and to recover operations within a “predefined time” [6].

The BCM life-cycle [4] integrates a four-stage process: (1) Identification of activities and resources supporting key processes; (2) Definition of a BCM strategy; (3) Development and implementation of a BCM response, Business Continuity Plan (BCP), which is a set of procedures and documents describing a sequence of actions, and people responsible for carrying them out, to resume business processes following a disruption; (4) Exercising, maintain and reviewing the plan.

Home-Care

The home-care process is a collaborative process [7] connecting an important number of technical and human resources, that involve multidisciplinary care providers [8] (doctors, nurses, case managers, physiotherapists, etc.) and personnel who provide activities to support daily living for patients (home health aide, personal care worker, etc.).

Due to health aspects, managing business continuity in health care environment is sensitive [9]. However, in the health care context the BCM is in its infancy [3] and no standard format for BCP exists. Then home-care organizations have difficulties to respond to organizational and technical dysfunctions.

In that way, our aim is to define an adapted BCM methodology to the home-care processes.

Proposed BCM Approach in Home-Care

To formalize a BCP we propose a model-centered approach, adapted to home-care specificities. As described in Fig.1, four different steps compose the method that is compliant with the BCM lifecycle proposed by the BS25999 standard [4]: (1) Organization Modeling: the process oriented modeling approach allows modeling existing home-care processes and the exchanged data. ARIS software [10] supports this. (2) Definition of continuity strategies: Proactive and reactive strategies definition to ensure
Busines continuity is the topic of this step. (3) Business Continuity Plan Modeling: since BCP model should integrate organizational and technical particularities of home-care system, a BCP meta-model is defined supporting different type of possible failures. The model is completed using Complex Event Processing (CEP) concepts [11] to model the anomaly detection process. By identifying complex sequences of events, the CEP is a strategic technology especially effective in situations involving numerous factors that interact in variable ways [11]. (4) Exercising: Anomaly Treatment Process: The anomaly treatment process allows continuing business until recovery is accomplished. This process is composed of three phases: evaluation of the failure, implementation of reactive actions and finally implementation of corrective actions.

Conclusions and Perspectives

Discontinuities in home-care system decrease patient safety. Ensuring business resilience has proven to be increasingly challenging as the home-care field employs more ICT applications and all signs for the future point to even more reliance on digital data.

In this paper, we present the framework of a BCM approach that should ensure the permanence of key processes in home-care system supported by an e-platform. To be able to respond, manage and recover from disruptive events in the shortest possible timeframe, the proposed BCP for home-care organizations helps quickly detecting the outage and restoring operations.

Our ongoing work is to achieve a formal description of the BCP, following an approach grounded in Model-Driven Engineering (MDE).

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AFA-ConnectAlzheimer: Telepsychology for Caregivers

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Abstract: Caregivers caring for dementia patients suffer of stress, especially if the caregiver is a relative of patient. AFA-ConnectAlzheimer platform includes a web videoconference platform with the objective of provide remote psychosocial attention with a psychologist and group therapy with other caregivers. Also other relevant services for caregivers are included. In order to address the lack of computer skills in elderly caregivers, a low cost all-in-one touch computer was also delivered to users to easier interaction with our test platform.

Introduction

Alzheimer disease represents the most common form of dementia in Europe and approximately 7 million Europeans are directly affected by this disease [2]. Unfortunately, the cure to this disease is still unavailable and the need of new techniques and tools to provide better psychosocial attention to patients and caregivers (in Spain, usually a relative of patient) is a need.

In this paper we present a telepsychology tool to support Alzheimer caregivers at emotional level, their daily tasks and patients in initial stages of the disease. The proposed solution, in form of a web application, includes a videoconference (VC) tool and other relevant services for caregivers. In order to provide a comfortable and friendly access to inexpert users, a low cost customized all-in-one touch computer was also delivered to users.

The project has been implemented by eHealth and eDependence cluster of “Fundació i2CAT” [6], who provided the technological platform, and “Associació de Familiars d’Alzheimer (AFA) Baix Llobregat” [7], which selected users to participate in the project and provided with a psychologist to conduct VC sessions with remote users. The project lasts for two years (2009-2011) and it was funded by Citilab [8] with 100.000€.
Background

The total estimated worldwide costs of dementia are US$604 billion in 2010. Costs of informal care and direct costs of social care contribute in similar proportions (42%) of total costs worldwide; direct medical care costs are lower (16%) [1]. Just in Europe, approximately 7 million people are directly affected by dementia with an estimated cost of 160 billion € in 2008, of which 56% were costs related to informal care [2]. Informal care is one of the most common forms of attention provided in dementia scenarios and according to a Spanish survey, 93% of informal care providers declare to have a low quality of life [3].

According to previous data, development of new tools to support informal caregivers’ functions, in order to reduce care costs and improve their quality of life, is a need.

Implementation

AFA-ConnectAlzheimer project [4] created a community web platform that allowed social interaction among caregivers and with a psychologist from AFA through a web VC tool. Also additional services to support caregiver tasks were included in the platform: agenda, educational multimedia contents and news related to Alzheimer disease. The access to an online cognitive stimulation tool, Smartbrain [5], has also been integrated in the platform to allow remote cognitive training for patients in initial stages of Alzheimer disease. An all-in-one touch computer was delivered to users in order to obtain a user-friendly approach.

Videoconference tool

The VC system, based on Flex technology, included in AFA-ConnectAlzheimer project allowed audiovisual interaction among users without installing any third party software; the only requirement was the access using a web browser with Flash plug-in installed. The developed tool also included a network bandwidth estimation function that adapts VC requirements (quality of image and frames-per-second) to the available network resources between user and streaming server, in our case a Red5 server.

Users could access to the VC services in two modes: using predefined rooms that allow a maximum of seven concurrent users interacting at the same time or using a “Fast call” method that allowed creation of dynamic rooms between two users that were connected to platform.
**Additional services**

In order to provide caregivers with resources that easier his daily tasks several additional services have been included in the platform managed by AFA psychologist: daily agenda, news about Alzheimer disease and caregiver’s multimedia resources. With the aim of obtaining a greater interaction of from users with the online platform, a radio station and a newspaper sections were also included.

Additionally, access to online Smartbrain was integrated in project platform to allow cognitive stimulation to initial stage of Alzheimer patients on a remote way. The objective was to avoid their trip from homes to AFA Baix Llobregat facilities to conduct this kind of activities.

**Testing scenario**

One of the goals of AFA-ConnectAlzheimer project was to provide real users access to the designed online platform with a user-friendly approach. Considering majority of users were elderly and have low experience with computers, we delivered to them low cost all-in-one touch computers (approx. 400 € in 2008) that were installed in their homes. A kiosk solution was included in those computers with the aim to allow access of users to web platform just switching on the computer. The rest of interactions with these computers were done using their fingers. Also, remote access software was installed to help users with troubleshooting and avoid technician trips in minor problems cases.

The project was tested during 18 months with 10 users with an average of 62 years old.

**Findings**

The functionality more appreciated by users in AFA-ConnectAlzheimer was the VC service and the attention provided through this medium by AFA psychologist. Regarding this service, 50% of users preferred individual VC sessions with psychologist and other 50% considered more important virtual group sessions with others caregivers.

Considering the psychological attention provided by the platform to caregivers, it has eliminated physical barriers (there was no need to travel to AFA facilities) and enabled immediate attention in critical situations. In addition, virtual support groups, in which they shared experiences, strategies, emotions and situations of their everyday life, have facilitated the creation of a social network among caregivers. Consequently, involvement of caregivers in those groups has significantly improved their emotional wellbeing, self-esteem and personal motivation in their everyday life.
The involvement of caregivers has not only contributed in expanding their knowledge about the disease and their feeling of group belongings. Schedule a VC session stimulated and activated the self-esteem of caregivers, i.e. the simple act of taking care of their self-image for a VC session with the psychologist or with other caregivers can be considered a qualitative leap in self-abandonment or loneliness situations.

Conclusions

AFA-ConnectAlzheimer represented a small scale telepsychology approach which validated psychosocial attention to caregivers of Alzheimer patients through a videoconference system included in an online platform with other services for caregivers. Also a cognitive training tool for Alzheimer patient in initial stages of disease was included in our platform.

Low cost all-in-one touch computers with personalized kiosk interface were also delivered to users in order to provide an effective user-friendly solution for elderly caregivers with low degree of computer skill.

As future work we would like to expand the project in order to obtain an integral solution in form of a web application to support caregivers in care of dementia patients and validate it with more participants.

Acknowledgment

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References

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Alcatel-Lucent Patient Centered Telemedicine (PCT) – Enabling real transformation in Healthcare

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Abstract: PCT is an innovative telemedicine platform that is designed to enable true multi-point communication between a patient and their healthcare team over the entire duration of a medical event. It allows everyone involved in the medical case to securely view each other, patient data and medical records regardless of the communication device used. By enabling the remote exam and access to relevant patient data, PCT will help to lower medical costs and improve access to high-quality care.

Introduction

Alcatel-Lucent and the University of Pittsburgh Medical Center (UPMC) signed a joint development agreement in March 2011 to collaborate on the development of a new telemedicine/teleconsultation platform called Patient Centered Telemedicine (PCT). The platform will support a collection of Telemedicine services such as scheduled real-time Remote Consultations (hospital owned and corporate clinics), Emergent non-schedule services such as TeleStroke, and post-operation/procedure Virtual Rounds. ALU and UPMC are jointly funding development and productization over 2 years.

The solution, which will be ready for commercial launch in early 2013, will offer secure, real-time clinical encounters in a virtual “exam room” designed to fit the workflow of health care providers and the mobility of patients. Using a secure Web portal, patients will have access to both scheduled and emergency care from any location at any time through a variety of mobile devices using real-time video and audio communication among multiple participants in multiple locations. At the same time, the system will securely generate, retrieve and store patient data in a clinically relevant way.

The long-trusted partner of service providers, enterprises, strategic industries and governments around the world, Alcatel-Lucent is a leader in mobile, fixed, IP and Optics technologies, and a pioneer in applications and services. Alcatel-Lucent includes Bell Labs, one of the world's foremost
centers of research and innovation in communications technology. With operations in more than 130 countries and one of the most experienced global services organizations in the industry, Alcatel-Lucent is a local partner with global reach.

UPMC is a $9 billion global health enterprise with more than 50,000 employees headquartered in Pittsburgh, PA., and is transforming health care by integrating more than 20 hospitals, 400 doctors’ offices and outpatient sites, a health insurance services division with 1.6 million members, and international and commercial services.

Product Description

Patient Centered Telemedicine is a secure, web-based virtual exam room that:

a. Provides a single point of access for patients and the medical community;
b. Fosters collaboration by allowing users to easily interact remotely with anyone involved in a patient’s medical case;
c. Is available for the entire length of the medical episode;
d. Is accessible from anywhere, using any device.
e. Maintains a time based log of interactions between the participants

While conceptually similar to a live patient appointment, Telemedicine sessions offer additional capabilities. Fundamentally, a Telemedicine session represents a patient’s medical case. Each encounter between the patient and the medical provider is represented as an event of the session. Sessions are kept open until the complaint is resolved to the satisfaction of the provider/patient.

Each Telemedicine event virtually brings together a patient with a chief complaint to a physician / medical provider from a specialty practice area or service line at a mutually agreed upon time in a mutually agreed upon location. At the completion of a Telemedicine event, the Patient Centered Telemedicine System will summarize the event in a readable report form as well as an electronic CDA/ HL7 compliant summary.

PCT will allow patients and their family members to easily access and view the patient’s data as well as interact with healthcare professionals using common devices over the internet.

Some of the key features for the initial release of PCT include the following:

- Secure web portal – accessible from any device;
- Session based Telemedicine encounters;
- Multi-point audio/video from variety of endpoints;
- Ability to add third parties from a live session;
• Allows scheduling of telemedicine endpoints;
• Policy based user views;
• Data and image sharing from medical databases;
• Integration with hospital’s clinical workflow and EMR systems;
• Tele station for images and video;
• Support for specialized video conferencing endpoints;
• Support for endpoint management and health checks;
• Certification of device availability;
• Audit trail of event activities.

PCT has several types of interfaces into various hospital systems:
• User Authentication/Authorization using the Hospital User Directory supported by an LDAP interface;
• Data from EMR Systems (EPIC, Cerner, etc.) extracted using a configurable gateway;
• Screen Image capture and import into the patient’s session using the web portal;
• Uploading of images or video files for sharing during medical encounters. Drag and drop of files into the portal will also be supported;
• Capability to archive session data for auditing purposes.
Anatomy of a Teleconsultation

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Telemedicine, as stated by Jeff Bauer, is «practicing medicine at a distance». In France, the HPST telemedicine act has individualized several practices: teleconsultation, teleexpertise, teleassistance, collaborative staff meetings…

Our approach is focused on teleconsultation, which leads to or benefits from the other practices: distant expertise on imaging, assistance of a non medical care provider to perform an ultrasound examination, online discussion on diagnostic or therapeutic approaches…

Teleconsultation is nothing less than a regular consultation including different phases:

- Listening to chief complain, history of present illness, past history, allergies…
- Asking some symptom-oriented questions;
- Practicing a review of systems;
- Followed by physical examination;
- General, vital signs;
- Then unique or multiple organ/system(s), according to complains.

Both the local nurse/physician assistant next to the patient, as well as the remote physician shall put the patient in confidence; the ultimate goal is to withdraw mentally the screen(s). Through appropriate remote-control camera movements and zoom effects, the distant physician will give the feeling that is in the room. Listening quietly to patients concerns is of upmost importance in this respect, before asking some oriented questions.

Then, exo (skin, eyes) / endoscopie (ENT) followed by auscultation and, if necessary ultrasound «palpation» will end into a thorough and comprehensive physical examination.

All the captured information / data will be entered into the patient health record, using the most convenient entry mode (pre-established touch screen templates, digital handwriting and dictation). Next step will be to transfer a prescription at the patient’s site. Great care should be taken from full compliance to administrative forms, with a special concern to consents and authorizations.
Jacques Cinqualbre, M.D., Chief Medical Officer

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Assistive Tools for Real-Time Optimized Audits of Homes of People with Disabilities or With Loss of Autonomy

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Abstract: In a context of aging populations, policies supporting home care are becoming major issues. The audit of the living space has become an important preliminary step in the process of compensation and prevention of loss of autonomy. A number of improvements can be identified through the audit such as adequate accessibility of the habitat permitting or facilitating ambulation and daily life activities. However, each evaluator often operates under his own methodology and the main problem arises during the evaluation, due to the lack of information support that could help and guide efficiently in real-time for example on current standards or regulations. Our proposal relies on an interactive "connected" tool integrating real-time assistance databases.

What is a home audit? For whom? What for?

Ideally, maintaining people at home relies on technological support as well as environmental adjustments. For patients to stay at home adequately it is necessary to assess their needs and those of their relatives. The following criteria are essential: the person's wishes, health and health history, degree of autonomy, social environment (isolation, neighbours...), professional helpers (attending physician, social worker, home help...), type and state of dwelling, financial means and Social Security cover.

Auditing consists in controlling and advising. It is a tool supporting continuous improvement which enables to assess a specific domain by evaluating the premises and producing an inventory of weaknesses and/or nonconformities. Subsequently, appropriate measures can be taken to remedy deviations so as to implement compliance with norms.

If staying at home happens to be manageable, evaluating the premises is part of the process of assessment for persons progressively losing their autonomy. Various factors can account for this loss of autonomy:

- Diseases: degenerative deteriorations of the central nervous system, cerebrovascular condition, psychiatric conditions, arthropathies and after-effects of fractures, eye and ear diseases;…
• Deficiencies: altered or impaired state or function affecting psychology, physiology or bodily structure;
• Impairments: generally restricted faculties which involve deficiency, inaptitude or even handicap;
• Handicaps or disadvantages: restrictions concerning an environment in terms of accessibility, expression, understanding or apprehension.

Obviously, adapting the lodgings cannot remedy all these difficulties, but a number of improvements can be identified thanks to an audit:
• Complying with accessibility standards enables to move around and perform everyday life tasks like preparing meals,
• Preventing falls,
• Improving salubrity and comfort,
• Accessing social and cultural life.

Thus, an audit aims at performing an inventory of all failures so as to establish a list of recommended renovations. The report is to be passed on to fitters and artisans (for estimates) and eventually to social financiers.

Organisation and Actors Involved

In France, like in other countries, the main bodies that perform or request audits are public establishments run by regional councils, hospitals, welfare agencies or, pension funds, associations of social workers and users, private agencies and service providers, social medical institutions. Audits are generally performed by occupational therapists. They aim at assessing the person so as to maintain and increase her independence and autonomy within her usual social and professional environment. They can collaborate with medical professionals (like orthoptists for the visually-impaired), building contractors (plumber, architect…), social sector professionals like case-workers to help set up a file for funding.

Advantages of adopting a digital tool

Depending on the domain, each evaluator uses his own methodology without any standardized guideline. This may result in approximations and discrepancies: incomplete audit, post-reading and understanding difficulties, no standardized format, long re-keying after evaluation completion. Moreover there is a lack of information that could provide efficient real-time support, for example on current standards or regulations.

The following example relies on a connected interactive tool integrating assistance databases. It can be an IP-enabled touch pad with dedicated software permitting to:
- Standardize file output data, thanks to report templates,
- Evaluate comprehensively through a list of parameters to be checked based on the disabilities of the person and the room being inspected,
- Provide real-time assistance by displaying standards and regulations,
- Access edit and complete a third-party evaluator's audit report,
- Improve readability by displaying selectively the main criteria to be appraised depending on the room and impairment,
- Import patient details (name, address...),
- Compare different evaluations of the same house,
- Capture and annotate photos and explanatory sketches on-the-go,
- Generate statistics by sharing information within a single database.

As shown in figure 1, the example architecture is composed of a database hosted on a web server, a network administration interface, a site enabling to display the shared knowledge base and a client-application on the touch pad. A copy of the data-base is installed on the tablet to provide for a lack or loss of internet connexion. All information is eventually uploaded on the server and secured within the online database.

As shown in figure 2, when creating a new audit report, a general information page is displayed, the different fields have to be filled in, (name, address...). Selecting the type of disability already permits to filter the criteria that need to be assessed in the house. It is then possible to add a room by picking up from the list. The overall criteria for this room are displayed (circulation, lights, flooring...). If the evaluator thinks there is nothing wrong with a criterion, he can validate by ticking the green OK box. Otherwise the criterion can be invalidated (red tick) and a list of sub-criteria is displayed, then following the same validation process. The
navigation bar on the right can be popped up at any time to display selectively context sensitive help for the current room.

After assessing all the relevant rooms, a summary of the audit is displayed. In case something has been forgotten or a mistake has been detected, it is possible to re-edit the room by clicking the corresponding tab. Otherwise the evaluation is validated and a draft report is issued. The various fields can be filled out to describe the solutions devised to meet the different needs.

When saving the audit at final step, several documents can be attached (blueprints, annotated photos...). Once saved, the information can then be reviewed by a third-party or mutualised for statistical usage.

Fig. 2: Application Screen Capture

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Domestic Risk Prevention and Technologies: New Jobs of Tomorrow for Home Support

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Abstract: Falls inside the house are by far the leading cause of accidents. ICT for the autonomy of persons including home automation are working to develop space in terms of safety and ergonomics. However, to preserve the parameters established by an elderly person on a daily basis, a multidisciplinary support is vital when working for improvement in the housing. Mainly, the professionals in health, social and medico social fields have been trained in assisting in the daily life by combining health care and human support. But other tracks are to be thought and developed facing new tools for "autonomisation". The aim of new jobs converging transversal through gerontechnology and intelligent building will be to find innovative solutions tailored to maintain independence.

Context of Aging and Dependence

According to figures from INSEE (French demographic institute), in 2009, 22.7% of the population in France was over 60 years, with an average life expectancy of 77.8 years for males and 84.5 years for women. Similarly, more than 9.6 million people with disabilities are reported in 2007. The place of the elderly and the disabled person has been reaffirmed in society through a recent law of January 2002. This demographic, social and political past twenty years has fostered new jobs around support for autonomy. Others jobs are still to be thought with respect to the law of 11 February 2005 on rights and opportunities equality, participation and citizenship of people with disabilities. The question is then: "What the needed jobs are, today and tomorrow, to ensure autonomy of people?"

Current Strategies Evolve

Public administration, education, health and social action represents 29.7% of jobs in France. In the field of autonomy, it primarily concerns health and social professionals. In the foreground, general practitioners, specialists such as geriatries, are in charge of various kinds of patients. Nurses accompanied by other caregivers and sometimes hospital workers ensure a medical survey. They are sometimes assisted at the level of rehabilitation and support after hospitalization, by physical therapists and
occupational therapists. Meanwhile, jobs in social work can develop an efficient support. Social workers are responsible for social support. In everyday life of disabled people, other professionals are involved, such as medical and psychological aid, carers at school. For the elderly, support will be more daily performed by social assistants and home caregivers. Trainers and animators may also, through activities, maintain the autonomy of individuals.

Aforementioned professionals are trained in assisting in the daily life combining health care and human support. With the evolution of practices involving technology and paramedical support, they have and will necessarily have needs for trainings to face these new tools for "autonomisation". In the medical field, telemedicine is a good example. It is a booming approach to remote medical practices using the information and communication technologies. Some university research laboratories are working for example, on prosthetic "smart" arms controllable by means of electrodes implanted in the brain. Users of these prostheses will need to be assisted by rehabilitation professionals such as physiotherapists specifically trained for these new technologies. In the field of social workers, a challenge of learning is and will be required to take into account new technologies as a tool for facilitation and support.

New Concepts to Face the Loss of Autonomy

At the initiative of the Chamber of Craft Trades of the Limousin region, the National Centre for Health Innovation and Job Autonomy (CNISAM - a national label) accompanies the artisans in their business practices to integrate environmental, health, social and regulations related to habitat for autonomy. Also, a label called Handibat certifies the quality of professionals and facilities for accessibility of buildings. In addition, the label aims to provide reliable, consistent and objective of the skills of the professionals. This label is new and still not well known. This approach may soon be a source of jobs and new specializations for the market of autonomy: for support and consulting, but also for the evaluation of the professional. Training programs are and will be provided for giving competencies to these professionals. The training market being promising in terms of economic and human development, other training centres specialize in "how to work with people with diminishing abilities and disabilities" could develop. These trainings could be aimed at various companies and professionals (secretaries, plumbers ...) so they can develop support and counselling tailored to each user.

Jobs of the Future for Today’s Needs
"Gerontechnology", "Handibat", words that mean both convergence and transversality. The main objective is to find innovative and personalized solutions to maintain autonomy (intelligent floor, touch interfaces...). Consultant in domotics, specialized architect, social technologist, engineer in autonomy... all these new jobs will have to ensure the maintenance of the proposed techniques in the broad sense, not only technological but also social, societal and economic to optimize and ensure the functionality of the provided assistance.

Similarly, a professional specializing in the adaptation of the habitat "for the independence of people," will result from all the above fields (technology, health and social habitat management, architect...) with transferable skills. It will be necessary to develop a strong partnership and a strong transversality between technologists and social workers, and even converge towards a single global competence answering to the problem of "autonomy". This professional will be an expert coordinator with a broader vision. One can imagine that many jobs skills will be impacted in the field of marketing, coordination, advice, expertise and audit, in legal and ethical issues, and those of the audit and norms and standards.

Toward A More Efficient Prevention of Domestic Risks

With the aging of the population, domestic accidents are brought to multiply. If the accident rate decreases with age until age 70, it increases again over 70. Women are the first victims (over 70% of accidents). Falls inside the house are by far the leading cause of accidents (82%) and fractures account for 36% of lesions in people over 65 years. The loss of vision, loss of balance, discomfort, heart problems and osteoporosis are all possible causes of these falls. It is also estimated at one million the number of people affected by neurodegenerative disorders (Alzheimer's, Parkinson's...), which raises the potential risk of domestic accidents.

In this context, jobs of tomorrow, driven by transversal skills and competencies can efficiently act to reduce the number and probability of risks at home. In particular, this transversality will ensure a better evaluation of the risks in the house, taking into account very different parameters such as:

- the life style of the person in loss of autonomy;
- the life project;
- the standard of living and medical conditions;
- the degree of acceptance of technologies;
- the needs for social links and the ergonomic aspects of the habitat;
- the possible degree of integrating home automation and ICT equipments for assistance in a non-intrusive way;
• the possible connection with telemedicine or telecare services;
• the best mode of interaction of the user with the assistance equipments (ICT, home automation and health technologies), in particular in terms of interfaces (Human-Machine Interfaces);
• the possibilities (public or private) for financial supports.

It will also ensure the best security by adequate equipments (for comfort and medical aspects) and living space design (in terms of ergonomics and aesthetics), and a better support in the daily life in a broad sense.

In any case, all this set of parameters show that jobs of tomorrow will have to keep in mind that technology cannot and should never replace the human help. In particular, all the prescribed solutions must stay human-centric. These solutions must neither proact nor substitute the role of the people. In this case, the result would be to add more dependence and constraints in the people’s daily life. The elderly and disabled people must remain the main actor of his life and immediate environment. All the provided solutions must appear as a natural extension of his habits, gestures and way of life (more generally of the “history” of the people).

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DREAMING – Alarm and Monitoring System for Empowerment of Elderly Citizens

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Abstract: This paper presents the DREAMING project – a project focusing on home monitoring and eInclusion in relation to chronically ill elderly citizens. The paper will provide intermediate results and experiences drawn from the ongoing pilot study as well as bring information on barriers, challenges, and successes.

Introduction

The DREAMING project aims to provide an answer to the well-known demographic challenge faced by most European countries consisting of a diminishing labour force with the responsibility of caring for a growing number of chronically ill elderly citizens. This produces the need for a solution enabling the care for chronically ill elderly citizens to be more efficient and flexible, as well as less reliant on traditional home care. The DREAMING project offers a unique combination of socially acceptable and financially sustainable solutions relevant to the health and social care sectors. By bringing together videoconferencing solutions and monitoring and alarm handling services, the project bridges a traditional gap between the areas of telecare and eInclusion. The services included in the DREAMING project empower citizens by letting them handle their own measurements (e.g. blood pressure or oxygen saturation), ensure the citizens’ safety by use of automatic alarms directly connected to district nurses, and allow citizens to stay in contact with friends, relatives, and health professionals via video conference. The aim of this paper is to share important intermediate results and experiences from the project.

Methods

In the context of a real life pilot setting, the DREAMING project tests a range of welfare technologies in six European countries (Denmark, Estonia, Germany, Italy, Spain, and Sweden). The participating citizens have been included in a randomisation process to produce a test group, who has had a number of technologies installed in their homes, and a control group, who have continued with regular home care. Citizens must be at least 65 years
old and suffer from diabetes, heart failure, or Chronic Obstructive Pulmonary Disease (COPD) to be included. Furthermore, it is a criterion that the citizens do not suffer from any cognitive impairment as they must be able to carry out regular health measurements.

The citizens take their own measurements which are sent to a portal accessible for the nurses. In the portal, individual threshold values are set up for each citizen, and if a measurement is higher or lower than it should be, an alarm is sent to the district nurse in charge. Furthermore, the portal provides the nurses with an overview of each individual citizen, thus making it easier to assess the overall health situation of each person as well as to judge which of the citizens are in need of assistance and which are managing well on their own. At this point, the health data recorded in the portal are only accessible to the district nurses, but on a regular basis copies are provided to other health care providers, such as GPs and outpatient clinics, in order to provide them with as much information about the individual’s health situation as possible.

Secondary data from both groups, such as the number of hospitalisations, falls, deaths, etc., as well as a user satisfaction survey and questionnaire surveys based on HADS [1] and SF36 [2] will form the basis of an analysis of the efficacy and overall impact of the services. Furthermore, an economic impact analysis will be carried out to evaluate the possibility of generating savings as well as meeting the challenge of a diminishing labour force.

The project was initiated in May 2008 and runs for four years.

Results and Lessons Learned

Through the unique mix of eInclusion, telecare, and eHealth services, the DREAMING project opens up for unexplored opportunities in a setting where the two individual fields of health and social care are brought closer together. Although the project is still running, intermediate results show positive effects from the use of the technologies. Both citizens and nurses are pleased with the new possibilities that the services give them and find the technology easy to use. Citizens feel safer knowing that the nurses can check up on their measurements and react if something is wrong. The nurses can save time by avoiding trips to citizens whose measurements are in order. All in all, the services can result in elderly citizens staying longer in their own home, avoiding hospitalisations, and being released from hospital sooner.

However, new opportunities seldom come without challenges. In this context, the most interesting of these are the challenges experienced in the real life pilots. Apart from technical difficulties relating to the video conferencing and home monitoring equipment, which have in turn given
rise to significant user driven innovation and development, DREAMING has experienced challenges in relation to the inclusion criteria for participating citizens as well as changes in organisational setup within the participating health organisations. As the project entails a radical change of the working procedure of the district nurses who are looking after the citizens, full acceptance took some time to be established. In this process, the Danish team has experienced that a higher degree of involvement results in greater acceptance. Furthermore, the nurses constitute a source of valuable knowledge about adaption of the technological and organisational factors in order to get most out of the services. Concerning the participating citizens, they have been remarkably open towards the new way of managing their chronic condition that the project has introduced. Although some of the participants have chosen to leave the project, it is undeniable that elderly citizens are ready to be empowered through eInclusion and home monitoring. In this connection, the pilot sites have learned that appropriate training and support promotes a positive attitude towards the services. Despite this positive finding, a considerable number of citizens have dropped out of the project due to a severely worsening of their condition, moving to a nursing home, or even death. This indicates that the target group of the project consists of elderly people considerably weakened by their health situation. This spurs the thought that even though the testing of the DREAMING equipment and services has indicated considerable benefits, even greater benefits may be reachable by applying the same method of home monitoring and eInclusion with a broader group of citizens in need of home care.

Within the project, the abovementioned challenges are seen as the chance to learn about this new area in order to ensure the success of future large scale implementations. This paper serves an important part of this objective by sharing the knowledge and experiences drawn in the project.

After the end of the project in June 2012, final results will be published and presented at a Final Conference.

Conclusions

By combining eInclusion with alarm handling and monitoring services, DREAMING introduces a possible solution to the current demographic challenge. The project has learned from the mentioned challenges, and experiences obtained during the real life pilots will be used to refine e.g. the technologies and organisational adaptation. Given the positive outcomes so far, this solution can be anticipated to contribute significantly to the improvement and streamlining of healthcare services not only for elderly citizens but for citizens of all ages and with all types of illnesses.
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Casper Marcussen’s field of activities has mainly been linked to management of ICT and healthcare-related projects (especially R&D ones from ICT-PSP to AAL & FP6 & FP7 projects), from their birth as not-yet-approved proposals, to their successful conclusion. Besides his role as a project manager and consultant, he is the owner of the company WeCare, whose main field of activity is market research on the European market.
ElderCare: How Technology Can Help To Care for Elderly People Who Live Alone

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Abstract: Actually medical systems are based on the data that doctors obtain from patients at medical consulting. This data is only accessible for people/entities that belong to the same health network. The current technologies give us the capability to get real time information from any place and store it in several places. This information can be sent from many different sources, like: sensors, medical devices, computers, television, phones... If we combine these technologies we could build a home environment where elders can spent their daily life, improving their quality of life and feeling more secure about their health. Our project consists on putting some sensors at home, with this environment we could get data about their habits: how many hours they sleep, how many hours they stay at home, how many times they go to the bathroom, if they watch too much TV despite of going for a walk and things like that. This information could be completed with health records using medical devices as blood pressure monitors, weight-scales... which send the data to the remote server. Something to consider is that elders are often unfamiliar to new technologies, so it is a big challenge to build an environment where the direct interaction with the technology is as less and easier as possible. Beside this, we have worked on systems which get other kind of information, for example about diseases or medical reports. To get this data we connect via internet to health-data providers and using semantic standards we organize all the information we get. On the other hand we have developed how to use all the information that is collected. There would be a server which would contain all the data and present it via web pages or via web-services to allow third party companies reuse the data or increase our information. With all the information and with the correct interfaces the medical staff could make habits' statistics, health-data statistics... to improve the diagnosis, making the health care of elders who live alone much easier and cheaper.

Introduction

In a world where life expectancy has increased in the last decades, is needed to evolve the ways of managing our health. Elders are the ones who need to pay more attention to their health, and these results on an increase
of the cost of medical services. Nowadays medical consultations are full of elderly people who see that they need a more comprehensive tracking.

We are surrounded by technology, we have mobile phones which allow us to get or send information, there are tracking systems that give us information about the weather, the state of the streets and there are sensors that give us the chance to get health and habits' data.

There is a necessity and the technology to attend it is available, so we have created a home environment where we can get the data to improve the health and habits management decreasing the cost to the medical services.

Connected World

Everything is connected. Internet has become a powerful network that reaches most of the homes and now we can gain access to it from our mobile phones. We can talk easily with someone who is at the other side of the world as he were in front of you, and at the same time we can send him any data almost instantly. This is a little slice of how our lives have changed thanks to advances in communication technologies.

But this is not everything, applications have evolved to a new tendency called cloud computing:

“Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a metered service over a network”

By this way we host services and information online. There are several protocols to access this information stored on the servers, RESTful and SOAP are well known. RESTful is a protocol which uses HTTP methods to communicate the server-side with the client-side. SOAP is a communication protocol that defines how two objects in different processes can communicate via XML data exchange.

These protocols provide us the necessary way for the client-server communication, but that does not guarantee any interoperability. For this reason some standards for electronic exchange of clinical information has been created: Among these we can highlight CCR, and HL7. These protocols set out the structure of the messages that are used by the server. With this, we can create a platform that can be integrated with third-party software, obtaining the necessary interoperability between systems for the management of clinical records.

Combining all the above we create an accessible and interoperable platform for medical data management [1]. This kind of architecture allows us to have different types of applications to consume data, native or web applications. In our case we have developed web platforms, allowing us to access our data from anywhere without installing any software, all you need
is a browser. Lots of progress has been done on mobile phones so developing a Web application allows us to display the application in any current mobile OS without the need of different developments.

Sensors and Habits

One of the biggest challenges for elder people who live alone is the record and management of the actions they take in their daily living, there are no records about how much time they spend doing different activities [2]. This results on a poor habits management, which can greatly affect the health status of the elderly.

A wide range of sensors can be found on the market, but for the habits' management on the elderly, we basically need the presence sensors. Using sensors we can get the number of times and how much time elder people spent in a room. There are also pressure sensors for chairs and beds, which let us know if they spend too much time sitting watching TV or sleeping, or if they spend little time. But this is only a small part of what can be done with this technology. We can generate statistics and reports about sleep problems due to the data that has been collected which contains the number of hours spent in bed, how many times someone gets up...

To perform these tasks we have created a home environment which includes a motion sensor "Jung FW 180 WW" which detects the presence using RF to perform the monitoring of the time spent and how many times the elderly are in every room. To control how much time the elderly spend sitting or bed we use the pressure sensors "Recora Bed Occupancy Sensor" and "Recora Chair Occupancy Sensor", finally to get data to know if the doors, drawers or windows are open or closed can be checked using sensors 1A66B Meder-MK4-Meder 500W Magnet M4.

All these sensors are connected to a hub which is a mini-PC using the KONNEX standard, which is a communication standard for devices in houses. To connect the sensors to the mini-PC we used the Jung 2700 AP and Jung 2130 USB REG devices. This makes easy the work of understanding the sensors' data because the information is represented in binary code, where the 1 means that there is presence and the 0 means that there is no one.

Health Management

Currently an elder should go to the doctor frequently, most of the cases it would be to monitor his health. This generates an increase at the waiting lists in hospitals, while bearing in mind the elderly who often rely on someone to accompany them to the doctor.
Right now there are a large number of monitoring devices that can be used at home without technical or medical knowledge, and they have connectivity via WIFI, Bluetooth, USB and even 3G. These devices can be placed in a home environment allowing an elder to monitor himself, after this; the data will be uploaded automatically on the cloud. So besides having their PHR more updated, you have a better record of the evolution of the elder people's health status, and all this decreasing the costs.

But this presents a challenge: Most of this kind of people are unfamiliar with technology, and we cannot ask them to go on with complex tasks, thus the devices that have to be used must be simple, for example, devices that you put them on and by pressing a button data is uploaded. The data uploading task is a platform duty, so it has to be transparent for the user. With this system the user only has to get on the weight scale, put on the pulse oximeter or the blood pressure monitor and press a button.

Future

So far data pickup, reporting and statistics have been presented. This is fine for the purpose of monitoring, but the next step is the symptoms understanding and illnesses prediction. Why not follow the evolution of habits and health of an elder to predict if he is getting ill or if he may have a problem, and all this without the supervision of a user? Different semantic ontologies are being developed in the health area and there are projects such as SNOMED-CT [3]. Using semantic technologies we could make the platform to recognize symptoms or irregularities and link them with possible explanations and if it is necessary, notify a doctor, family, etc...

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Go-myLife: How ICT Can Improve and Facilitate the Social Interaction While Ageing

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Abstract: Online social networks play a key role in our increasing mobile and dislocated society, providing a new channel to facilitate the communication and the interaction among members. This social need is important for everyone, but it has a relevant meaning for the elderly as their participation in the society become lower everyday due to their physical status or the lack of means to facilitate this task and which can lead to a feeling of isolation and loneliness. However, fulfilling these needs become a harsh challenge for them. The majority of the mainstream social networks were designed and built with the youth in mind and have little participation of older people as they find real difficulties to interact with it. Go-myLife (full title: “Going social: my social life”) is an AAL2 project aiming to improve the quality of life for older people through the use of online social networks combined with mobile technologies. Go-myLife is developing a social networking platform customized to the needs of older people, supporting interactions with the members of their networks and communities, as well as easy access to information. It is a location and mobility based platform providing contextual awareness of whom and what is around the user which will make easier to get help and feel supported, find interesting sites, meet others and contribute with their knowledge and experience for the benefit of others. Moreover, Go-myLife provide a series of interfaces for the integration with third parties' services and content in order to create relevant and customized communities for the elderly offering not only a more meaningful experience for the end-user but a new channel for public and private providers to offer their services and add an extra value to them. Go-myLife pretends to be the gateway to the local services and communities offering to the elderly access to them through an only one platform. Go-myLife project encourages and facilitates the social life of the older people, becoming and maintaining them as active members of the society while ageing.

Introduction

In the last decades, the number of elderly has increased significantly. It is well documented the relevance that the support for the people of that age has [1] and the direct influence on their health and physiological status. The social networks play a key role providing practical, informational and
emotional support (so-called “social support”) which can entail an increase on longevity and an improvement of the physical and mental well-being.

This social support needs to evolve and adapt itself to the new ways and channels of interaction. In our increasingly dislocated and mobile society, online social network sites (SNSs) are proving valuable in bridging distances and facilitating interaction and communications.

Mainstream online SNSs are usually designed with young and middle aged people in mind and they can seem alien to elderly as these sites don’t attend to their particular needs [2].

Go-myLife: Social Networking Platform

It has been a significant increase of the participation in the online social networks. A report of the Pew Internet and American Life project [3] indicates that in USA, two-thirds of adult internet users (65%) now use a social networking site like MySpace, Facebook or LinkedIn, up from 61% one year ago. That is more than double the percentage that reported social networking site usage in 2008 (29%).

However, the use of these social networks is not proportional in the different age strata: only 3% of the users are over 65 in comparison to the 75% of 18-22- year-old.

However, fulfilling the social needs is as important for the youth as for older people, but the latter encounter more barriers and difficulties to participate in the online SNSs which discourage them from being active users and consequently force them to miss out the benefits of the social support.

In order to address this gap, the Go-myLife project (full title: “Going social: my social life”) was born as part of the AAL program Call 2 which aimed to “provide innovative ICT based solutions focused on helping people to be active, joyful and socially connected in the society as they age, from both a societal and personal perspective, effectively contributing to their health, overall quality of life and to social inclusion”.

Go-myLife is a social networking platform that integrates external services, content and social networks providing relevant contextual-awareness information about what and who is around the user and it is customized to the needs of the elderly, which enhances the social interaction with members of their networks and communities.

A Platform Built With Elderly in Mind

Most of the existing social networks nowadays have been designed by and for young people, who have grown up in the online world, and have
only slowly expanded to include older demographics, but no enough effort has been made in order to satisfy their needs.

Go-myLife pays special attention to the usability and accessibility requirements this sector demands, taking into account standards as the Web Content Accessibility Guidelines (WCAG) 2.0 and ISO 9241.

Go-myLife follows a user centered design (UCD) where the involvement of the end-user is present along the different phases. Initial workshops with end-user helped developers to understand the social needs and the networks elderly have as well as the communication issues and patterns of people of that age.

Early pilots with end-users’ communities in United Kingdom and Poland have tested the Go-myLife prototype. The feedback from these trials is used for the redesign and development of the final architecture and prototype to obtain at the end of the project a platform that satisfies real needs of the users.

A Platform Integrated to Online Social Networks

Nowadays, there are online social networks that focus only on elderly. On the other hand, some relatives and friends of the seniors are already members of online SNSs where they share and participate actively. Go-myLife doesn’t want to create a standalone social network for elderly, creating an isolated network for them. It wants to make elderly participants of the mainstream online social network, becoming itself into a gateway where older people easily connect to other social networks from an only one platform.

A Platform Based On Mobility and Location Awareness

Elderly tend to stay at home due to the lack of support or motivation to go out and participate in social activities, which can lead to isolation and a decrease of the health status. Go-myLife provides a mobile solution to accompany the aged people while they are out and around.

Go-myLife is a social network based on geolocation that not only shows the location of the content, but it takes this one step further, providing relevant information around the user.

All the content is managed by the Go-myLife Social Engine as geolocated nodes providing the latitude, longitude and even the altitude of each piece of information. The user can know where the content has been taken or to where location refers to. This content is created and uploaded by the users. In that way, users become the providers of the information and can also contribute to it adding comments. Go-myLife is an alive platform that is enriched by the own users.
Go-myLife users not only find content near them, but also they can find and join local groups, where they can participate and feel part of a community, and services, through which they can discover relevant information in the vicinity.

The information about who and what is around will allow serendipitous meeting: the user can know where his/her friends are; where the events are taking place, which local communities and service are in the neighborhood as well as see relevant information that other users uploaded to the platform. With this information, elderly feel part of the society as their knowledge is used by others, they can share their ideas and memories, they can discover new places and content, they can find people near them and establish new relationships. Go-myLife boots the social support.

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Hospital At Home: Telemedicine Assisted Discharge of COPD (Chronic Obstructive Pulmonary Disease) Patients to the Home Environment

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An estimated 300,000 people in Norway suffer from chronic obstructive pulmonary disease (COPD) with c.1400 deaths each year being contributed to the disease [1]. In 2020 COPD is predicted to be ranked globally as the third fatal disease [2]. Most of the patients suffering from this disease will have numerous exacerbations with frequent readmission to hospital.

The Norwegian Department of Health is planning a more coordinated, systematic care provision for all patients, with more efficient integration between primary and specialist healthcare, delivering treatment at the appropriate level. Patients should not experience barriers between different levels of funding, but a smooth, individually tailored, total care pathway. The COPD patient briefcase is intended as an integral part of future healthcare, delivering quality assured specialist consultation to the patients within their home environment [3].

The COPD patient briefcase technology has been under development in Denmark since 2006, and the new technology is now being tested for the first time outside Denmark at Dalane District Medical Centre (DDMC) in Norway. DDMC is a decentralised unit attached to Stavanger University Hospital, comprising a hospital trust rehabilitation bed-unit, private specialist consultant clinics, hospital outpatient clinics, hospital day surgery, physiotherapy-occupational therapy dept. X-ray, patient coping courses, and general practice doctors.

There are now 18 primary health care areas involved in the COPD patient briefcase project with a total population of 330 000.

Other primary aims of the project include enabling patients to have more quality days in their own home, with shorter stays in hospital and fewer readmissions. With the support of the COPD patient briefcase one can give patients an increased sense of security and empowerment, by providing expert multidisciplinary consultation, monitoring and education for patient, carer or health professional. This is an effective and user friendly way of utilizing available resources, while freeing capacity within the hospital.
The COPD patient briefcase is special laptop with on/off switch, alarm, spirometry connection, and finger clip for pulsoximetry. It is extremely easy to operate. Communication is via a to-way audio-visual screen which can utilize available communication modalities already in the patients’ house (e.g. broadband, telephone, satellite etc.). Inclusion criteria for patients are a COPD diagnosis, in a phase which is worse than usual, and an FEV1 under 50% of that expected. The patient must be living at home (not in a nursing home) and have contact with either the district nurse or own doctor because of the COPD diagnosis.

The COPD patient briefcase is on loan to the patient for 14 days, and the patient and nurse arrange a 30 minute consultation each day. FEV1, FVC and blood-oxygen saturation is recorded, a subjective record of how the patient feels is taken, and a standard checklist on daily status is filled out by the specialist nurse. Physiotherapy and occupational therapy consultations are agreed from day to day as required. Data is encrypted, made anonymous, given an alias, and stored electronically. In addition, each member of the multidisciplinary team writes up the patient notes. Physiotherapy and occupational therapy input can include breathing exercises, secretion mobilization, networking with the patients’ local health professionals, energy conservation techniques, motivation to activity - physical, mental and social, and any other coping strategies which individual patients wish to address.
The initial Danish user study shows a 46% improvement regarding readmissions to hospital in the group using the telemedicine patient briefcase contra the control group. There was also a 68% improvement regarding total days stay in hospital in the telemedicine group [5]. In a patient satisfaction survey 97% of those who received consultation with the COPD patient briefcase would recommend it to others in the same situation. 86% reported that they felt they had received the help they needed concerning their lung disease. 14% answered that they had received the help needed to a certain extent.

DDMC COPD patient briefcase user-survey [6] includes 90 registered patient care pathways up to 1.11.11, with 900 telemedicine consultations (+360 additional telephone consultations). Most patients were over 65 years and nearly all managed to use the technology without any help. 80% reported that the COPD patient briefcase contributed to the fact that they felt more secure when being discharged from hospital and 65% reported that use of the COPD patient briefcase had an important effect on their coping strategies.

Reported gains include prevention of some readmissions, early intervention, increased patient insight into the disease, feeling of security, better coping strategies, better quality of life, and very satisfied patients. With regards to the ethical dilemma of cold technology versus warm caring hands, patients in Norway have reported that they have felt that with the COPD patient briefcase they experienced an uninterrupted direct contact with a specialist not always possible during a hospital stay on a busy medical ward. Further specific research is necessary, and is already planned [7, 8].

Further developments regarding specialist telemedicine in the home environment include treatment of congestive cardiac failure, diagnostic blood analysis, diabetes, post-natal control, palliative team support, and physiotherapy exercise programs.

Acknowledgment

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Mariann Svanes, CV: Nurse, head of rehabilitation unit, have been working with telemedicine project; COPD patients briefcase, the last 3 years.
ICT Health and Home: What Opportunities Exist on the Horizon of 2015-2020?

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Abstract: A survey carried out on the use of telehealth solutions in Europe shows some reservations about their use among certain population groups. There are numerous differences between countries which equate to different approaches and penetrations in European countries in terms of telehealth provision.

Introduction

This study, carried out by Coda Strategies, presents three possible perspectives of the European ICT health and home market: telecare for the elderly; telemedicine for the chronically ill; and the wellness market for the general public. The result consists of four parts: the study of health and regulatory environment in several European countries; the analysis of the needs and expectations of target populations; a comparison of services and products, as well as strategies and positions, of the various suppliers; and finally, the quantification of three sub-markets for the next ten years.

Methodology

We present the main results of the study with specific supporting evidence and a quantitative analysis of the different target groups, namely the needs and expectations of European populations. Each population group has been analyzed using direct home telephone surveys (100 per country). Seven countries have been analyzed in this manner, namely, France, Spain, Italy, Germany, United Kingdom, the Netherlands and Sweden (all data is from Coda Strategies surveys carried out between December 2011 and January 2012).

Telehealth in Europe

On the whole, Europeans are still not largely open to the idea of installing telehealth tools for their day-to-day well-being at home. Swedes appear to be by far the most enthusiastic about this idea while Germans are going to be more difficult to motivate to use "ICT & health" for their general well-being.
Solutions Preferred by Europeans

While the Spanish do not show any particular preference with regard to the type of "wellness" technology, the English are more interested in fixed and discrete tools such as cameras, motion, smoke and fall detectors, allergens or other harmful substances. The Italians and the French show a preference for discrete and portable tools such as sensors and smart textiles. The Dutch are more interested in mobile tools such as smartphone applications and smart sensors they can carry on them unlike the Germans who favor intelligent devices which they can place in the home (grip ball, hypertensive cushion, smart scales, and spirometers) with integrated sensors and smart textiles.

Table 1. Solutions preferred by Europeans

<table>
<thead>
<tr>
<th>Country</th>
<th>Device preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Integrated sensors.smart textiles (and video)</td>
</tr>
<tr>
<td>Germany</td>
<td>Mobile and smart devices</td>
</tr>
<tr>
<td>Italy</td>
<td>Integrated sensors.smart textiles</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Sensors and mobile devices</td>
</tr>
<tr>
<td>Spain</td>
<td>Little preference</td>
</tr>
</tbody>
</table>
Sweden | Smart sensors and devices
United Kingdom | Fixed and hidden devices

The Priorities of Europeans

When healthy Europeans seek to install telehealth equipment in their homes, their priorities vary. The French appear to be primarily interested in security and the prevention of possible diseases. The Dutch, on the other hand, place more importance on physical activity and healthy eating for a better life balance. The Italians appear to be exclusively concerned with the prevention of diseases. The Swedes appear to be open to all aspects of wellness. The Germans place a lot of importance on comfort and none on pathology.

![European preferences by type of field (% of first choice by country)](image)

**Figure 2.** European priorities in relation to health monitoring

Willingness to Pay

From a global perspective, healthy citizens are not willing to pay much for "wellbeing" telehealth services. Nearly around half do not want to spend anything on staying in good health.
Participation of Insurers

Regarding the propensity to establish contracts with insurers to reduce risk behavior through technical solutions, the Swedish, the French and the Dutch are the most open, representing half of those motivated by the idea. The English seem quite positive in relation to this type of agreement, while over two thirds of Spanish and Italians show little enthusiasm. The Germans, faithful to their reluctance, appear to be completely closed to the idea.

Teleconsultations

As a whole, Europeans are still reticent towards teleconsultations. Less than half of the respondents actually believe that distance consultations are a good move. The Swedish and the English are the most enthusiastic about this prospect, while the Germans are very reluctant with more than half criticizing the lack of human contact.

With regard to home telecare of the elderly through the installation of ICT at home, there has been a warmer welcome with about 70% of people enthusiastic in France and Sweden, 50% in Italy, and 40% in the UK, Spain and the Netherlands. Germany, once again, is the most reluctant country with only 30% of people interested. However, this German demographic would be able to pay well for these facilities.
Key Findings of the Survey

The introduction of telehealth solutions requires taking into account the views of users. Looking towards the horizon of 2020, the new proposals envisaged in the direction of populations will integrate national sensitivities in the health domain. While there are opportunities for offers which come out of the regulated environment of telehealth (supported by the welfare system), they are constrained by the willingness of populations to pay, which remains low. Regarding public policies for the deployment of telehealth solutions, these need to adapt to well-defined behavior on health.

In conclusion, public and private actors will have to innovate with regard to the provision of health services in order to convince the target populations of the relevance of offers and thereby ensure themselves against low usage of proposed technical solutions. Low use would create extra costs, therefore telehealth must convey arguments for improving available medical services and economic efficiency.

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Henri Delahaie, president of Coda Strategies SAS, has 30 years of experience in the analysis of information technology markets. He holds a Masters degree as well as diplomas of superior studies in business law, graduate on accounting, and graduate from Sciences Po, Paris. He is currently Study Director of telecare and telemedicine projects at Coda Strategies SAS. He has a strong background in international telehealth markets, has realised business models in the field of telehealth, and has provided strategy consulting in the field of health technology.
Improving Care of the Elderly with an ‘Intelligent Bed’

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Abstract: This paper describes the evaluation of the use of the ‘intelligent bed’ in a nursing home facility and in citizens’ own homes. Focus is on one of the functions of the intelligent bed: the wet sensor. The intelligent bed has been developed in order to improve quality of life for its users and to ease the work environment of the nursing staff and improve safety for citizens and nursing staff. The wet sensor, which detects patterns of perspiration and urination in the citizen, can help them avoid becoming wet for several hours, thus making it possible to plan care visits according to the citizen’s actual needs.

Introduction

The population of the world is changing. Worldwide, the proportion of people aged 60 years and over was 8% in 1950, and 10% in 2000, and it is projected to reach 21% in 2050 [1]. This trend is the same in Denmark where it is estimated that the elderly population will increase by 76%, from 875,500 in 2009 to 1.54 million in 2042 [2].

In Denmark, 8,900 persons resided in a nursing facility in 2009, and an additional 183,270 persons were receiving permanent home care in 2008 [2]. These numbers are also expected to increase. This change in the population means more elderly people and more people with chronic diseases, and more pressure on the health sector to maintain the same level of care.

This increased proportion of elderly needing care will put tremendous strain on national resources and cause an increase in the cost of elder care [3] providing an incentive to develop more effective ways to care for these citizens. New technologies are necessary to improve quality of life for elderly people and their families and to extend the time that the elderly are able to remain in their preferred environment at home [3-4]. Furthermore, there is a need to find a balance between safety and risk for those citizens choosing to live independently in their own homes [5].

To meet the needs of nursing homes and domiciliary care, the ‘intelligent bed’ has been developed with the aim to improve safety, working environment of the nursing staff and quality of life for the elderly citizens and relatives through safe set functions and monitoring function on the bed.
The aim of this paper is to describe the evaluation of the intelligent bed and present preliminary findings on one of the intelligent bed’s functions, the wet sensor.

The Intelligent Bed – The iCare Project

The intelligent bed consists of the following functions: wet sensor, out of bed detection, under bed light, catheter bag sensor, two-way communication, lights on when exiting the bed and safe set functions on the bed including power on/off, brakes locked, lowest position and bedrail in safe position. Messages from the intelligent bed sensors can be sent to the staff at the nursing home or domiciliary care, to the citizen or to their relatives.

The target groups for the intelligent bed consist of elderly citizens living in nursing homes or citizens receiving permanent home care in their own homes. The intelligent bed is being tested in the municipality of Sønderborg, Denmark. A total of 50 persons are testing the intelligent bed, 17 beds in nursing home facility and 33 beds in the homes of the citizens receiving permanent home care.

The citizens test the intelligent bed for eight weeks.

Method

The use of the intelligent bed is assessed through an evaluation in a before and after perspective. We have conducted qualitative interviews with citizens (n=5), and healthcare professionals (n=5), conducted participant observations at the nursing home, in citizens’ homes, and studied patient care records. The data has been analyzed according to methods developed by Kvale [6].

Findings

During the test of the intelligent bed, the preliminary findings reports two event related to the wet sensor. First, the wet sensor sent an alert to the nursing staff when a citizen had been lying wet in the bed due to perspiration. The nursing staff can then react to the message, thus preventing the citizen from having to lie in bed wet for several hours before the actual planned visit. Second, the nursing staff reported that a citizen’s wet sensor sends them a message at about the same time every day because of diuresis. Due to this new knowledge, it is possible to plan the citizen visits more effectively.

These preliminary findings make it possible for the nursing staff to identify the citizen’s patterns of sweating and diuresis in order to, to avoid situations where they lie wet for several hours, thus optimizing citizen care.
Conclusion

The preliminary findings show that the wet sensor function of the intelligent bed can contribute to improving citizen care, as it alerts the nursing staff when action is needed, avoiding situations where citizens lie wet for several hours. The wet sensor helps clarify the citizen’s pattern of sweating and diuresis, thereby helping to plan visits according to the citizen’s actual needs.

Acknowledgment

The authors wish to thanks Linak A/S, the Municipality of Soenderborg, the domiciliary care and the nursing home for their cooperation and engagement during drawing up of the evaluation of the outcomes of the intelligent bed.

References


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Plug&Care-Connector – A Middleware to Reduce Costs and Create Platform Independence in Telemonitoring Programs

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Abstract: Connectivity is a problem in telemedicine. Data has to be acquired from devices and transferred to the recipient. In Europe at present telemonitoring programs especially focus on home monitoring. Only few of these projects support patient’s mobility. The technical setup in these projects usually requires identical devices for all participating patients. This applies to the communication device (e.g. a mobile phone or smart phone) and the medical device (e.g. a blood pressure meter) as well. To be able to use these devices patients have to be trained as well. Furthermore on travel patients use and carry their own phone containing all their contacts and further data.

The idea of the Plug&Care-Connector (PCC) is to provide a technology that enables service providers to reduce costs in mobile or home monitoring setups. It’s a Java™-based middleware for different operating systems like Android, Windows™ Mobile, PC-Windows™, Apple-OS or Linux. The PCC consists of a core application designed for each of the mentioned operating systems. It abstracts the platforms interface medical devices connect to presenting one identical interface. Thus device manufacturers only need to develop one PCC-driver to be able to connect to all supported platforms. Patients are able to use their (PCC-compatible) smart phone or PC they are familiar with when participating in a telemonitoring program. If their medical device is PCC-compatible as well they can use it too. This can reduce technology costs significantly and can increase patient’s compliance as well.

Furthermore the Plug&Care-Connector supports so called transmitters. Transmitters are plug-ins for the connector responsible to forward the acquired data of the medical device. Transmitters can easily be written using our developer guide. Transmitters hand over the data or to apps running locally (e.g. diabetes diaries) or forward it to remote recipients. Various messaging services and export to data bases and patient records are supported.

The first version will be provided in the Android-market. We will test the Plug&Care-Connector with Diabetes patients within the EU-AAL-project EmotionAAL in Finland and Germany in early 2012.
Due to the demographic change in Europe and especially in Germany, the part of elder people amongst the population increases continuously. Persistent low birth rates and an ongoing increase of life expectancy which today and in the future bases predominantly on the reduced mortality in old age, will cause a change of the age structure to the advantage of the fraction of the older population for the next decades too [1]. With a proceeding age a clear increase of health problems can be observed regarding the number of diseased persons as well as with reference to the complexity of the existing disorders. As per sample census 2005 more than every fourth person at 75 years of age or older was ill or injured by an incidence the time the survey was conducted. The somatic spectrum of medical conditions in old age is dominated by cardiovascular diseases and diseases of the musculoskeletal system in particular. Heart failure, angina pectoris and stroke were the most frequent diagnoses related to hospital stays in people elder than 65 years in 2006 [2].

In less densely populated countries with mostly rural areas people have to cover long distances to visit medical service providers. Thus telemedical services focus on solutions to bring medical expertise to the point of need.

In Germany rural areas are scarce. A clinic, doctor’s office or hospital mostly is in close range to peoples home. But caused by the demographic change more and more chronically ill people need medical support which includes a continuous control of vital signs related to e.g. heart failure, COLD or diabetes like blood pressure, body weight, blood sugar or parameters of the pulmonary function. E.g. telemetric monitoring can be applied in many areas of health care and be of positive assistance, within the single therapeutic strategies, to patients with acute and chronic cardiac illnesses [3].

There are different companies in Germany providing telemonitoring solutions to their customers. In most cases patients have to pay for these services by themselves as there are only few contracts with health insurance companies. This is caused by a lack of data about the cost-effectiveness of diagnosis related telemonitoring services on one hand. On the other hand the technical setup is expensive because usually patients have to be equipped with new devices for medical data acquisition like blood glucose meters or spirometers. Additionally to transfer the data patients have to be equipped with set top boxes, computers with internet access, modems, mobile phones or other devices for data transmission.

To enable patients to handle these devices they aren’t familiar with causes costs for user training. Furthermore the success of telemonitoring can be
affected by insufficient compliance as a consequence of too difficult or faulty operation of the new and unknown devices.

Objective

We intended to develop a solution that:

- Allows to easily connect medical monitors to different operating systems and platforms;
- Allows to easily transfer measured data to various recipients like physicians (via mail or SMS) or data bases like electronic patient records;
- Allows to easily handover measured data to applications running on the communication device like diabetes or weight diaries cookbooks or other apps;
- Allows people to use their own devices (measuring or communication device) they are familiar with.

This solution should simplify the setup of telemonitoring systems. It should reduce costs and improve patient’s compliance. It was also intended to support and maintain patient’s mobility by supporting mobile communication devices like cellular phones, especially smart phones.

Methods

We developed a middleware for different operating systems and platforms called the Plug&Care-Connector (PCC). The PCC is Java™ based and runs on devices that support the Java™ platform. For every supported platform a PCC-version is available. The architecture of the PCC is shown in Fig. 1.

The core application is specific for the operating system platform. It’s different e.g. for Windows™ Mobile or Google Android™. The interfaces to the driver, the application and the transmitter are identical on every platform.

That means that the same driver once developed for the PCC connects a device to any platform supported by and running the PCC.

Applications can import data from devices via the core. The interface is identical on every supported platform. Thus developers of applications who
for example support Windows™ for PC or Android™ just have to support one interface.

Transmitters are plug-ins that can be developed by the users themselves. They acquire data like local applications do but are responsible for the transmission of the data to a recipient. Transmitters can send data e.g. via mail or export them to remote web applications, data bases or electronic health records.

Results

Up to now we developed Plug&Care-Connectors for Windows™ Mobile 6.5, Google’s Android™ and PC-based Java™. We developed drivers for 2 body scales, 2 blood pressure meters and a blood glucose meter, all connected via Bluetooth™. The development of a driver takes about 2 days for devices transferring numeric data. But devices like ECG or EEG are supported as well.

A local sample application for Android™ has been developed to visualize the measured data in a chart.

Sample transmitters have been developed as well. They forward data via mail, to twitter or to Microsoft™ Health Vault™ a web based personal health record. Within EmotionAAL, a project of the European ambient assisted living (AAL) program we developed a transmitter to the patient records of a medical expert center. To program a transmitter, developers can use our developer guide.

The latest product is a software development kit (SDK) to support application developers to integrate the connector into their software avoiding a separate installation and configuration of the PCC.

Updates are available on a regular basis as soon as new drivers have been developed and implemented.

Discussion

Our goal was the development of a tool that supports telemonitoring by decreasing costs for technical setup and patient training. We think that the Plug&Care-Connector can achieve this goal due to its platform independence and due to the fact that patients can use their smart phone (or other communication platform) and measuring device if PCC-compatible. This avoids hardware costs for additional devices. Furthermore when people use their own devices, they are familiar with the usage, which could increase compliance in comparison to using new and unknown devices.

Transmitters and drivers can be developed in a short time and once ready they can be used on any supported platform.
Local applications (apps) can easily acquire data via the interface of the connector. This simplifies the development or adaption of apps that compute the measured data. Even if the apps have to be compatible with the operating system they are running on the interface to the PCC to import the data is always the same.

The SDK is a further step to simplify data acquisition in applications as the connector can directly be integrated and doesn’t have to be configured by the user.

One great advantage of the PCC for patients is the support of smart phone platforms. This increases patient’s mobility allowing them to continue telemonitoring even if on travel providing an overall feeling of safety and access to medical support.

Our Plug&Care connector will be available for the public in a first version for Google’s Android™. It can be downloaded in the Android™-market. A list of devices and drivers, available transmitters and supported apps can be found on the connector’s website www.plugandcare.com.

References


After studying medicine in Ancona (Italy) and Bonn (Germany) Dr Markus Lindlar worked as an assistant doctor and later as head of the department of information technology in the CURA hospital in Bad Honnef. He is specialized in medical informatics. In 1997 he moved to the Institute of Health Economics and Clinical Epidemiology at the University of Cologne (director Prof Dr Dr Karl Lauterbach) where in 2000 he received his PhD with a thesis on “Cost and Benefit of Telematics and Robotics in Medicine”. Since 2002 Dr Lindlar focusses his work at the Institute of Aerospace Medicine (director Prof Dr Rupert Gerzer) at the German Aerospace Center on person centered medicine, mobile healthcare and health economic questions of eHealth. Dr Lindlar is assistant lecturer at the Bonn-Rhine-Sieg University of Applied Sciences and president of the German Association for Health Telematics.
Abstract: Due to raising interest on dermatology among professional and non-professional individuals, Teledermatology Working Group Bangladesh Limited (TWGBD) designed and implemented a model of dermatology based ICT (Dermato-ICT) to explore an opportunity in the field to establish Dermato-ICT.

Web based (www.myspecialistdoctors.com) application server TIMES® performed the function of hybrid teledermatology. To facilitate teledermatology, TIMES® provided instruction to an innovated clinical device called DICOT®. Patients in front of DICOT® presented their skin condition by providing clinical data, such as demography data, chief complains, images, history of present/past illness and laboratory test reports. Hence from other end, dermatologist did diagnosis and send an e-prescription. The clinical data were stored for future usages in the e-dermatology and e-health program. It was an integral part of Dermato-ICT to establish e-dermatology program by registering general medicine practitioner under www.skinvd.org and that of non-professional individuals under e-health program of www.skinproblembd.com. Thus, TWGBD registered different users to demonstrate Dermato-ICT network and analysed their intention to use the model. The general practitioners were found as user because they felt essence of e-dermatology program in their practice. The mobile phone operators found as user because they looked this model as a business case. The patients found as user because teledermatology care was available in their vicinity at low-cost (when deducted from travel cost). The public found as user because they intend to increase knowledge/awareness of skin health. TWGBD categorized users and explored possible opportunities in the field to establish Dermato-ICT.

Introduction

Teledermatology is a sub-specialty in the medical field of dermatology and probably one of the most common applications of telemedicine and e-health [1]. Applications comprise health care management such as
diagnoses, consultation and treatment as well as education. With the omnipresence of the Internet excess in mobile devices and desk/laptop computers, ICT application in dermatology has gained further importance among users. Domain of health-care organization with special interest allows registration to patients, doctors and non-patient healthy individuals; they are providing access to a vast store of information about ‘healthy skin and disease. 

The arrival of ICT in any society has many potential benefits for citizen. The interactive technologies to store and transmit clinical data multiplies the possibilities for physician–patient interaction [2]. Research has shown that the citizen live in the least-developed country are ready to accept teledermatology [3]. Not only do they teledermatology consult for treatment; they care teledermatology information as such electronic health record (EHR) for follow-up and future reference. They learn clinical signs-symptoms and attempt blogging by using same network. 

An observation by Telemedicine Working Group Bangladesh Ltd (TWGBD) was that, e-dermatology can meet the ‘essence of dermatology’ for general medical practitioner. However, given them the vast amount of resources with full of medical topics available on Internet sites may not attract them to develop e-dermatology learning. The concept of e-dermatology has to be received much attention to those skin conditions particularly are prevalent in a given geography. For instance, during anthrax outbreak in Bangladesh in 2010, TWGBD observed, Bangladesh general practitioners were visiting frequently and checking ‘Anthrax: What Doctors Need to Know’; the topic viewed in e-dermatology program of www.skinvd.org [4-5]. Like other health care technology, the derm to-ICT i.e. ICT application in Dermatology could be a portal for total skin health care. It is not only the quality of interventions and health care delivery but, from a broader perspective in the ICT exploring intellectual road-map. Although such kind is still underemployed in most dermatology faculties, it represents the future opportunity to explore in the field.

Materials and Methods

The working group, TWGBD designed a dermato-ICT portal to establish a “citizen-centered care” for greater public involvement at possible levels of users. To perform the function of teledermatology, a web based (www.myspecialistdoctors.com) application server TIMES® was developed. The server TIMES® provided instruction to an innovated Internet enabled clinical device named DICOT®. To facilitate teledermatology, patients in the one end with a DICOT® presented their skin condition by providing clinical data to dermatology center on other end. Hence, dermatologist did
diagnosis and send an e-prescription. The clinical data such as, patient’s demography data, chief complains, images, history of present/past illness and laboratory test results were stored in TIMES®. The clinical data were counted as ‘product of teledermatology’. Later this product was utilized in the dermato-ICT web-sites to establish a “citizen-centered care” towards greater public involvement. For instance, the site www.skinvd.org was built to generate e-dermatology for general practitioner; the other www.skinproblembd.com was designed to generate e-health for patient and healthy individuals. The ‘product of teledermatology’ were processed to edit out as ‘case reports’, ‘articles’, MCQ, CME and ‘short communications to meet an ‘essence of dermatology’ in general practice. The skin cases which were prevailing in the teledermatology consultation, were quickly viewed in the site. The contents of e-health program were however, were chosen in according to the demand of the patients and healthy individuals. Thus, TWGBD registered different users and analysed them their intention to use teledermatology products of dermato-ICT.

Table I. Showing teledermatology products and likely users of dermato-ICT.

<table>
<thead>
<tr>
<th>Dermato-ICT platform domain</th>
<th>Functionality</th>
<th>Teledermatology products</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>myspecialistdoctors.com</td>
<td>Teledermatology consultation and systematic collection of electronic health information such as demographics, medical history, medications, laboratory test results, images of skin disease, personal stats like age and weight, phone number and email address.</td>
<td>Health care management and Electronic health record (EHR)</td>
<td>Patients and Dermatologists</td>
</tr>
<tr>
<td>skinproblembd.com</td>
<td>e-Health and home telemedicine</td>
<td>Electronic medical record (EMR) file: e-Prescription with laboratory test results, and patents hand-out. Arrange appointment and Tips on healthy skin and Beauty, nutrition and healthy living, health forum &amp; blog on specific skin disease &amp; personalized e-card greeting.</td>
<td>Patients and Citizen</td>
</tr>
<tr>
<td>skinvd.com</td>
<td>e-Dermatology</td>
<td>Online dermatology such as case reports, articles, MCQ, CME</td>
<td>General practitioners</td>
</tr>
</tbody>
</table>
Table 1 Showing teledermatology products and facilities offered from dermato-ICT for different users.

<table>
<thead>
<tr>
<th>twgbd.com</th>
<th>e-Commerce</th>
<th>CME and short communications</th>
<th>rs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Internet enabled device (DICOT®) &amp; software (TIMES®) support, Teledermatology networking &amp; third-party advertisement</td>
<td>Pharmaceuticals, mobile phone operators and clinics</td>
</tr>
</tbody>
</table>

Results and discussions

A more than 400 general practitioners were found to have registered under the www.skinvd.com. They updated dermatology knowledge by visiting website and acknowledged the usefulness of it in their general practice. TWGBD found ‘health friendly sponsors’ (pharmaceutical company) for the domain; they participated and disclosed their ‘conflict of interest’. The aim of pharmaceuticals was to encourage e-dermatology program, to build a healthy community and ultimately allow patient and care providers to experience their products. The sponsors believed that the dermato-ICT has potentiality to collaborate in the social business through e-health and e-dermatology program [6].

A total 12030 patients and 570 healthy individual users registered under www.skinproblembd.com. They accepted benefits of dermato-ICT facilities such as online electronic medical record (EMR), home teledermatology, online appointment and online hand-out etc. In addition the healthy individuals visited here to find out topics on ‘healthy skin and beauty’, ‘nutrition and healthy living’. TWGBD assisted users to make forum on specific skin disease and allowed them blogging.

One of the leading mobile phone operators in Bangladesh got involve in selecting dermato-ICT model. An EDGE (Enhanced Data rates for GSM Evolution) enabled mobile phone network making access to Internet possible in rural areas [7]. They trained entrepreneurs to run EDGE enabled teledermatology from remote Community Information Center that is CIC. This CIC in the teledermatology pilot project reached under served people, who paid a small fee to access dermatology center. There is up to 20 million people the chance to enter in to social teledermatology care [8].

Dermato-ICT has potentials to establish doctor–patient-citizen relationship and may shift towards better purposive way of serving people.
References


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D. B. Zaid, currently heading the Clinical Device Development and Maintenance division in Telemedicine Medicine Working Group Bangladesh (TWGBD). Engr. Zaid has been contributed in developing DICOT, the Internet enabled clinical device suitable for teledermatology and also other medical equipments.

A. Islam, heading the CSR Health Projects in Grameenphone, working in the field of Public Health for >20 years. He has contributed in developing health systems in Bangladesh as one of the leading members of several Pilot Projects’ Team notably Community Based Tuberculosis Control Program, Community Based ARI Control Project & Community Based Nutrition Initiative in the early Nineties which have now been scaled up across the country as well as globally.
Smart Homes in 2012: When the Floor Becomes Intelligent for People with Loss of Autonomy

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Abstract: A smart home is characterised by its ability to understand and adapt to the needs, desires and habits of elderly and disable people living in the house. It starts from specifications from the user as a central parameter. Five key features have to be considered: comfort, security, autonomy, flexibility and communication in order to maintain the social link and taking into account non-discriminative, non-intrusive and non-proactive approaches through home automation equipments. The philosophy of a modern smart-home is the based upon the appropriation process of the smart home functionalities appearing as the natural extension of their lifestyle. To illustrate the approach, an actimetric carpet which can detect falls in real time and prevent emergency situations is discussed.

Home Automation and Dependent Living in 2012

Home automation, which is the set of techniques to automate various aspects of housing, is currently with the information and communications technologies, telemedicine and telecare, an effective way to preserve home support and compensate for the loss of autonomy, but not replace human help. The adaptation of the environment also requires consideration of habitat: how to facilitate the lives of people by meeting their needs and expectations and how to enable home support through technical solutions while rethinking spatial planning? "Smart" habitat is not only technology but also the ability to understand and adapt to needs, but also desires and habits of people with disabilities living there. How to enable a person with loss of autonomy to stay at home, without altering its familiar environment? What technical, home automation and human means to implement within the habitat, to ensure comfort, security, autonomy and communication of a person with loss of autonomy?

To define what a smart home is, the user must be put as an entry point of the specifications and as a central parameter in the development of the housing. In order to design a "home for all", the evolutionary aspect of the disability must be associated to the preventive aspect of the proposed solutions, that thus apply to a much wider audience including people with
disabilities and non disabled people. The main features which should be based on the definition of a smart home are:

- Comfort: heating, ventilation, lighting, doors, acoustic and interfaces;
- Security: surveillance, intrusion, ambulation and home accidents;
- Autonomy: home automation, perambulation, features of the furniture;
- Adaptability: personalization, respect of the needs and desires, possible evolution of the equipments;
- Communication: social links (family, carers, doctors, administration, associations), interfaces for interaction.

Analysis of Existing Technologies

Today, the smart home is still a concept. Some of the leaders in the field of electrical equipment such as Legrand with the "Wellness House" or Schneider with the "IHC House (Intelligent Home Control)" have initiated this reflection, but mostly propose prototypes, mainly concentrated on comfort. Information and communication technologies are now progressively associated to home automation that network a number of facilities and allow considering serious applications for home support. They release the occupants of daily constraints while ensuring the security, comfort and energy management features. The control of all electrical equipment in the house is made from a single remote controller, a computer or a television while taking into account information from temperature sensors, light and other sensors. Moreover, systems now provide the ability to script home features based on the lifestyle of its occupants.

Home automation telecare packs are being deployed over several counties by the General Councils particularly in the Limousin region.

They alert when a problem of the person or their environment arises through a number of connected devices (smoke and gas detectors with visual or audio alarms, self-closing valves, ambient temperature gauges to eliminate the risk of hypo or hyperthermia, light path illuminating the way to the bedroom, toilet or corridors, remote management of professional at home such as homemakers, nurses, meal portage services).

The assistance is not only material but also social. As an example, the visage screen of Camera Contact in Guéret allows older people to have a "tele-link" to the family and caregivers. However, it appears that, while many systems exist to make home smarter, the dispersion of solutions and the lack of interoperability are still too heterogeneous to be considered in a comprehensive way and speak of "intelligent living".
When Floor Becomes Intelligent

To become really efficient, a smart-home must take essential parameters into consideration: non-discrimination, adaptability and customization, security, ethic assistance for more autonomy through adequate appropriation of the technology, assistance through communication means.

A floor-based solution is given with the example of an actimetric carpet primarily used for prevention and real-time detection of falls of elderly. It consists in placing a thin layer of sub-sensors under resilient flooring connected to an electronic network managed by specific software. The system is able to identify all falls even those for which the resident is recovering without immediately visible sequel. In addition, these solutions are non-intrusive because not visible to the person and thus, may be better accepted by the elderly. Depending on the location of the person in the house and along the path he takes, the detection of his presence on the floor allows for example to automatically control lighting. In the absence of a person in a room, lighting and appliances on standby can usually be turned off, reducing power consumption and promote energy conservation. With the same principle, the system equipped with floor sensors can also easily and intelligently manage the heating mode for comfort in occupied rooms and in economy mode in the non-occupied rooms, or even offline (e.g. for guest rooms). Different scenarios can be created for optimal management of the habitat.

Connected to an intelligent system, the floor can also easily be used to track activity of the person. The overall system connected to the Internet can handle emergency or alarm (e.g. a fall) and

![Fig. 1: Example of use of actimetric carpet](image-url)
automatically notify by various means (SMS, phone call, email) family and medical caregivers (family, neighbours, caregivers…). In the same way, it may assist the people in his daily tasks, controlling the automatic start of some appliances or multimedia (e.g. TV), or automatically opening some doors or shutters. Following this, figure 1 shows how several carpets can be put at strategic places to prevent accidents of everyday life and the intrusion in the home.

Conclusion

In order to answer more efficiently to the needs and desires of elderly and disabled people and to maintain them at home, a study was conducted on the layout, arrangement or redevelopment of housing space coupled with the implementation of home automation systems maintaining the role of caregivers. The smart home of tomorrow is a communicating environment that reflects and supports the lives of its occupants, designed or redesigned and adapted adequately. This technical assistance is meaningful only if the beneficiaries have accepted and appropriated it. For this, the criteria are to prevent the intrusiveness in favour of adaptability, customization, security, comfort and communication. Loss of autonomy being not only physical but also often social, intelligent housing, even with a significant technological dimension stays primarily based on an essential human dimension.
Successful Business Case: Telecommunication Product allowing eHealth Companies to Extend Lifetime of Their PSTN Devices

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eDevice, France

Abstract: The BridgeD130 (also known as WireX) combined with Global Cellular Services from eDevice, allows Remote Patient Monitoring companies to extend the lifetime of their devices in the field by replacing analog phone-lines with GSM / GPRS connectivity.

The BridgeD130 / WireX and Global Cellular Services by eDevice is an innovative end-to-end solution that has enabled several world leading Healthcare companies to extend their legacy solutions for patient monitoring, providing a much needed lifeline due to a growing and impending change in the telecommunication landscape that is slowly setting PSTN availability.

eDevice, an ISO 9001 certified company, with its headquarters and R&D in France, from where it designs and develops these innovative solutions for the Healthcare industry.

Large Healthcare companies provide solutions for monitoring patients that have been released from hospital following heart surgery or other treatment and that require either short term (30 to 90 days) or long term (for life) monitoring. Traditionally these monitoring devices allow sending health and usage data for analysis to physicians and nurses over standard fixed telephone lines (PSTN). The evolving nature of telecommunication infrastructure has resulted in the removal of PSTN lines in many places, a trend which is growing fast and will eventually result in few or no traditional phone lines being available due to commercial and regulatory sunset trends. In addition, due to advances in medicine and treatment, elderly patients as well as younger patients with implanted cardiac devices are far more mobile nowadays than in the past. The overall outcome of these trends is that it has become difficult to rely on the availability of a PSTN line for patient monitoring. This is particularly acute in some countries where fixed lines are going away at an accelerated rate.

eDevice's Patient Monitoring Device PSTN saver solution enables patient monitoring devices that connect over regular fixed telephone lines (PSTN / POTS) to be switched to cellular communication without requiring any
changes to the patient monitoring device or to the back office systems supporting the ecosystem.

eDevice’s solution consists of in-house developed hardware that replaces the phone line and enables cellular communication (BridgeD130 / WireX) and a global cellular communication service that allows the BridgeD130 / WireX to send and receive data from anywhere around the world provided there is a GPRS (GSM) data network available. This provides both a global solution to companies with patients around the world and a solution to those patients that travel internationally. The global cellular communication service has been designed from the bottom up for Healthcare companies only and consists of two redundant NOCs (network operation centres) in Europe and the USA that are manned 24/7. A web-based interface allows the Healthcare companies to manage their units worldwide from one central location, troubleshoot, and control usage.

The solution has been adopted by companies such as Medtronic, Philips, and Honeywell. It is already used in dozens of countries around the world by tens of thousands of users and the list of countries is expanding every month.

Marc Berrebi is in charge of the strategic and business aspects of eDevice. In this role, Marc leads the company's strategy toward growing markets with high level requirements.

Prior to eDevice, Marc co-founded in 1989 and was President of Marvin Software, the world leader in financial calculation software. Marvin was acquired by The Reuters Group in 2000.

Marc co-founded also Com6, a company specialized in Customer Relationship Management. Com6 did an IPO on the French stock market in 2000 before merging with B&D.

Before that, Marc was consultant at PWC and VP Sales of a major French PC distribution company.

Marc is 50 years old and holds a MBA from ESCP-Europe (Ecole Supérieure de Commerce de Paris), a leading European business school.

Marc has been awarded the Transformation Award by the University of Wharton / Infosys and has been featured by TIME Magazine as one of the 25 European Tech leaders who are changing the way we work, live and play.

Under a different name, he has written three art books, and produced an award winning film about the Middle-East.
Michael is responsible for eDevice's sales activities including direct strategic account management and sales team leadership. Michael was a key protagonist of the company's expansion beyond hardware into service-based solutions which he developed by negotiating partnerships with wireless carriers. Michael joined eDevice in April 2003 as VP Sales Western Europe. In November 2003 he took over responsibility for sales in the Americas and in late 2005 became VP Sales and Business Development responsible for eDevice’s worldwide sales and business development operations.

Prior to joining eDevice, Michael headed the UK Business Development team for leading consulting firm Fantine Group and at the same time managed its Information Technology Professional Practice.

Prior to his role at Fantine, Michael co-founded and was Managing Director of GO Interactive, an interactive marketing agency, which he founded in partnership with Saatchi & Saatchi and DBM Group. GO Interactive developed and ran some of the most innovative interactive campaigns of the time including building marketing websites for companies such as Procter & Gamble, Hewlett Packard, Harel Insurance, and many others.

Michael is 43 and holds an LLB in Business Law from London Guildhall University and is a qualified Advocate of the Bar.
Telehealth UERJ RJ-Brazil: Innovating By the Fusion of Technologies for Teleconferences

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Abstract: Introduction and aims: Teleconferences are meetings at distance through the web. Into this group there are the videoconferences – demanding high speed and complex equipment – and the webconferences, which can be accessed from any computer or mobile device with internet. Uniting both technologies simultaneously is the best way for e-Inclusion concerning all the available ways of broadband, yet there are no protocols of standardization for the concomitant use of those technologies. UERJ Telehealth Center implemented, as far as we know, a new way solution for the referred fusion. This study demonstrates that solution and its partial outcomes.

Methodology: In order to use a virtual room with a Multipoint Control Unit (MCU) it is necessary that the codecs are registered in a gatekeeper, which controls the admission and authorization of the calls. Telehealth UERJ’s videoconference system uses a high speed codec TANDBERG and the solution web used was the software Adobe Connect Pro linked to a web server. The combination of both technologies is made through the capture of the audio and codec video sent to the work station and shared to the points connected at the webconference.

Results: From March to December 2011, 35 teleconferences applied both technologies increasing the number of online participants in more than 50%. The quality of the audio and image was considered to be satisfactory in all the sessions. Conclusion: The fusion of technologies for teleconference allows a wider scope without losses in quality.

Introduction

Teleconferences are meetings at distance through the web. Into this group there are the video conferences – demanding high speed and complex equipment – and the web conferences, which can be accessed on any computer or mobile device with internet. These technologies used simultaneously are the best way for engaging users wherever they are. On the other hand, there are no protocols of standardization for the concomitant use of those technologies. UERJ Telehealth Center implemented, in a new way, a solution for the referred fusion. The aim of this study is to demonstrate that solution and the preliminary results.
Methodology

The teleconferences included simultaneous videoconference and web conference technologies. The videoconferencing system uses a Multipoint Control Unit (MCU) and the TANDBERG gatekeeper to connect the University Hospitals by using the backbone, funded by the Brazilian Government [1, 2]. This MCU is responsible for managing multipoint conferences, and at the endpoints, a TANDBERG 6000 MXP Codec integrator provides all the necessary components needed to simplify custom integrations which use a customers access into the protocol H.323 (a standard for codification and decoding of the flow of audio and video data). In order to make use of a virtual room at MCU, a minimum demanded speed of 2GB is requested and it is necessary that the endpoints are registered in a gatekeeper, a component that controls admission and also authorizes the incoming calls. At Telehealth’s Center [3], at University Hospital Pedro Ernesto of the State University of Rio de Janeiro, the

Figure 1: Summary of the teleconferencing fusion of technologies
endpoint is linked to a work station with a web server that transmits the videoconference’s audio and video to remote points with minimum demanded speed requested of 256 Kbps. The management’s web software used was Adobe Connect Pro (Burlington, New Jersey USA), installed in a Dell server, Windows Server 2008, Intel Xeon Processor E5450, 3GHz, and RAM memory of 4GB. The combination of both technologies was made through the capture of the audio using a sound board and also of the codec video using a capture card that are sent to a work station and distributed to the points connected to the web conference. The remote access to the web conference was made through a browser Web, that will demand only a browser and an add in whose installation is going to be required at the first access to a virtual room of the web conference. In the videoconferencing conditions all the participants could interact orally like face to face and by web conferencing the remote participants could send questions and comments using a chat. Most of the lecturers’ presentations used the Microsoft Office PowerPoint software while others used only a speaker talking to the group. The use of videos and animation was not allowed by the association of both technologies. The resumed teleconferencing system is described below (Figure 1).

Results and Conclusion

From March to December 2011, 35 teleconferences applied both technologies increasing the number of online participants in more than 57%. The quality of the audio and image was considered to be satisfactory in all the sessions.

The fusion of technologies for teleconference allows a wider scope without losses in quality.

References

[3] Telehealth Center of State University of Rio de Janeiro (UERJ), www.telessaude.uerj.br

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Telemonitoring of Diabetic Retinopathy in Rural Areas in Lithuania

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Abstract: The aim of this paper is to show the advantage of telemedicine and new diagnostic equipment and technologies in monitoring diabetic retinopathy in rural areas. This is an effective method and can help in early diagnosis of possible complications of diabetic retinopathy.

Introduction

Diabetic retinopathy is the second most prevalent cause of blindness in Lithuania. Its diagnostics and treatment is concentrated at 5 largest cities of Lithuania. However, rural population’s access to tertiary level specialists is limited by travel to the main centers (factors are patient mobility and accessibility to public transportation) and by long wait times. There is a lack of ophthalmologists in rural areas in Lithuania and main healthcare service provider is usually a general practitioner. Telemonitoring, homecare could help avert this trend and improve clinical outcomes.

The aim of the project is to develop and implement a protocol for delivering diabetes screening at primary care level using advanced ophthalmic diagnostics with the purpose of bringing services and diagnostics closer and faster to the patients in rural areas.

Objectives

Objective 1: To develop the protocol and training program using mobile digital medical diagnostic systems – fundus camera and camera for anterior part of the eye;

Objective 2: To train the primary care medical personnel on early diagnostics of diabetes using new telemedicine diagnostic equipment and technologies;
Objective 3: To perform monitoring of diabetic retinopathy seeking minimization of complications;

Objective 4: To perform preventive eye disease screenings and early diagnostics.

Methodology

Telemonitoring of diabetic retinopathy was conducted in rural areas of Lithuania by joint activity of the Family Medicine Clinic of the Lithuanian University of Health Sciences, Stratelus JSC, Telemedicine Research Center, Kaltinenai Primary Care Center, Elektrenai Primary Care Center, and Vilnius University Santariskes Clinic. Telemonitoring was focused on diabetic population in rural areas and its aim was to determine the level of diabetic retinopathy and select patients for a) referral for ophthalmologist’s consultation at a tertiary level healthcare institution, and b) for remote ophthalmologist’s consultation.

In the activity performed, general practitioners – members of the telenetwork monitored diabetic population and used the telenetwork for remote evaluation and consultations. Experts of Stratelus JSC and Telemedicine Research Center served as a hub – competence center.

Monitored populations included towns and villages of Kaltinenai, Elektrenai, Birzai, Zarasai, Utena, Kedainiai, Klaipeda, Jonava, Vilkija, and groups of patients at Lithuanian University of Health Sciences.

Methodology used allowed to identify patients for further referral to tertiary institution or remote consultation, in which case evaluation and recommendations for further treatment including referrals to laser therapy, urgent vitreoretinal surgery, were provided. Family Medicine Clinic of the Lithuanian University of Health Sciences provided local support for general practitioners. E-platform of the Vilnius University Santariskes Clinic and electronic patient record software by Softneta were used for secure data storage and transmission. The equipment used was digital ophthalmoscope Smartscope developed by Optomed OY (Finland).

Results

It was found that use of telemonitoring and remote cooperation between general practitioners and tertiary level specialist serves as effective method and can help in early diagnosis and significantly increase accessibility of rural population to high competence healthcare services, bringing service closer to patient’s home, provide with more timely and better quality diagnostics and treatment. This is especially important for elderly population with limited mobility in rural areas who otherwise would often
choose not, or could not to, travel to tertiary level healthcare providers for advanced diagnostics until late stage of symptoms.

Benefits of this method of service delivery are early diagnostics, improved treatment outcomes, avoidance of complications from diabetic retinopathy, and economic efficiency (earlier diagnostics can reduce costs of treatment at a later stage; some of the patients don’t need to travel to a tertiary level institution which can be more expensive and receive equivalent service via telenetwork which is less expensive).

Some of the critical factors for successful expansion of this activity are availability of high quality equipment for image acquisition suitable for telemedicine applications, interest and cooperation of rural general practitioners, and their proper training.
Make it Quick: Texting is Now the Preferred Way to Communicate in Relationships

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Abstract: This study explored factors that contributed both positively and negatively to online relationship quality such as gender, age, education and marital status. A global preference for SMS texting as a way to communicate with persons in general was found, mediated by relationship type and social distance.

Introduction

Data that reflects accurately how people feel, perceive and implement electronically based communication dates itself at nearly the same speed that it is written. This researcher completed a similar study less than four years prior to this 2012 study, and in retrospect, appears dated by more than a decade when one considers the sweeping changes technology has made in our everyday relationships. The most preferred way of communicating with persons in general, as reported by participants in this study did not even exist a decade ago, when email was still a novelty. Using the internet to email others and search for information remain top rated uses, followed closely by use of social networking sites such as Facebook with no significant differences with regard to use based on race, ethnicity, income, education or geographical location [1].

There seemed to be a perpetuated myth in media with regards to who utilizes electronically based communication. Perhaps much of the literature being produced focuses heavily on youth use, as there is much interest in the effects of growing up with such communication as part of “normal” childhood development. The experience of social networking as a norm in childhood is in stark contrast to persons who were already adults when the internet arrived, and lived through the sweeping changes of the past decade or so. However, this does not mean that the older set has not caught on to new ways of communicating, and quickly. The Pew Internet and American Life Project found that the rate to which older adults were using the internet to maintain (or reconnect) relationships blazed from 13% in April 2009 to 33% by May of 2011, which was an approximate 150% increase in use in an incremental period of time, which in all likelihood has exponentially increased.
Older adults tend to have more time after retirement than working adults or those with children still under their care, and many suffer health related issues that making leaving the house or retirement home more difficult. So, it makes sense that older adults would embrace ways to keep connections with family members and friends that do not live nearby, and perhaps even those who do, for more frequent contact. The primary motivation cited by older adults was that signing up for social networking sites was the result of persuasion by a friend or family member [2]. The most common age group to respond to this study’s survey was adults over the age of 56 years, followed closely by the youngest category (18-24 years of age).

Women tend to use more strategies to maintain their relationships through computer mediated communication than men do [3]. Chesley and Fox found that women were more likely to use email to communicate with family, email a greater range of family members than men, and contended that gender was a central factor influencing perceptions about email use and better relationship quality [4], to which many components of this study reflected similarities in findings.

Objectives

This study sought to explore factors that contribute both positively and negatively to online relationship quality such as gender, age, education and marital status. Exploratory factors such as participant perception of posting frequency, level of personal information disclosure and perception of modality ease were also examined to see if they were possible mediators to an optional qualitative open ended question at the end of the survey.

Methodology

An online survey was distributed through Facebook via a web-based platform, targeting adult ages of 18 and over recruited through electronic communication means such as Facebook, Twitter, as well as professional and personal email lists. The snowball sampling technique was used to encourage Facebook users to repost the survey link on their pages to further distribute the survey. Descriptive statistics were used to analyze results, including cross tabulations, as well as t-tests and chi-square analysis.

Of the 296 participants, 81 identified as male, 209 identified as female, and 1 identified as “other.” During analysis, the researchers decided to eliminate the responses from the participant who identified with the “other” category in order to restrict the research analysis to two sexes as opposed to three.

Participants were asked to respond to 30 multiple-choice questions by selecting a single answer they felt best reflected their opinion and 1 open-
ended question where they could describe their opinion in their own words. The survey was designed with a non-optional informed consent agreement, which stated that participants must be over the age of 18 to take the survey, and made it clear that the survey was completely voluntary and anonymous, and included contact information for the IRB as well as the researcher so that participants were able to pose questions, comments, or complaints if needed. IP addresses were not collected and with the exception of the informed consent agreement, every item was voluntary and could be skipped without interrupting the rest of the survey (and also provides explanation as to why \( n \) may vary according to the question).

Results

*Myth #1 Dating Online is for Younger Adults*

When participants who were currently in a relationship were asked whether or not they met online, retiree aged participants aged 56 years and above were more than twice as likely as any other age category to have met online (34.3%), which is contrary to perceptions of online dating (younger adults are the ones most actively engaged in online romance). These older adults were the highest number of participants in a category (25%), and tended to be more honest about themselves online when compared with the younger adult participants. While 59% of younger participants (ages 18-24)
stated that they never posted misleading information about themselves, 80% of adults aged 56 years and older stated that they never posted misleading information.

Myth #2 “I only post a little bit”

The most fascinating finding in this study was that when participants were asked to fill in the blank with one of four options, not one single participant admitted to be in the upper limit of information sharing. The statement posed was: “When posting information about yourself online you will______”. Options given were: post a lot, a moderate amount, post a little, or that they don’t post personal information at all.

For those who claimed that they posted no personal information, they by far had the most formal education, with 52.2% holding graduate degrees.

Myth #3 Females are less likely to mislead others online

Participants who stated that they never mislead others online were females (55%) while males that stated that they never posted misleading information were much more firm in their assertion of honesty online at 73%. Those who misled were also more likely than not to say that they post “only a little” information about themselves online and were more concerned with how they appeared to others both online and offline.

Conclusion
The more one uses text (SMS) to communicate, the more one tends to post on social networking sites such as Facebook. The more one email rather than text (SMS), the less information one seems to post about themselves online. It may be that once someone has posted personal information or photos online, they may feel as though there is less to “say”, thus, a quick text message seems to suffice as a way to stay connected. Reliance on text messaging as a way to communicate in personal relationships is also reduced when participants showed a preference for email as a means of maintaining friendships. Unsurprisingly, those who most often stated that the least appealing aspect to online relationships was that it was “not as personal” were also ones who opted out of posting personal information online.

Being that 100% of participants did not tick “post a lot” with regard to the amount of personal information that they share, there was clearly a personal perception of what constituted “a lot”. With no criteria provided to participants defining what constituted a “a lot”, participants seemed to equate “a lot” with “too much”, thus it was not a perceived choice (n=271). And those who admitted to a “moderate” level of posting were on the youngest and eldest of the categories (either 18-24 years old or over the age of 56 years old).

However, for all that has changed in how people communicate in their relationships over the past decade or so, one desire has remained surprisingly unchanged. The more personal the relationship, the more participants desired face to face contact, which participants clearly stated could not be replaced by electronic efforts.

References


Kristie Holmes, Ph.D. is an Associate Professor of Social Work in the United States, specializing in ethics in technology, human behavior, media influence on children as well as women’s issues.
Ultrasound Imaging Teleconsultations in Peru and Brazil

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Abstract: MEDNet is a European project which has developed a health care network in rural areas in Peru and Brazil. Isolated clinics at rural areas communicate via satellite communication, based on DVB-RCS (Digital Video Broadcasting - Return Channel Satellite), with central hospitals in Peru and Brazil. In addition, there are 3 more sites connected via ADSL with a central hospital in Brazil. Physicians at the isolated sites are sending ultrasound examinations in order to get a second opinion from expert physicians. The system is in operation since June 2010 and number of teleconsultations takes place daily.

Introduction

We will introduce the MEDNet project and the need for such a project to be deployed. Access to medical care is sometimes very difficult to be reached from people living in rural and underserved areas. This problem is very well known in rural areas in Latin America. Citizens have no access to health care. They have to travel hundreds of kilometers to receive a medical diagnosis.

Within our project, we developed a medical network that addresses the problems of providing health care from a distance. The medical network is supported by expert physicians located in urban cities of Latin America [1].

The examinations involve ultrasound and CT examinations. All the patient information, extracted from the examinations, is stored in the health care database, along with the demographic information and medication prescription.

MEDNet project connects isolated Amazonian regions, in two countries; Brazil and Peru. Moreover, MEDNet utilizes AmerHis system (satellite communication) based on DVB-RCS [2-3].

Brazil Deployment

In Brazil, there are in total six remote sites. There are three satellite and three ADSL installations. The satellite installations are located in the Amazonian region in Maranhão state and ADSL installations are located in southern Brazil, in Rio Grande do Sul state. The referral hospital is located
in Porto Alegre, in a complex of hospitals, named Irmandade Santa Casa de Misericórdia de Porto Alegre that provides all types of medical expertise.

Results

In Brazil, two different scenarios were put into operation. One in Rio Grande do Sul (RS) state in Southern Brazil, using ADSL and one in Maranhão (MA) state in Amazonian region using satellite communication over AmerHis.

In *Rio Grande do Sul*, MEDNet deployment started in July 2009 with the installations in Lagoa dos Três Cantos using ADSL connection. Dr. Marcus Dalsasso is using the MEDNet system from the first day and now is a routine at the healthcare center in Lagoa dos Três Cantos. Every ultrasound examination was sent to the referral hospital and stored in a DICOM compliant database for future patient control. Table I shows the number of exams sent per site in Rio Grande do Sul (RS).

<table>
<thead>
<tr>
<th>City</th>
<th>Type of Exam</th>
<th>Teleconsultations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagoa dos Três</td>
<td>Abdomen, pelvic, obstetric.</td>
<td>74</td>
</tr>
<tr>
<td>Cantos</td>
<td>(U/S)</td>
<td></td>
</tr>
<tr>
<td>Alegrete</td>
<td>Abdomen. (U/S)</td>
<td>3</td>
</tr>
<tr>
<td>Pelotas</td>
<td>Cranium, hips, thorax. (CT)</td>
<td>3</td>
</tr>
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</table>

The use of MEDNet system gave the opportunity to avoid the transportation of 22 patients from Lagoa dos Três Cantos to the reference hospital in Porto Alegre. This represents almost 30% of the second opinions requested by Dr. Marcus Dalsasso.

A small testimony of Dr. Marcus Dalsasso about his experience with MEDNet is presented below:

“...some answers sent by the specialists were very useful for me...many patients here won in the lottery, they got their diagnosis, they were operated, now they are working...this has no price.”

The pilot tests in *Maranhão* started in December 2009 when the satellite installations were finished. Table II show the number of exams sent by the sites in Maranhão (MA) until March.

<table>
<thead>
<tr>
<th>City</th>
<th>Type of Exam</th>
<th>Teleconsultations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balsas</td>
<td>Abdomen, obstetric (U/S)</td>
<td>290</td>
</tr>
<tr>
<td>Carolina</td>
<td>Abdomen (U/S)</td>
<td>3</td>
</tr>
<tr>
<td>Fortaleza dos Nogueiras</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>
A significant discrepancy is observed when the number of exams performed in Lagoa dos Três Cantos (RS) is compared to the rest of sites in RS. In Balsas (MA), the same behaviour is observed.

An essential knowledge in informatics by the users (physicians) has a relevant impact in the project results. This can be seen in the number of exams sent from Lagoa dos Três Cantos (RS) and from Balsas (MA). Both sites have physicians with experience in informatics and feel comfortable using the telemedicine system. On the other hand, the other physicians involved in MEDNet showed resistance using the telemedicine application, despite of the workshops, training and constant support given.

The Table II number of exams sent from Balsas (MA) per month from December 2009 until March 2011. From February 2010 until December 2010 there is a period that the system was not operational due to technical problems in the satellite connection. Nevertheless MEDNet activities in Balsas were going on. The physician stored the ultrasound exams in the DICOM Database and when the connection was recovered he sent them to the reference hospital, which has already answered all his requests of second opinion.

Peru Deployment

In Peru there are in total eight satellite installations including the referral hospital in Huancayo. All the sites are located in the jungle area and are very difficult to be approached especially under certain weather conditions.

Results

<table>
<thead>
<tr>
<th>Health Care Centre</th>
<th>Ultrasound Consultations</th>
<th>Image Transfers</th>
<th>Local Consults</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.S. Chongos Alto</td>
<td>25</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>C.S. Paranhuanca</td>
<td>22</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>C.S. Comas</td>
<td>45</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>C.S. Rio Negro</td>
<td>57</td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td>C.S. Mazamari</td>
<td>35</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>C.S. Pangoa</td>
<td>28</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>C.S. Puerto Ocopa</td>
<td>12</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Hospital D.A. Carrion</td>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td><strong>General Total</strong></td>
<td><strong>224</strong></td>
<td><strong>144</strong></td>
<td><strong>105</strong></td>
</tr>
</tbody>
</table>

All the teleconsultations in Peru are Ultrasound consultations. The table presents more detailed the number of exams was sent through the system to the other sites and the exams were locally consulted. The main type of exam was obstetric and abdomen.
Conclusion

As a conclusion of the analysis of the first MEDNet data we could say with certainty that Telemedicine is a real need for rural and underserved areas. It is low cost, efficient and useful for people living far from central hospitals. Of course there are certain problems like the difficulty of the doctors with the technology or the bureaucracy. But all of these problems are not seem so important when a life is saved or a poor person avoided the huge costs of a travel and hospitalization. In the future there are many challenges for Telemedicine. Some of them are technological of course and the most are sustainability challenges.

More specifically the most important challenges –lessons learnt from MEDNet are:

- The technological challenge is to provide an integrated solution to the sites. Separate pieces of hardware & software is very difficult to be obtained or maintenance in rural countries. This happens because of restrictions of the customs or import laws of each country.
- Another big challenge is the motivation of the doctors. In order to succeed this, payment of the doctors should be foreseen.
- Public authorities in rural countries have different procedures to follow. Delays are common. Thorough, advanced planning is critical to mitigate against the risk of long, unnecessary, delays.

References


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Using a Teleophthalmology Service to Facilitate Appropriate Referrals of Patients with Diabetic Eye Disease

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Abstract: We show how a teleophthalmology service was used to improve the referrals made by clinicians at a rural health care facility in South Africa. There is limited availability and accessibility to specialised eye care in South Africa and unnecessary referrals to busy eye clinic can further burden an already strained system. A teleophthalmology service was set up at a diabetic eye disease screening camp where any patient found to have abnormalities on fundus examination were sent for further assessment. The teleophthalmology service included digital fundus photography with real-time feedback from a remote ophthalmologist. 217 patients attended the eye camp. 61 patients were sent to the teleophthalmology station for further assessment. Following the teleophthalmology assessment only 27 (44%) patients required referral to a tertiary eye clinic for further assessment, with the remaining 34 (56%) patients being discharged home. We were able to prevent the unnecessary referral of in 56% of cases and facilitate the appropriate referral for the remaining cases. In resource limited settings like South Africa, a simple teleophthalmology service can reduce unnecessary referrals to busy tertiary clinics as well as improve the timing of referrals that are made by clinicians at outlying health care facilities.

Introduction

Telemedicine and the use of information and communication technology are increasingly being recognized as a method to improve healthcare in developing countries [1]. One way it accomplishes this is by improving access to specialised healthcare. In South Africa there is a critical shortage of healthcare providers with further limited accessibility and availability to specialised healthcare. For example, the number of eye specialists available in the public sector in South Africa is 1/305,721 people [2]. This is below the ratio of 1/250000 people recommended by the World Health
Organization. Increased demand for specialised eye care and a limited availability of ophthalmologists often leads to long wait times for patients. In the Western Cape Province of South Africa, there are only two tertiary eye care facilities both situated in urban areas, with limited accessibility for rural patients. Patients presenting with eye disease at rural health facilities can only obtain a basic eye examination due to the lack of appropriate equipment and expertise. Patients requiring a comprehensive eye examination by an ophthalmologist need to wait months for an appointment and have to travel great distances. The eye clinics are often overwhelmed with appointment requests and are booked up for months in advance. Unnecessary and avoidable referrals further compound the situation by adding to the burden on these already strained services. Diabetic eye disease is a complication of diabetes. Diabetes is on the rise both globally and in Africa [3]. The number of people living with diabetes in Africa is estimated to increase from 12.1 million people in 2010 to 23.9 million by 2030 [4]. The incidence of diabetic eye disease is also likely to increase. Diabetic retinopathy is one ocular complication of diabetes and is a leading cause of blindness. Worldwide it is estimated to affect 1.8 million people causing 4.8% of global blindness [5]. In South Africa it is the third leading cause of blindness responsible for 8% of total blindness [6]. Early detection and management of diabetic retinopathy can prevent blindness. Teleophthalmology has been shown to be an effective method to identifying cases of retinopathy [7, 8] and in resource limited countries like South Africa it can be an effective way to screen diabetic patients. We show how a simple teleophthalmology service was used to improve the management of diabetic patients by improving their referral to tertiary eye care clinics.

Method

The Grabouw Community Health Clinic, a small health care facility in the rural Western Cape, organised a Diabetic eye disease screening camp. Every diabetic patient was invited to attend the camp with the aim of educating and screening each patient for eye disease. The clinic staff, which comprised of volunteering registered nurses and a medical officer, performed dilated fundus examinations on each patient using mydriatic eye drops and direct ophthalmoscopy. Instead of directly referring any patients found to have abnormal fundus examinations to the referral eye clinic, these patients were first sent to the teleophthalmology station for further assessment. This assessment included digital fundus photography (using a Canon CR2 digital camera) with real-time transmission (via the internet) to a remote eye specialist. The digital images were attached and sent via email. In all cases informed consent was obtained. The specialist that reviewed the
images and provided feedback was approximately 1100 km away and was available to provide immediate feedback on the appropriate management for each patient. Patients requiring referral for further assessment and management were then transferred to the referring facilities accordingly.

Results

217 diabetic patients attended the eye camp. 156 patients were assessed as having normal fundi on examination and were discharged home with the advice to obtain an annual fundus examination. 61 patients were assessed as having possible eye disease and were sent to the teleophthalmology station for further assessment. Following the teleophthalmology consultations, 27 (44%) patients required referral to a tertiary eye clinic for further assessment with the remaining 34 (56%) patients being discharged home with the advice to obtain an annual diabetic fundus examination. Of the 27 patients referred, 10 were referred urgently and 17 were referred non-urgently.

Discussion

The availability of a teleophthalmology service at the Grabouw eye camp prevented the unnecessary referral and transfer of 56% patients. It also facilitated a more appropriate referral practice where urgent and non-urgent cases were booked in accordingly. Patients needing transfer to tertiary clinics are often required to take a full day off work. Hospital transport leaves early in the morning and only returns once every patient being transferred has finished being attended to. The benefits of preventing unnecessary transfer include the saving of patient’s time, hospital transport costs as well as the opportunity cost of possible missed earnings for those patients. This potential cost saving would need further assessment in comparison to the cost of setting up and running a teleophthalmology service to better understand its economic impact. The 44% of cases that were referred were able to receive appropriate clinic appointments. The 10 urgent cases received appointments within 1 month, whereas the usual waiting time for an appointment at the eye clinic is between 6-12 months. The teleophthalmology service also reduced the burden on the tertiary eye clinics by halving the number of required referrals. In the Western Cape there are a limited number of eye clinics with only two tertiary eye centres. Theses departments are already working beyond capacity and unnecessary referrals add an avoidable burden to these services. The critical shortage of human resources in the public sector in South Africa remains a challenge and is unlikely to be solved in the near future. It is therefore even more important to look after the available resources and optimize how they are
utilized. In a study done by Hofstetter and colleagues, entitled The Impact of Telehealth on Wait Time for ENT Speciality Care [9], telemedicine was shown to reduce the average wait time from 4.2 months to 2.1 months over a 16 year period. This is a dramatic improvement in service for the patients involved. If a teleophthalmology service is going to be integrated into the public healthcare system, it should be designed to comply with the necessary standards of security and technical quality. Guidelines for the appropriate use of such a service would also have to be developed.

Conclusion

In resource limited settings like South Africa, a simple teleophthalmology service can reduce unnecessary referrals to busy tertiary clinics as well as improve the timing of referrals that are made by clinicians at outlying health care facilities. A benefit-cost analysis study of a teleophthalmology service compared to the alternative option of providing eye care would be useful in assisting policy makers to decide how best to allocate resources.

Acknowledgment

The authors would like to thank Doreen Van Nelson at the Grabouw Clinic, Jill Fortuin from the Medical Research Council and Mike Hubberstey from GENOP for all their support and involvement in setting up the telemedicine service at Grabouw.

References

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Clearing the Path – How to Improve Clinical Pathways in A Cost-Efficient Manner

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Abstract: This paper explains how an innovative Finnish Holter ECG consultation service is organized and describes a research project that will examine the benefits of the service model compared to the traditional procedure. The differences and costs between a conventional clinical pathway to secondary care and a modified pathway where a telemedicine consultation service is in use at a primary care facility will be analyzed and compared. Also, differences in the time it takes to complete the pathways as well as other benefits will be studied.

Introduction

In continuous ambulatory monitoring of a person’s electrocardiogram (ECG), or Holter ECG, the electrical activity of the heart is recorded for a relatively long period of time, most often 24 hours. Electrodes that connect to the Holter monitoring device via lead cables are attached to the patient’s chest and a recording device is carried around the waist. The device records the patient’s electrocardiogram into a digital memory. The patient is encouraged to act and work normally during the monitoring period and to keep a diary of any symptoms and activities.

The Holter ECG method is useful in detecting rhythm disturbances, or arrhythmias, that are associated with a wide variety of symptoms [1]. Individuals suffering from arrhythmias may experience palpitations such as skipped heartbeats or fluttering. Arrhythmias may also cause dizziness or fainting. Arrhythmias cover a variety of irregularities in the heartbeat ranging from non-symptomatic and harmless irregularities to life-threatening ones. A normal rest ECG is not always an effective way to examine certain arrhythmias, in particular those that are paroxysmal in nature because the arrhythmia might not manifest itself during the often quite short time the rest ECG is recorded for. Also, since Holter ECG allows for the patient to work and act normally during the registration period of 24 hours it is possi-
ble to link the resulting ECG recording to activities and symptoms to compare their time of occurrence with possible events in the ECG curve.

In Finland, municipalities are required to finance and arrange for healthcare for their inhabitants. Primary care is provided by municipality health centers employing mainly general practitioners and nurses, and seldom any specialists. Therefore, when a general practitioner decides that a patient needs specialized care, he or she is usually referred to a larger secondary care sector hospital. Unfortunately, both the waiting times for referrals in the secondary care and the distances between municipalities and secondary care facilities can be very long.

In the telemedicine service concept featured in this study, a service operator equips a healthcare center with as many Holter ECG monitoring devices as they require without any investments from the center’s part. A nurse sets the patient up with the monitoring device and sends the patient home. The next day the patient returns with the device. The nurse then uses a private internet portal to upload the monitoring data from the device along with anonymous patient information onto a remote server over a secure connection. The data is checked for accuracy by technicians and then put forward for specialist (a cardiologist specialized in arrhythmias) analysis. The specialist writes a report complete with treatment recommendations, which is then made available for download at the internet portal.

The service charges are based on the number of delivered reports. The service model provides hospital-level specialist consultations to primary care facilities and makes it possible to refer only the patients who actually need secondary care treatment. Furthermore, with this model the specialists making the consultation reports can put their expertise to a much wider use than normally.

In addition to Holter ECG the system includes ambulatory blood pressure monitoring and sleep apnea monitoring services. The service model is in use in 160 locations in Finland, Sweden and the United Kingdom. During 2011 12834 consultation reports were delivered, of which 7988 were Holter ECG reports.

Objectives

The purpose of this research project is to compare the overall costs of a traditional clinical pathway where patients are referred to secondary care for Holter ECG examinations with a modified pathway where a telemedicine consultation service is in use at a primary care facility. The costs include for example patient’s travelling costs, cost of nurse’s work and costs of doctor’s work. Also, the time it takes the patient to travel through the pathway will be analyzed.
Methodology

This study will be principally implemented by Laurea University of Applied Sciences. The study will be limited to the public sector municipality healthcare centers and hospitals.

The bulk of the research will be carried out using the quantitative descriptive analysis method. Also, qualitative interviews will be used to verify the presuppositions associated with the study and to support the quantitative analysis. Three different patient types were identified and selected as examples to illustrate the types of clinical pathways that are examined in this study:

- Patient A: A history of fainting, no findings in auscultation or rest ECG.
- Patient B: Subjectively difficult recurrent palpitations, no findings in auscultation or rest ECG.
- Patient C: An elderly patient, history of episodic dizziness and slow heart rate.

The usual clinical pathways for these patient types as well as the modified pathways utilizing the telemedicine service will be carefully mapped and analyzed. The pathways will be followed from the moment the patients first come into contact with the healthcare system to the successful delivery of the specialist doctor’s diagnosis based on a Holter ECG monitoring. The pathways will not be systematically followed after the Holter ECG monitoring in order to contain the study and to ensure applicability between different healthcare systems. The findings related to the two different types of pathways will then be compared to determine which is the most cost-effective and advantageous alternative.

A sample of several thousand patient cases from Remote Analysis Ltd’s archives will be investigated and utilized in order to determine the average distance a patient has to travel in Finland going through the traditional clinical pathway. This information will then be compared with statistics about the modified pathway. Also, for example the percentage of patients who do not have to be referred to secondary care will be examined.

Predicted Results

The telemedicine service model is expected to offer significant cost savings compared to the traditional method of referring arrhythmia patients to the secondary care sector for Holter ECG and diagnosis. These savings will most likely be related to lower prices for Holter ECG and personnel costs in the primary care sector, as well as shorter travelling distances for the patients.
The preliminary results of this study will be presented at the 2012 Med-e-Tel conference in Luxembourg.

References


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Four Years Evolution of a Teleconsultation Service in Minas Gerais, Brazil

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Abstract: Telehealth has emerged in Brazil as a strategy to support primary care practitioners in small and geographically disadvantaged cities. The Telehealth Network of Minas Gerais provides teleconsultations and tele-electrocardiography for primary care in Minas Gerais province. The objective of this study is to describe the evolution of the teleconsultation service by Telehealth Network of Minas Gerais from 2007 to 2011. The service was initially implemented in 82 municipalities in 2007, and successive expansions have been performed, reaching 658 of the 853 province municipalities in 2011. The mean utilization rate per month has increased from a mean of 5% in 2007 to 60% in 2011. A total of 30,975 teleconsultations were performed, 15,052 in the past year. The increase in the number of teleconsultations has led to the adoption of professionals on duty of different areas, who answered 90% of the teleconsultations. The mean response time is 22 hours. Most health professionals (97%) were satisfied with the service and referrals to distant centers were avoided in 81% of the cases. Cost-effective analysis showed that the service is cost-effective and economically viable. In conclusion, teleconsultation service provided by Telehealth Network of Minas Gerais has been expanding continuously, and has been gradually integrated to primary care assistance in the municipalities.

Introduction

Minas Gerais is a Brazilian province with 853 municipalities, a population of almost 20 million people and a large territory which represents an obstacle to patient referrals. Additionally, the health system in Brazil cannot meet the demand for specialists. Telehealth has emerged as a strategy to support healthcare practitioners in small and geographically isolated cities, in order to avoid unnecessary referrals and improve service quality.
The Telehealth Network of Minas Gerais has expertise in teleassistance and provides teleconsultations and tele-electrocardiography for primary care in Minas Gerais since 2006 [1]. The system uses low cost technology, which is suitable to poor villages. The objective of this study is to describe the evolution of the teleconsultation service by Telehealth Network of Minas Gerais from 2007 to 2011.

Implementation and Utilization

A methodology for implementation and maintenance of the teleconsultation service was developed in 2007 [2-3]. The service was initially implemented in 82 municipalities and successive expansions have taken place, growing to 149 municipalities in 2008, 421 in 2009, 553 in 2010 and finally 658 of the 853 provincial municipalities in 2011.

The mean teleconsultation utilization rate per month has increased from a mean of 5% in 2007 to 60% of the implemented municipalities in 2011. Nevertheless, the average number of teleconsultations sent by municipalities in 2011 was 2.5 per month, meaning there is still potential for a large increase in the demand (Fig. 1). A total of 33,042 teleconsultations were performed, with 15,052 in the past year (Fig. 2). Of these, 53% were requested by nurses, 36% by physicians and 11% by other healthcare professionals, including dentists, pharmaceuticals, physiotherapists, psychologists, nutritionists, audiologists, biochemists.

![Mean number of teleconsultations online and offline per municipality](Image)

Figure 1 Mean number of teleconsultations per municipality from 2007 to 2011
Professionals on duty and response time

The increase in number of teleconsultations has led to modifications in the service, with adoption of professionals on duty, who perform all clinical activities supported by a network of specialists. When these professionals judge it necessary, they can ask for additional information from a subspecialist. From September to December 2011, professionals on duty answered 90% of the teleconsultations and forwarded the remaining 10% to the subspecialists. Regarding the teleconsultations performed in 2011, 29% were answered by general practitioners, 19% by dermatologists, 12% by nurses, 11% by gynecologists and 6% by pediatricians. The success of the professionals on duty contributes to the rapid responses and cost-effectiveness of the service.

System efficiency is measured by teleconsultation response time, and it strongly impacts user satisfaction. In 2011 the average response time was 22.3 hours, being 18.7 hours for professionals on duty and 41.6 hours for subspecialists. Demand on weekends and holidays correspond to 8%, and 17% of the teleconsultations are nocturnal, although primary care functions only in working hours, indicating that healthcare practitioners sometimes use their free time to perform teleconsultations.

Satisfaction survey

The satisfaction survey given to the 1,284 users from January to October 2011 has shown that most health professionals (97%) were satisfied with
the service, and referrals to distant centers were avoided in 81% of the cases.

Cost analysis

Cost-effective analysis showed that the service is cost-effective and economically viable. The main economical benefit of using telehealth is to reduce costs by reducing the number of referrals. Considering that the system is able to reduce 80% of them we have a cost/benefit ratio of 1/3.43. Considering the total investment since 2006, the Return on Investment (ROI) is 2.75.

Conclusion

In conclusion, teleconsultation service provided by Telehealth Network of Minas Gerais has been expanding continuously, and has been gradually integrated to primary care assistance in those municipalities, improving quality of care, providing continuing education, reducing isolation of primary care professionals, referrals to distant reference centers and costs.

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References


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Home Telemonitoring of Respiratory Function in Cystic Fibrosis Patients: Economic Evaluation and Quality of Life

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Abstract: We attempted to quantify the real economic impact of Telemonitoring on NHS balance.

Introduction

In chronic lung disease, the continuous monitoring of clinical status, the detection and early treatment of respiratory complications are currently the main criteria guiding the treatment [1]. Early initiation of antibiotic therapy can prevent the development of serious complications perhaps using less invasive antibiotic therapy [2].

In The Center for Cystic Fibrosis (CF) of Bambino Gesù Pediatric Hospital of Rome since 2001 the telehomecare (THC) has been activated in the follow-up of patients at home.

In a previous study [3] we have investigated the possible role of THC in the follow-up of a group of patients with CF in detecting early stages of infectious pulmonary exacerbations. The study included 17 subjects (11 f, 6 m) with CF followed at home with THC in addition to conventional treatment, for a period of 29.6 months ± 13.5. The age of entry in THC was 15.74 years ± 5.8. As controls were enrolled 28 patients with CF (13 f, 15 m, age 14.77 ± 5.22). The results indicate, in subjects with THC, a statistically significant reduction of hospital admissions and a tendency over time to the stability of lung function.

In the present study we have attempted to quantify the real economic significance of using the monitoring of respiratory function on the scale of economic NHS, in order to find a balance between spending on health and health needs.

Materials and Methods
In our CF center, the activity of THC was initially performed using Oxitel equipment and since 2005 using Spirotel equipment supplied as “Home Vivitel Control Service” (www.vivisol.it). Patients included in the program were followed and treated in the Day Hospital with the usual protocols of follow-up [4].

The calculation of the budget statement was made by examining the costs of medical equipment, medications used, the cost of housing, of a day hospital and of an outpatient visit. We considered as revenue the fees relating to admissions avoided through early detection of acute events and therefore to remaining free beds that the hospital could use for other patients.

Simultaneously we administered to patients a questionnaire (sent via e-mail) with multiple answers, partly open, to confirm the level of satisfaction with this method and related matters. We used 3 categories of subjects, homogeneous for age and all chronic diseases: 1) CF patients who used the telemonitoring, 2) CF patients who did not use the remote home monitoring and 3) 28 chronic non-CF patients who did not use the remote home monitoring. We tried to evaluate some parameters to which a market value does not match such as anxiety, pain, the expectation of well-being, using the method of individual "willingness to pay" (W.T.P.) [5].

Results

We recognized 136 pulmonary relapse episodes: 99 were treated at home by oral or i.v. antibiotic therapy (€ 379,833) and 37 by hospitalization (€ 150,405), with a total cost induced of € 530,238. Considering that, in absence of THC, all episodes would involve hospitalization; we compared the total cost of THC patients with the cost of 136 in-patients acutely hospitalized in the same period for chronic pathologies with similar DRG (€ 552,840). On the other hand, in THC treated patients, the 99 avoided hospitalizations needed the structure to perform as many admissions, with an income of € 422,916 that we considered a saving (€ 530,238 – € 422,916 = € 107,321,88). The balance (€ 552,840 - € 107,321) shows a total saving of € 445,519 (€ 89,103/year, € 5241/patient/year considering a 5 years period).

The results of the questionnaire are presented in graphical form in Figures 1-6 (our elaboration).

Discussion

The annual savings achieved through home telemedicine in the management of patients with CF is not very relevant, especially in view of the national average expenditure per patient. It should however be noted
that these savings are obtained in front of improved levels of care and satisfaction levels of the subjects.

Figure 1 shows the answers to the question about knowledge of the methodology. As you can see, in spite of telemedicine in Italy has not yet been adequately spread, a large number of patients, however, know the existence of it.

Figure 2 shows how long our CF patients are using telemedicine.

Figure 3 reports the opinion of patients on the utility of telemedicine: % of positive responses about its usefulness

Figure 4 reports the opinion whether telemedicine may change the doctor-patient relationship. According to our CF patients, telemedicine cannot replace the doctor, and can help you to better follow the course of the disease.
Figure 5 - answers if the telemedicine do save time in the daily management of therapy. As seen above, the responses of CF patients in telemedicine appear more homogeneous than the group not in telemedicine.

The results on Figure 6 reveal the willingness to pay (WTP). CF patients in telemonitoring gave a report very close to reality. CF patients not in telemedicine, have an expectation on the method so they would be willing to pay more than twice in the first group. Patients in the third group are positioned in a central location. They probably do not have a direct interest in the technique, but as chronic patients, however, have similar expectations on innovative technologies to patients in the second group.

Conclusions

The use of telemedicine highlights several advantages that will surely become even more evident when its use will spread more. Being able to monitor patients at home is certainly a turning point for the "quality of life" of people with chronic conditions that, with the progress of medical knowledge, will in time more and more numerous.

The reduction in hospital accesses is a goal of considerable magnitude in the long-term management of chronic diseases. Telemonitoring in the follow-up provides a further guarantee of better survey on exacerbations often cause of the gradual decay of the general conditions.

From the economic point of view, we pass through a historical phase in which health is increasingly considered a right for all. In front of
in increasingly limited economic resources, it still shows a steady increase in health expenditure, which is now a substantial part of the National Gross Domestic Product. At this economic stage, telemedicine can be a rare source of savings. The hope is that new studies confirm our initial data to begin with conviction the phase of the development of telemedicine in Health.

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Introducing Economical Criteria for Telehealth Implementation: An Application at the Telehealth Network of Minas Gerais

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Abstract: The Telehealth Center of Universidade Federal de Minas Gerais University Hospital, Brazil, provides teleconsultation and telecardiology services for primary care professionals in 658 villages since 2006. The Telehealth Network was formed by successive implementation phases, funded mainly by State of Minas Gerais Health Department and the Brazilian Ministry of Health. To know the return of investment is important for funders and to convince municipal managers of telehealth benefits. The Network research team conducted previous studies to evaluate telehealth economical feasibility in Minas Gerais State. However, the used methodology was difficult and expensive. Therefore, it became necessary to develop a more simple methodology showed in this paper. It is based on the consideration that referral cost strongly depends on distance. Using a linear correlation between referral cost and referral distance and the concept of telehealth activity efficiency, it was possible to obtain a simple equation giving the minimum referral distance for economical feasibility. Applying the methodology to Telehealth Network situation, it was concluded that if reference centers are far from about 20 km, the use of telehealth would be economically feasible.

Introduction

Telehealth Network of Minas Gerais, a partnership of six public universities and the State Health Department connects 658 municipalities in the State of Minas Gerais, Brazil. Coordinated by Telehealth Center of Universidade Federal de Minas Gerais University Hospital, provides teleconsultation off line, analysis of electrocardiogram and teleconsultation on line in cardiology to support primary care professionals
located in remote and isolated regions of the state [1]. Since June/2006 about 33,000 teleconsultations and 850,000 ECG analyses have been conducted. To reach this scale of attendance, the Telehealth Network was formed by successive implementation phases in the last five years. At each phase, the implementation methodology has been enhanced [2]. Although the objective of those expansions was not economical and cost saving was not a criteria for choosing the sites to implement the service [3], the return of investment must be evaluated as a response for funders and to analyze the economical feasibility of telehealth implementation in the state. Furthermore, knowing previously if telehealth will promote savings for the municipality is certain an important argument to convince municipal management [4]. Under the economical point of view, telehealth service in these municipalities has the objective to reduce patient referral costs [5]. However, previous evaluation of these costs is extremely difficult due to the large amount of information as well as the hardship and cost to collect them. Consequently, it became necessary to develop a new methodology to previously evaluate the economical feasibility to implement the service in a specific region.

Methodology

Previous studies to evaluate economical feasibility of using telehealth in support to primary care professionals in Telehealth Network of Minas Gerais have been developed [6]. Necessary information for such studies was collected in 86 municipalities before system implementation. To collect information it was necessary to visit each municipality and these visits used to take the whole day. Although more detailed and precise, this methodology takes time and has a high cost. The information collected was regarding number and distance for referrals, personal and transportation costs, depreciation, taxes and insurance of vehicles used for transportation and communication costs. Another group of data were collected at the Telehealth Center: administration, technical and clinical staff costs and communication costs. Considering all costs to operate the system plus depreciation and capital cost and dividing this sum by the number of activities developed it is possible to calculate the telehealth unitary activity cost. Additional information used in this study was the telehealth activity efficiency defined as the percentage of avoided referrals caused by the use of telehealth in relation to the total number of referrals. Comparing costs to benefits it was possible to establish the minimum number of telehealth activities (equilibrium point) where the system becomes economically feasible and to evaluate the savings for each municipality connected to the
system. However this approach takes time and it is costly. It was necessary to have a fast and low cost approximated evaluation of the economical feasibility for a specific site before the implementation.

From the data collected in the previous economical study, it is possible to obtain a correlation between the unitary referral variable cost (RVC) and the referral distance (D) using a statistic linear correlation of the type:

\[ \text{RVC} = a \cdot D \quad (1) \]

where \( a \) is the slope of the curve of RVC versus D (“a” represents transportation cost per kilometer). It is important to observe that only the variable cost has to be considered in this analysis since the use of telehealth will not reduce 100% of the referrals and consequently the fixed costs, such as personal and depreciation, are kept and the savings will be only on variable cost. Considering that only part of telehealth activities will reduce the number of referral (for instance, telehealth activities are not able to avoid urgency referrals), the saving (S) promoted by telehealth will be:

\[ S = \eta \cdot \text{RVC} = \eta \cdot a \cdot D \quad (2) \]

where \( \eta \) is the telehealth activity efficiency, defined previously. \( \eta \) is collected by the system after each ECG or teleconsultation. Defining the unitary telehealth activity as UAC, the shortest distance to economically enable the system can be obtained equalizing cost (UAC) and saving (S) using equation (2) to obtain the minimum distance as

\[ D_{\text{min}} = \frac{\text{UAC}}{\eta \cdot a} \quad (3) \]

If the referral distance for a specific municipality, calculated as weighted average of number and distance of referrals, is greater than \( D_{\text{min}} \) the implementation of the system will result in savings for that municipality. This evaluation is very simple to do since information about all referrals is recorded in these municipalities.

Results

The values collected regarding the referral variable cost (RVC) in US$/referral as a function of the referral distance (D) in kilometers are shown on Figure 1.

The linear correlation equation shown in Figure 1 gives \( a = 0.3887 \) US$/Km. The average value for telehealth activity efficiency (\( \eta \)) is 78% [2] and considering the telehealth unitary activity cost (UAC) obtained in
the previous study as U$$ 6,03 [6] the minimal distance for economical feasibility is

\[ D_{\text{min}} = \frac{6,03}{0,78 \times 0,3887} = 20 \text{ Km} \]

Therefore, it can be said that for municipalities which have theirs references centers far from about 20 km the use of telehealth will be economically feasible. It can be observed that as the activity efficiency increases or the unitary activity cost decreases shorter references distances makes the system economically feasible.

\[ y = 0,3887x \]
\[ R^2 = 0,45301 \]

Figure 1. Values collected for the unitary Referral Variable Cost in function of referral distance

Discussion and Conclusion

Although not very precise, a methodology to make a fast economical evaluation of telehealth impact to reduce referral cost was developed. Since most of referral costs are related to patient transportation, the economical criterion adopted to evaluate the economical feasibility was the average referral distance. Knowing the distance to referral centers and the average number of patients referred in the municipality it is possible to make an estimative of average referral distance. Comparing it to the minimum distance here calculated, it will be possible to evaluate if telehealth will be able to promote referral savings for that specific municipality. Although this is not a decisive and precise criterion, using
this methodology it is possible to introduce economical aspects to the
decision of which municipality should receive telehealth service.

Acknowledgments

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References


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Retrospective Return on Investment Analysis of an Electronic Treatment Adherence Device Piloted in the Northern Cape Province

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Abstract: The return on investment for utilizing the SIMpill electronic treatment adherence solution as an adjunct to directly observed treatment short-course (DOTS) is assessed using data from a 2005 pilot of the SIMpill solution among new smear positive Tuberculosis patients in the Northern Cape Province. The value of this cost minimization analysis (CMA), for use by public health planners in low resource settings as a precursor to more rigorous assessment, is discussed. The retrospective analysis compares the costs and health outcomes of the DOTS-SIMpill cohort with DOTS-only controls. Hypothetical five-year cash flows are generated and discounted to estimate Net Present Values. Comparison between the DOTS-SIMpill pilot cohort and DOTS-only supported controls, for a hypothetical implementation of 1,000 devices, over 5-years, demonstrates positive return on investment for the DOTS-SIMpill cohort based on improved health outcomes and reduced average cost per patient. The net stream is positive from the first year. Discounted Net Present Value is ZAR 3,255,256 (US$ 493,221) for a cohort that would have started mid 2005 and ZAR 4,747,636 (US$ 487,339) starting mid 2010. This is a return on investment of 23%.

The addition of electronic treatment adherence support technology can help to improve Tuberculosis outcomes and lower average cost per patient by reducing treatment failure and the associated higher cost and burden on limited resources. CMA is an appropriate initial analysis for health planners to highlight options that may justify more sophisticated methods such as Cost Effectiveness Analysis or full Cost Benefit Analysis where a preferred option is immediately revealed. CMA is proposed as a tool for use by public health planners in low resource settings to evaluate the return on investment of treatment adherence technology post pilot and prior to implementation.
**Introduction**

Directly observed treatment short-course (DOTS) regimen is the cornerstone of controlling TB. One of the aims of DOTS is to ensure patient medication compliance. Approximately 10 – 15% of patients in South Africa default on treatment and treatment success rates remain low [1-2]. Failure of compliance is associated with the development of multiple drug resistant TB (MDR-TB), the prevalence of which increased from 1.8% in 2004 [3] to 9.6% in 2011 [4].

The SIMpill® system (Simpill Pty Ltd, Western Cape) is a cellular telephone SMS based medical adherence support (MAS) system developed in South Africa. It consists of a device that attaches to a standard pill-bottle or blister-pack and communicates with a web-based application by SMS every time the patient opens the bottle or removes a tablet from the blister pack.

The solution enhances existing SMS-alert systems by only sending SMSs when patients do not take the medication (open the bottle or use the blister pack) as prescribed [5]. A patient motivated to “fake” adherence, however, can cheat the system.

Before considering wider implementation of this type of electronic treatment adherence support the related costs and benefits, if any, need to be calculated. E-health economic assessment is complex [6-7]. Telemedicine economic evaluations remain rare [8] and few are conducted in accordance with standard evaluation techniques [9].

**Background**

The application of cost effectiveness analysis (CEA), cost-utility analysis (CUA) or cost benefit analysis (CBA) can be challenging in the developing world setting where accurate patient follow-up is often difficult or incomplete and adequate data are not readily available [10]. To overcome this, this study utilizes cost-minimization analysis (CMA) as a precursor to a more definitive study. CMA is used to arrive at a cost comparison between patients using the MAS and the controls. ROI assessment calculates discounted break even analysis and net present value (NPV).

A review of telemedicine experience in the developing world emphasizes that cost-effectiveness is a fundamental aspect of the introduction of telemedicine and cautions that very few studies were found in which the topic was addressed [11]. This study proposes evaluation of costs and health outcomes as a precursor to more extensive analysis, utilizing data that are usually readily available and a method that allows for a less cumbersome though useful assessment to be conducted.
Results

A retrospective analysis was conducted on a pilot study utilizing the MAS device at the Betty Gaetsewe clinic located near Kimberly in the Northern Cape Province of South Africa in 2005. The study examines the costs and health outcomes of a pilot implementation of a MAS solution and compares it with a control group supported by conventional DOTS methods only.

The average medication costs for the different drug sensitivity profiles at the time of study were ZAR 295.58 (US$ 44.78) for drug sensitive new smear positive patients, ZAR 1,732.17 (US$ 262.45) for re-treatment of drug sensitive patients and ZAR 27,117.28 (US$ 4108.68) for treatment of MDR-TB. The large treatment cost difference between TB and MDR-TB patients is the dominant cost driver that results in cost savings when MDR-TB cases are reduced, despite the additional technology investments required. The effects (health outcomes) evaluated were the smear conversion rate after two months of treatment, the treatment outcome after completing treatment (where negative sputum in the last month of treatment was regarded as treatment success or cure) and the MDR-TB rate. For both of the participant scenarios the MAS pilot group was compared with the corresponding control group using the Fisher’s exact two-tailed test. The results are summarized in table 1.

Table 1. Treatment outcomes for scenarios one and two

<table>
<thead>
<tr>
<th>Scenario one</th>
<th>Scenario two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>MAS pilot</td>
<td>Control group</td>
</tr>
<tr>
<td>Smear conversion rate</td>
<td>62.5%</td>
</tr>
<tr>
<td>Cure rate</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

Break even analysis is used to determine the theoretical point in time from starting a hypothetical implementation of 1,000 MAS devices, to the time that the deployment will have generated benefits equal to cost \((T_R = T_C)\). Present value tables are used to discount annual figures and inflation is set at 8% per annum. Break even analysis is of little relevance in this study, which shows a positive net stream from the first year of implementation for both the 2005 and 2010 hypothetical starting points.

For a theoretical implementation of 1,000 units in the Northern Cape Province, the net stream for both the 2005 and the 2010 starting points was positive from the first year of implementation. Discounted NPV for the hy-
potentially implementation starting in 2005 was ZAR 3,255,256 (US$ 493,221) while starting in 2010 resulted in a discounted NPV of ZAR 4,747,636 (US$ 487,339). This is a return on investment of 23%.

Discussion

The study proposes a methodology whereby public health planners in the developing world can use relatively accessible data to evaluate whether a potential investment in treatment adherence technology will yield positive returns on the investment and whether further analysis using CEA or CBA is justified.

Despite a number of limitations, the CMA findings may be of value to public health planners contemplating economic evaluation of eHealth pilot projects in low resource settings to make more informed decisions when allocating scarce resources.

References

eHealth for Low Resource Settings and Developing Countries
Collaborative Efforts towards eHealth Adoption in Asia

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Abstract: eHealth has paved its way throughout the healthcare setup globally; however, little work is done on generating evidence in developing countries. The need of eHealth initiatives in Asia generated the idea of a collaborative network funded by International Development Research Centre (IDRC) Canada. The PAN Asian Collaboration for Evidence-based eHealth Adoption and Application (PANACeA) was formed with objective to generate evidence on how eHealth could improve the health programs and services in the member countries through multinational eHealth projects. PANACeA comprises of eHealth researchers from Pakistan, India, Afghanistan, Bangladesh, Nepal, Malaysia, Indonesia, Philippines, Sri Lanka, Mongolia, and Canada. Eight research projects were initiated involving multi-national teams. Alongside, Network also works in PANACeA Common Thematic Activities (PCTA) that works parallel to support the projects. To determine how the Network supported networking, capacity building, and research projects, an evaluation was conducted using ‘Utilization Focused Evaluation’ approach. The major strengths of the network include: diversity, effective communication and increased eHealth understanding. The major areas of improvement were: less hierarchical structure, blending of the team with similar interests, and involvement of institutions rather than individuals. PANACeA serves as a model for collaborative effort for generating evidence in eHealth.

Background

PANACeA is a network of researchers in eHealth to support multi-country research projects in 10 countries of Asia. The network is supported and mentored by a group of eHealth experts forming the Advisory and Monitoring Team (AMT). First year of the project (2007-2008) focused on building structure and strategy; identifying research projects and appropriate partners, establishing institutional relationships, and finalizing research proposals followed by needs assessment and actual project activities (2008-10). Targeted thematic activities, such as readiness assessment, systematic reviews, communication, outcomes, and networking visits were conducted during this period.
Objectives

The key objectives of PANACeA include:

1. To support a set of multi-country research activities to address core research questions;
2. To create a theoretical model for evaluating good practice in eHealth;
3. To build eHealth research capacity amongst Asian researchers

Results

Achievement made by PANACeA during the project period can be described under:

1. Research Projects:
   Brief results of eight research projects are summarized as below.
   
   **Project I: Community-based eHealth Promotion for Safe Motherhood (Philippines, Indonesia and Pakistan)**
   This project tested the effectiveness of mHealth interventions for Behavioral Change Communication, among pregnant women for utilizing Emergency Medical Obstetric Care (EMOC) services. The project developed mHealth solutions, based on FrontlineSMS and OpenMRS to send short messages for behavioral change to improve utilization of antenatal and delivery services. Results showed significant increase in utilization of health facilities for antenatal care and delivery services.

   **Project II: Portable System for Telehealth and Health Informatics in Rural & Remote Areas (THIRRA) (Malaysia, Sri Lanka and Nepal)**
   This research used a web-based open-source EMR system, and customized it to use Wireless Application Protocol (WAP) facilitating healthcare providers to access appropriate healthcare information timely and sufficiently. The project curtailed the postal delay in the notification, and achieved near real-time investigation of communicable diseases.

   **Project III: Economic evaluation framework of computerization in hospitals (Pakistan, Philippines, and India)**
   This project aimed to compare manual hospitals and computerization hospitals in three countries. Results showed that computerized solutions for laboratory test recording and reporting lower the costs per unit of all laboratory tests substantially in all three countries. The marginal cost analysis for computerized hospital showed a consistent cost advantage over the non-computerized non computerized hospital for all of the four tests.

   **Project IV: Online TB Diagnostic Committees for Clinically Suspect Sputum Negative Patients in the National TB-DOTS Program (Philippines and Pakistan)**
To provide an innovative technology solution to address delays in diagnosis of tuberculosis through telemedicine, web based solution ‘iPath’, and emails were used. Digitized images for radiologic diagnosis of tuberculosis found as effective as F2F diagnosis. Expert pulmonologist and radiologist show satisfaction with the quality of X-ray images.

**Project V: Improving maternal health care services by using ICTs for remote consultation and education (Mongolia and Philippines)**

The project aimed to improve health services for rural, pregnant women by connecting rural physicians to ‘provincial’ hospitals for remote consultation through software to complement live consultations. Results showed that computer skills of HCPs increased 11% difference in case and control sites. About 210 pregnant women accessed antenatal care service from the project sites and 116 women delivered under supervision of obstetric consultants.

**Project VI: A Systematic Review of Current ICT Applications in Disasters – The Potentials of Integrating Telemedicine (Philippines, India, Indonesia)**

A systematic review following Cochrane methodology was conducted to collect information on disaster management, involving ICT applications at different stages of disasters. Preliminary findings showed that not many peer reviewed publications describe actual eHealth deployment at various phases of disaster management cycle. Most of the implementation experience shared/available is from EU and US.

**Project VII: Framework identify eHealth needs in a Primary Health Care Setting (Philippines, India, Indonesia and Pakistan)**

The project aimed to develop a framework for Primary Health care providers to identify gaps in eHealth delivery. Community Health Information Tracking System (CHITS) and OpenMRS were used. Electronic medical records systems in two rural health units were established in Philippines. e-Prescription system with adverse drug event alerts installed and operationalized in Indonesia. District Health Information System (DHIS) was customized and successfully used in four primary care centers in Maysore, India. Three tiers of health system (primary, secondary and tertiary) were connected through OpenMRS in Mardan, Pakistan.

**Project VIII: Basic Intervention Research on eHealth for the Visually Challenged Project (Philippines, India)**

Considering the widely varying health needs of the different segments of visually impaired population, the study used health education material for adolescent population through CDs in Philippines, while a digital cane was tested in the field sites of India. The study revealed need for accessible health information (especially on reproductive health issues) by the visually challenged population. In Manila, special CD based stories focused on
reproductive health of adolescent and young adult was developed. Sensory Folding Canes were found to be user friendly for their day to day activities.

2. **Capacity Building**

PANACeA continued to build capacity of its researchers and other stakeholders and institutions associated with the network through continuing professional development and face-to-face workshops. PANACeA arranges one-hour seminar every week, which is telecasted online using Elluminate Live. Face to face workshops were conducted on FOSS, eHealth research, knowledge management, resource mobilization and variety of other eHealth related topics.

3. **Formative Evaluation**

The purpose of PANACeA’s formative evaluation was to determine how the network supported networking, capacity building, and knowledge dissemination. Network members found diversity, collaboration and mentorship as network’s strengths and hierarchical structure, informal communication, and focus on individuals rather than institutions, as major weaknesses. Network built partner’s capacity in research design, improved eHealth infrastructure and enhanced their readiness for conducting independent eHealth projects. Network not only provided encouragement for dissemination but also built members’ capacity in dissemination, and sharing of knowledge with relevant stakeholders in order to bring evident policy change.

Being a strong advocate of integrating eHealth with routine health care, Dr. Hammad Durrani is working as a Manager Research in the Department of Community Health Sciences at the Aga Khan University Karachi Pakistan and 1French Medical Institute for Children (FMIC), Kabul, Afghanistan. He is mentoring two eHealth Projects, being carried out in Philippines, Indonesia, Bangladesh, India and Pakistan which are part of PANACeA project (PAN Asian Collaboration for Evidence-based eHealth Adoption and Application). He is also involved in eHealth Research, conducting systematic reviews on different eHealth modalities (Telehealth and Health Informatics) and is a member of the eHealth Team for the Aga Khan Development Network (AKDN), with responsibilities of planning and strategizing eHealth applications and its concepts in different countries of Asia and Africa where the Network holds its presence.
Diagnosis of the Situation of Telehealth in Nine Countries in Latin America

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Abstract: The implementation of telehealth projects in Latin America is in the process of development, with very significant differences between countries. This project aimed to establish the diagnostic status of telehealth in nine Latin American countries involved six components: standard, deployment strategies, establishment of a researcher network, training courses and certification, project management and innovation policy. The ministries of health were responsible for diagnosing the state of telehealth in the country made possible with the use of a semi-structured questionnaire. The diagnoses were structured by components and an overview of the component was performed thus making it possible an overview of the development of telehealth in LA. Nine Latin American countries have their diagnosis: Brazil, Ecuador, El Salvador, Chile, Colombia, Argentina, Uruguay, Mexico and Peru. Countries that are more advanced and already have national telehealth projects in place are: Brazil, Colombia, Ecuador and Mexico. In an intermediate situation, with some actions in telehealth, are the following countries: Peru, Chile and Argentina. Countries that still do not have telehealth activities or that are still very incipient are Uruguay and El Salvador. Among the six different components analyzed, the least developed aspects in Latin America are the standards and technological innovation. On the issue of innovation policies in telehealth, even the most developed countries in the area such as Brazil and Mexico do not yet have structured innovation policy. The issue of standards is a little more advanced, with the structuring of national groups in these countries, but still very incipient. It was noted that several countries are already participating in international organizations that carry out discussions in this area with the formation of a critical mass already in place. However, they have not yet succeeded in creating an important internal dynamics in different countries. In general, the actions of telehealth in Latin America are in process of development, but are still very uneven, depending on the country.
Introduction

Nine Latin American countries (Mexico, Brazil, Colombia, Ecuador, El Salvador, Uruguay, Chile, Argentina and Peru) participate in the project called "Regional Protocols to Public Policy on Telehealth” Project financed by IDB (Inter-American Development Bank). This process has enabled a deeper knowledge about the systematic status of telehealth in Latin America. This process is important because, according to WHO, the use of telehealth resources is broad and uneven. Therefore, this project is aimed at establishing the diagnostic status of telehealth in nine Latin American countries involving six components: standard, deployment strategies, establishment of a researcher network, training courses and certification, project management and innovation policy in telehealth.

Methods

The ministries of health were responsible for diagnosing the state of telehealth in the country made possible with the use of a semi-structured questionnaire. Groups involving experts from ministries of health and universities that develop telehealth projects were structured in each country. These diagnoses were validated by six groups, one for each component, composed of representatives of countries under the coordination of an expert on the subject. These diagnoses were structured by components and an overview of the component was performed thus making it possible an overview of the development of telehealth in LA.

Results and Discussion

Among the different components, it was concluded that the least developed aspects in Latin America are to the standards and technological innovation. On the issue of innovation policies in telehealth, even the most developed countries in the area such as Brazil and Mexico do not yet have structured innovation policy. The issue of standards is a little more advanced, with the structuring of national groups in these countries, but still very incipient.

As for the training component in telehealth, there are many initiatives underway, particularly in countries which already have national telehealth project (Colombia, Brazil, Mexico and Ecuador). Few countries possess the subject of telehealth in undergraduate. Currently, there is no graduate course in telemedicine or telehealth in Latin America. As for distance education using advanced features, the process is still incipient, but virtually all countries already have some experience in distance education courses in health care.
Structured university research networks using video and web conferencing processes in Latin America are still very incipient; however, many groups are already working in the Brazilian University Telehealth Network (Rute – *Rede Universitária de Telemedicina*, in Portuguese).

The strategies used for the development of telehealth are quite uneven; however, what they have in common is that in general the initiatives focus on primary care, where the activities are web conferencing and teleconsultations involving academics or specialists who communicate using ICTs with primary care physicians. Colombia also has a telehealth project in semi-intensive care.

When it comes to the management of telehealth projects, there are still lots of ground to cover concerning regulation of telehealth activities by professional boards or payment for telehealth procedures. Some countries already have national groups of telehealth project management (Brazil, Ecuador, Mexico, Colombia), but with little progress regarding the evaluation of ongoing projects - Colombia and Mexico are furthest advanced in relation to these aspects. The civil society organizations, telehealth national associations such as councils exist in a few countries.

From this set of elements, it is possible to categorize the countries into three groups: the most advanced countries have national telehealth structured projects (Colombia, Brazil, Mexico and Ecuador); Chile, Argentina and Peru have started out at the state or municipal level, but still failed to bring together national initiatives; El Salvador and Uruguay are the countries with smaller initiatives in the area.

**Conclusion**

In general, the actions of telehealth in Latin America are in process of development, but are still very uneven, depending on the country.

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eHealth Standardization to Meet Needs of Developing Countries

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Introduction

The delivery of effective and affordable healthcare is a challenge that all countries face today, irrespective of whether they are developed or developing nations. The information and telecommunication industry has an opportunity to contribute substantially to global healthcare. There is no doubt that the introduction of eHealth services will be beneficial to all countries and in particular for developing countries where there are no resources to improve their healthcare systems using classical approach to increase the number of medical staff and hospitals.

It is due to the ITU effort the question about telemedicine for developing countries was introduced and discussed for the first time during the First World Telecommunication Development Conference in Argentina in March 1994. The Conference approved Question 6 (in 1998 it was renumbered into Question 14) on telemedicine which was assigned to the Study Group 2 of the ITU Development Sector. In accordance with the decisions of this Conference, the ITU has undertaken various activities related to the study of the potential benefit of eHealth applications in the health care sector of developing countries as well as the demonstration of these applications in implemented eHealth/Telemedicine pilot projects in selected countries.

Then the first World Telemedicine Symposium for developing countries was held in Portugal from 30 June to 4 July 1997. The Symposium was an ITU initiative, hosted by the Portuguese Telecommunications Administration through the Instituto das Comunicacoes de Portugal (ICP). It was attended by more than 57 countries and for the first time it was the case when telecommunication specialists were sitting together with doctors from the same country. The symposium was the first opportunity that was given to developing countries to become familiar with telemedicine demonstrations, to discuss with health and telecommunication experts and
to identify the different possibilities and practical applications of telemedicine in their own countries.

By the way, the World Health Organization only in May 2005 at its Fifty-eighth session of the World Health Assembly officially recognized eHealth and adopted Resolution WHA 58.28 establishing eHealth Strategy for the WHO.

One of the Main Obstacles – eHealth Standardization

As usual for any innovative ideas, there are many obstacles starting with the reluctance of medical staff in developed countries to adopt a new way of servicing till the lack of knowledge about eHealth among medical professionals and administration in developing countries.

There is another main obstacle that concern both developed and developing countries – eHealth standardization which is extremely complex question. In spite of huge amount of money and manpower spent in this field, the result is rather poor particularly for the interest of developing countries. They require special attention to meet their needs taking into account the condition of their fixed and mobile networks. It was not done so far in the professional way. ICT solutions for health and eHealth services, including mHealth as well, have been developed a lot, particularly in the last decade. However, the solutions are still much too often isolated islands of small-scale applications that are unable to communicate with other health systems and/or share information across geographies and technologies.

Barriers to scaling-up small systems in developing countries prevent supporting a larger patients and care providers base. Decision makers are not necessarily able to assess the actual health situation, which in turn inhibits comprehensive planning, response and policy formulation.

ITU’s Standardization Sector coordinates the technical standardization of multimedia systems and capabilities for eHealth applications. The Sector has just released a new Technology Watch Report (www.itu.int/en/ITU-T/techwatch/Pages/ehealth-standards.aspx) that looks to the future of eHealth. The report observes that eHealth development will require more universal e-health interoperability standards, and strategies to overcome technical infrastructure barriers and address privacy, security, and other legal requirements. There are many generic standards used in eHealth applications for video coding, security, multimedia transmission, and languages for instance. And many of those have been developed by ITU-T. These and other issues are being addressed by experts within ITU-T Study Groups 16 and 17, as well as within other external standardization bodies. International Standards for eHealth need to be based on already existing
“mature and stable technologies” rather than only on future advanced technologies.

The ITU Plenipotentiary Conference 2010 in Guadalajara, Mexico adopted a new Resolution 183 on “Telecommunication/ICT applications for e-Health” …calling ITU to give priority consideration to the expansion of Telecommunication/ICT initiatives for e-Health and to coordinate e-health-related activities between the Standardization, Development and Radio communications sectors and, in particular, to promote awareness, mainstreaming and capacity building in the creation of telecommunication/ICT eHealth standards, reporting findings to the Council as appropriate”.

In addition to the Resolution 183, the ITU Plenipotentiary Conference in Guadalajara approved “Strategic plan for the Union for 2012-2015” where one of the strategic objectives for ITU-T is “Bridging the standardization gap: to provide support and assistance to developing countries in bridging the standardization gap in relation to standardization matters, information and communication network infrastructure and applications, and relevant training materials for capacity building, taking into account the characteristics of the telecommunication environment of the developing countries”. It is exactly concern eHealth technical standards to be appropriate for existing network in developing countries.

The World Telecommunication Development Conference (Hyderabad, 2010) also approved Resolution 65 on “Improving access to healthcare services by using information and communication technologies”, where it was stated “…to continue to promote the development of telecommunication standards for eHealth network solutions and interconnection with medical devices in the environment of developing countries, in conjunction with ITU-T and ITU-R in particular”.

Recommended Plan of Action

Recently, The “Regional Asia-Pacific ITU meeting on e-Health” hosted by the Japanese Ministry of Internal Affairs and Communications (MIC) was held in Tokyo, Japan, 10-11 March 2011. The meeting was attended by more than 50 participants from Japan, India, Bhutan, Pakistan, Thailand, Korea, Malaysia, Indonesia, Russia and Bangladesh. The meeting was also attended by the Rapporteur and Vice-Rapporteurs of the ITU-D Question 14-3/2 on e-Health and the Vice-Chairman of ITU-T TSAG. The meeting approved “Tokyo Call for Action - Speeding up the adoption and development of e-Health Standards to meet urgent needs of developing countries for improving access to healthcare services”.

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This document, based on the above mentioned several Resolutions, has highlighted that it is important to solve the problem with technical eHealth standardization as soon as possible. It is necessary to provide standardization of technical telecommunication platform for different types of eHealth services. Technical standards will play a critical role in both achieving the public health benefits of aggregated patient data and providing solutions to requirements for security, privacy, quality assurance and interoperability.

It was recommended the following Plan of Action:

1. Conduct a **study to identify the challenges of adopting e-Health Standards** in the context of both developed and developing countries in terms of cost of adoption, technical barriers, lack of incentives, lack of compliance mechanisms, lack of national e-Health Standards, etc. The study will also **identify the requirements for e-Health solutions to be standardized and “Standardization holes”** (which standards are missing and emerging standardization opportunities) based on mature and stable existing e-Health technologies specially those that are already successfully applied in developing countries.

2. Complement the study by bringing the users who adopt the standards with those who develop them in an “ITU International Conference/Workshop on eHealth Standardization” to facilitate a better understanding of “adoption challenges” and how to address them and to confirm needed new standards. It is also help to find a solution by drawing attention of international community to this important issue.

3. Develop **Guidelines for countries on how to establish to “National e-Health Standards”** as part of a “National e-Health Master Plan” including:
   - What national process to engage; who to involve; what national committees to form and what would be their Terms of Reference;
   - Technical Standards and associated Regulatory and Legal Frameworks and process guidelines needed;
   - On which basis national standards can be identified from existing international ones and how and to what extent those can and should be “adapted” to the national context;
   - What compliance mechanisms can be possibly established to ensure adherence to Standards;
   - What kind of activities are to be implemented to raise awareness about the existence of the Standards and how to implement them;
• How to attract the private sector to participate in the offering of e-Health services in developing countries using different business models.

4. Ensure adequate human capacity building for e-Health professionals to be well acquainted in implementing and adopting e-Health Standards. **Training materials and content should be developed and provided to telecommunication training centers** around the world and made available through ITU and other online learning platforms to democratize the knowledge about this complex topic.

5. There are also several Foundations actively promoting eHealth, and in particular mHealth services for developing countries. The ITU could be an attractive umbrella to coordinate the work of many organizations interested in the development of market for eHealth services in developing countries and move from hundreds of individual pilot projects to wide scale deployment using standardize technical solutions as a reliable platform for eHealth services.

6. Taking into consideration the important of eHealth standardization for many organizations, there is a chance to organize a fund-raising campaign and get some fund to support training of participants from developing countries on how to use successfully standards and recommendations related to eHealth or mHealth.

7. To encourage UNDP in developing countries and other interested organizations to provide financial support for the development of strategically important document for each country – **eHealth Master Plan** which will be able to help the coordination of eHealth projects and activities within each country, and guide to use the recommended technical solutions/standards.

References

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Forensic Telepsychiatry: A Solution for the Developing World?

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Abstract: South Africa, like many other developing World countries has a shortage of psychiatrists and facilities to assess adjudicative competence of prisoners requiring psychiatric observation and assessment. Prisoners may wait for over a year to be assessed. Forensic telepsychiatry service may facilitate this process. This study reviews the literature on forensic telepsychiatry for assessment of adjudicative competence. Methods: The electronic databases, PubMed, Scopus, Cinahl and Google Scholar were searched for papers on forensic telepsychiatry. Results: 411 papers were found of which 13 were relevant. The use of videoconferencing for forensic psychiatric assessment was reported from four countries. The courts in those jurisdictions have accepted the use of videoconferencing for assessment and no successful appeals have been mounted on the basis of the use of videoconferencing for assessment. Forensic telepsychiatry has been found to be cost effective, improve access to scarce specialist skills and reduce transport of prisoners under guard to hospitals or psychiatrists to prisons. Conclusions: There is nothing in the literature to suggest that a forensic telepsychiatry service is not feasible in South Africa and a pilot project is being planned.

Introduction

The prevalence of serious mental disorders is higher among prisoners than in the general population [1]. With 1 psychiatrist per 100,000 people, there are too few psychiatrists in South Africa to meet the country’s needs and even fewer psychiatrists are involved in forensic psychiatry.

In 2007, the Criminal Justice Review Committee requested the South African Department of Health (DOH) to investigate the delay of trials of awaiting trial prisoners referred by the Courts for 30 days of psychiatric observation in a mental institution. In March of 2010 there were 735 pre-trial detainees awaiting observation in South Africa with only 168 beds available in 11 mental institutions. The time to observation in one province was 15 months [2]. At that time there were an estimated 38 psychiatrists in the public sector and 25 from the private sector who were available and willing to participate in undertaking psychiatric observations.
The aim of this study was to review the literature on forensic telepsychiatry to determine if it is a feasible in the South Africa.

Method

Searches were made of PubMed, Scopus and CINAHL electronic databases. Various search strategies were used which returned 317 abstracts. These were reviewed and full length papers in English obtained.

Results

Thirteen papers, two of which were reviews, met the inclusion criteria. Papers were published between 1997 and 2008. Five were from the US, four from Australia, three from the United Kingdom and one from Canada.

Discussion

In Australia, videoconferencing is used in forensic psychiatry for “court diversion”, which is the transfer of mentally ill people from the criminal justice system to hospital and or community mental health placements, or “court liaison” which includes court diversion and also “linking, brokering and advocating for appropriate care” [1]. One of the aims of the court liaison system is to identify mentally ill offenders and direct them to a mental health practitioner.

In the United States, the assessment of adjudicative competence can involve the use of assessment tools in addition to clinical examination. There have been several reports comparing the validity and satisfaction of both psychiatrists and prisoners when using various assessment tools by videoconferencing or face to face [3-6]. A pilot Forensic Telepsychiatry programme in South Carolina started in 2001 and undertook 28 evaluations of adjudicative competency and in the US Army, three assessments had been made by 2006 [6].

In Canada there were 14 telepsychiatry programmes in 2001, six of which offered forensic services. Whether all of these services included assessment of competency to stand trial is not stated [7].

The United Kingdom has been slower to implement forensic telepsychiatry. Three papers have come from one group, who introduced a forensic telepsychiatry service in Nottingham in 2005, with 30 assessments in the first year [8].

There are no reports of patient and clinician satisfaction when using videoconferencing for assessing adjudicative competence but patients were satisfied with the use of videoconferencing for completing assessment tools [3, 5] while clinicians were less satisfied [5].
These services all appear to be driven by common needs, such as the high prevalence of mental illness among offenders [1], poor facilities to manage mental illness in prisons, the shortage of beds assigned to the mentally ill in secure hospitals [1, 9], the shortage of skilled professionals to conduct forensic assessments which is worse in remote and rural areas [4, 6, 9, 10] and the practice of siting correctional facilities in rural areas. These are problems common to South Africa and many other African countries.

Forensic telepsychiatry addresses some of these problems. It improves timely access to specialist skills [1, 10-12], reduces costly transportation and escort of prisoners to urban areas and specialist hospitals for assessment, or transport of specialists to correctional facilities [1, 4, 9, 12], reduces unnecessary or inappropriate admission to hospitals, and reduces risk to psychiatrists by allowing them to perform assessments without having to enter prisons or secure hospitals.

It is generally held that there are significant cost savings in telepsychiatry and forensic telepsychiatry [1, 13] but some have identified set up and running costs as barriers to implementation [12]. In the United Kingdom [10] Australia[1] and in many states in the US [11] courts and prisons already have videoconferencing facilities used for judicial purposes and advantage is taken of this.

Guidelines are needed for the practice of forensic telepsychiatry. Sullivan correctly points out that there are situations where videoconferencing cannot replace direct assessment [12] and a clear definition of these instances is required [11].

A number of potential limitations of forensic telepsychiatry have been noted. The presence of correctional services personnel during consultation affects privacy and confidentiality as do poorly soundproofed rooms [12]. Some nuances like restless legs beneath the desk may be missed unless the clinician is skilled in the use of the pan, tilt and zoom features of videoconferencing cameras and the technology cannot provide smell [1].

Legal and ethical issues are always raised when telemedicine services are offered. These include licensure, liability, informed consent, confidentiality, privacy, record keeping, prescription and data security and storage [5, 10, 12].

Unsurprisingly, forensic telepsychiatry has been accepted by the courts in those countries reporting its use. Miller found limited case law on telemedicine and telepsychiatry in the US. In those cases in which State and Federal prisoners had been involved in telemedicine or telepsychiatry, none attacked either the doctor involved or the use of videoconferencing [11]. In the US Military, one case was reported in which the use of videoconferencing was the basis of an appeal and, “The court ruled that the
use of videoconferencing for a mental competency hearing did not violate due process and that there was no legal basis for appeal based on interview modality” [6]. In the UK, Saleem states that, “...information attained during psychiatric interview will not be undermined by the legitimacy of video link as a means of interview” [10].

The use of forensic telepsychiatry for the assessment of adjudicative competence is both relevant and appropriate in the South African context. There is nothing in the literature to suggest that forensic telepsychiatry will be not achievable in South Africa. What is needed is implementation of a controlled clinical trial of forensic telepsychiatry. This will require training of psychiatrists and staff in correctional facilities on the use of videoconferencing for telepsychiatry and development of standard operating procedures. Pragmatic solutions are required to reduce the delays in forensic assessment in South Africa, of which forensic telepsychiatry is one.

References

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OASIS II Implementation and Preliminary Results in Bonsaaso, Ghana


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Abstract: The Millennium Villages Project (MVP) involves the systematic delivery of a package of proven health and development interventions, with the aim of accelerating progress towards the Millennium Development Goals (MDGs). In parallel to enhancing access to proven interventions, global health gains require the generation of high quality health information that can be used to guide program delivery. Preliminary qualitative findings from the OASIS research project at baseline indicated that Community Health Workers (CHWs) experience difficulties in obtaining necessary data on patient health status and feedback on monthly reports from the district. The OASIS II project, funded by IDRC, seeks to evaluate the impact of the Millennium Villages Global Network (MVG-Net) components, including ChildCount+ and OpenMRS on various aspects of the healthcare delivery systems. Currently, there are 9,812 people registered in MVG-Net, of which 3,870 are under 5 years old. There have been over 8,500 ChildCount+ encounters transferred to the OpenMRS medical record encompassing over 40,000 data points. The integration of OpenMRS and ChildCount+ with the MVG-Net information system makes it possible for rapid assessment of effectiveness and provides important feedback to local providers and the Millennium Villages Project.

Introduction

The Millennium Villages Project (MVP) is a partnership between the Earth Institute at Columbia University, the United Nations Development Program (UNDP), Millennium Promise and national governments [1]. There are 80 Millennium Villages clustered in 10 countries throughout sub-Saharan Africa. MVP seeks to prove the concept that the Millennium Development Goals (MDGs) can be reached by the poorest of the poor,
throughout sub-Saharan Africa, in partnership with governments and other committed stakeholders, providing affordable and science-based solutions to help people lift themselves out of extreme poverty [2].

In parallel to enhancing access to proven interventions, global health gains require the generation of high quality health information that can be used to guide program delivery [3]. Most information systems in Africa are based on pen and paper, and data is frequently missing or inaccurate. In most cases data are received from clinics in aggregated format making data validation somehow impossible. The promise of health information systems depends on adequate infrastructure which ranges from complete lack of power and connectivity through portable data systems, such as USB memory sticks all the way to mobile networks and the Internet. In this context, the International Development Research Centre in Canada and the Earth Institute at Columbia University initiated the OASIS II Evaluation study in 2010 to evaluate the impact of the Millennium Villages Global-Network (MVG-Net) components, including ChildCount+ and OpenMRS on various aspects of the healthcare delivery system within the Millennium Village cluster in rural Ghana [4]. The aim of this paper is to introduce the OASIS II study and its evaluation of potential uses of information and communication technologies (ICTs) in achieving the MDGs. MVG-Net enables data capture in the field (from CHWs, using cell phones, etc.) and facility-based data at the clinic level all entered and stored within OpenMRS as individual patient records with an electronic medical record [5]. The qualitative assessment explores the initial evaluation of the work of the CHWs and the facility-based staff, information and communication flows as well as document existing processes and perceptions and changes over time related to the use of MVG-Net.

Material and Methods

The Bonsaaso Millennium Village Cluster is located in the Amansie-West District of the Ashanti Region of Ghana. The village is an agglomeration of 30 communities with an estimated population of 35,000 people, of which 23% are women with reproductive age (15-49 years). Currently the Bonsaaso community is served by seven health clinics and one referral hospital. A typical clinic is manned by a midwife who is in-charge of the clinic, a nurse and two to three CHWs. Besides CHWs in the clinics, MVP has introduced CHWs into the communities to maximize the delivery of health information and services to households in the project clusters. There is currently a ratio of 1 CHW to every 100 to 200 households, with household visits taking place every 1 to 2 months.
In the Ghana MVP site, outpatients, antenatal care (ANC) and family planning, vital registration and verbal autopsies records from the clinics have been integrated into MVG-Net to provide critical information at the community level to facilitate decision-making and assist in the delivery of care. Daily records were initially keyed in at the community clinic through the MVP server positioned at the Project Head Office. MVP has recently rolled out a CHW information system called ChildCount+, based on Rapid SMS (a UNICEF-sponsored SMS-based client on mobile phones) to hasten the transfer of data from the community to the clinic.

The qualitative study involved in-depth interviews with purposive sampling of facility-based staff in all the clinics. In addition, direct observation of data collection and reporting practices among health professionals were also observed. The interviews were conducted by trained local interviewers in the native language of the respondents, digitally recorded and then transcribed and translated into English. A total of 30 interviews were conducted by the MVP team.

Results

The initial results of the qualitative study show that the CHWs and facility-based staff have the potential to impact health care delivery in remote villages. The responsibilities of the interviewees included:

Maternal and child health - Midwives usually attend to pregnant women, from providing ANC consultations to assisting delivery and follow-up after births as well as treating minor conditions and injuries in the clinic. They perform a wide range of services to increase access to health care including educating of expectant mothers by visiting them at home and advising them to go to clinic every month or to participate in ANC sessions organized by clinic staff.

Malaria and other diseases - CHWs help combat malaria, via: home visits, environmental sanitation, health education and community development. The CHWs use rapid diagnostic tests (RDTs) for screening patients who present danger signs in the community. Apart from treating malaria cases, HIV/TB cases were also managed by the clinic staff, but clinic staff performed limited activities mainly focusing on sputum and blood testing.

Report writing - 9,350 people have been registered in MVG-Net, of which 4,217 are under 5 years old. There have been over 8,500 ChildCount+ encounters transferred to the OpenMRS medical record encompassing over 40,000 data points including demographics, health indicators and program management variables. Health workers surveyed acknowledged that mobile phones are an essential part of their activities, and that being able to consult
with colleagues or arranging for ambulance service for emergency cases made them more efficient. Among the staff, the evidence of electronic medical records impact was less visible, mostly because the staff did not have adequate time to be on the computers.

Discussion

Community health workers (CHEW) and health information systems can play an important role in meeting the health care needs of low resource environments. Using evidence from the baseline studies we observed that both CHWs and clinic staff performed a wide range of functions which according to the study included: home visits, environment sanitation, first aid and treatment of simple and common diseases, health education, nutrition, maternal and child health and family planning activities, referrals, record-keeping, and collection of data on vital events. A combined CHW and clinic-based health information system such as MVG-Net provides an important tool for both patient care and the monitoring and evaluation of the health delivery system in which it operates.

References


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Promoting an Enabling Environment for ICT in the Health Sector in Nigeria

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Abstract: Health care delivery in Nigeria has a lot of health problems such as maternal death, child mortality etc. The effort in deploying ICT in health has been slightly in effective. There are many challenges affecting the deployment of ICT in health in Nigeria such as absence of policy formulation; identification of private sector stakeholders to partner with capacity building of health workers in the use of ICT; lack of infrastructure in the sector. Finally, if the healthcare sector in Nigeria receives the boost and funding it deserves, or at least 15% of the GDP as recommended by WHO - our hospitals will become reputable and attract both local and foreign patients for treatment.

Introduction

Nigeria, a republic in western Africa, with a coast along the Atlantic Ocean on the Gulf of Guinea is the most populated of African’s country with more than one-seventh of the continent’s people. Some facts: population estimate - 155,215,573 (July 2011); population growth rate - 1.935 % (2011); birth rate -35.51 birth/1,000 populations (2011 estimate); death rate-16.06 deaths /1,000 populations (2011) and maternal mortality rate -840 death/100,000 live births (2008) [1].

Background Information

Health and ICT is considered to be an economic means of achieving National policy objectives with regards to the improvement and the extension of health care, especially for underserved and non- urban areas. It is also recognized that the rapidly declining cost of ICT equipment and telecommunication coupled with major breakthroughs in technological development have boosted the level of interest and corresponding activity in health and ICT development [2].

Information and Communication Technologies (ICT)

ICT is the delivery of voice/audio, data (high-speed and low-speed) video, fax and internet services from point A to point B (or possibly to multiple points B, C etc) using wired and wireless media and associated
equipment that are connected via internet protocol (IP) and non-IP network [3]. ICT in Nigeria has received a great boost due to the introduction of a broad band technology. This promises a lifeline for rural and semi urban communities, which do not have access to functional health care facilities. A developing nation like Nigeria that aspires to become the key player in the emerging information age needs to have in place; a highly efficient information technology system driven by a vibrant national IT policy is needed [4].

Enabling Environment-Policies and Strategies to Support the Information Society

Nigeria reports that the majorities of the listed actions to promote an enabling environment for Information and communication technology (ICT) in the health sector have been taken between 2000-2005 and is likely to continue. The implementation of procurement policies or strategies to guide software, hardware and content acquisition is planned to start by 2008. Nigeria highlights a psychiatric patient information system developed in some of the country’s tertiary health institutions as another important initiative in the introduction of electronic patient management systems.

Access to international electronic journals was introduced in 2001. This service has been moderately effective and may continue over the next two years. A policy for a digital national open archive for scientific research was implemented in 2002. It was reported to have been slightly effective. The most important projects to promote access to electronic health content are reported to be the establishment of an ICT committee for health and the development of an ICT work plan for the Federal Ministry of Health in Nigeria [5].

Improving Health Care Services with ICT

Information Communication Technology of Nigeria launched the National Health Strategic Development Plan (NSHDP) 2010-2015 on the 16th December, 2010 and signed the health compact with development partners including World Bank, African Development Bank, USAID and WHO. The goal of the NSHDP is to improve health status of Nigerians through the development of a strengthened and sustainable health care delivery system.

The National ICT infrastructure programs are on the heels of public-private partnership to build ICT centers in Nigeria universities, polytechnics, Hospitals etc.

On 27th of September 2003, Nigeria joined the League of Nations with satellite in space. Her desire to enter the space race was realized with the
launching of the 1st satellite - Nigeriasat-1 and this is subsequently followed by the deployment of a second satellite NIGCOMSAT-1. The National Space Research and Development Agency (NASRDA) began the NIGCOMSAT-1. The NIGCOMSAT-1 was replaced by NIGCOMSAT-1R on 30th December 2011. The satellite will commence full operation on 6th February 2012.

The Benefits of NIGCOMSAT-1R are as follows:
- Creation of micro ICT parks and hotspots in every local government in the country;
- Increase broadband penetration;
- Create jobs;
- Boost security;
- Provision of e-library and telemedicine etc.

Series of projects on the deployment of ICT in health sector using the Nigerian satellite have been put in place. One of such includes a pilot project on telemedicine which was introduced by Federal Ministry of Health in Nigeria in collaboration with National Space Research Development Agency (NASRDA). The pilot project on telemedicine did not last because the satellite was de-orbited due to the malfunction of the solar Array Deployment Assembly (SADA) [6].

Nigeria is pursuing an agenda of universal access to both telecommunication and Primary Health Care Services. The goal is that by 2015, every Nigerian no matter his or her social status will have access to any form of healthcare.

Challenges
- Absence of policy formulation;
- Identification of best practices that can be scaled up;
- Insufficient funding from public/government and private sector;
- Inadequate local and foreign technical support;
- Capacity building of health workers in the use of ICT;
- Scares infrastructural facilities and spaces.

Recommendations

Based on these efforts, Nigeria government is doing its best to put necessary facilities in place to provide an enabling environment for health sector with the use of ICT. There is need to improve the formulation and implementation policy strategies in the health sector. The government, academia should work together with professionals and ICT experts to educate health communities on the necessities of ICT in health.
Conclusion

Nigeria has the urge to develop/expand the knowledge of ICT in health sector. The sustainability of any innovation depends on collaboration from government, society groups etc. This is a new opportunity for quality health care for all Nigerians.

References


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Small Clinics CRM: A Key Factor in Promotion of Follow-Up Care (A Proposed Framework for Iranian Healthcare System)

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Abstract: Emphasizing the necessity of using CRM in healthcare systems, this paper proposes a proper primary framework for small clinics CRM or Patient Relationship Management (PRM) for both individual physicians as well as the circle of cooperating physicians in Iran. Based on an analysis of the societal atmosphere of Iran, such an approach would play a key role in improving the Follow-up care culture and changing doctor-patient relationship in order to empower patients.

Introduction

Necessity of Continuous Healthcare

Continuing Care for maintaining good health for the citizens is one of the major needs of modern societies so as to improve the quality of life, decrease healthcare costs, and increase life span among people. People seek health through pre-cautions and treatments. In other words, people of a society need their health to be continuously under control both before any diseases occur and also after they are treated; therefore, they are in need of proper services.

Customers & Service Providers in Health Related Businesses

All the members of a society and particularly patients are customers of healthcare services, and physicians, nurses, etc., are the service providers.

Competition in health care markets

The need of the providers of healthcare services is to have a job, maintain a good social reputation, and make revenue. This issue is being challenged in Iran due to the increase in the number of people graduating in medical fields. Young graduates of medicine, who are usually intelligent and are also familiar with ICT, can help change current traditional atmosphere to a
more customer-oriented one. Especially in societies like Iran, the increase in the number of such young physicians and nurses can lead to a competitive atmosphere and make practicing traditional medicine more difficult.

Customer Relationship Management (CRM)

CRM is a managerial philosophy that calls for the reconfiguration of the firm's activities around the Customer [1]. In the business world, CRM is used to retain customer loyalty in order to increase revenue [2]. CRM needs a customer-oriented culture which is based on simply the mutual relationship between the individual customers and the service providers. From this perspective, every individual customer is viewed as having different needs and expectations. CRM means different things to different people [3]. Healthcare organizations can build the same kind of relationship with patients and they can also offer more tangible benefits [2].

CRM in Healthcare (PRM)

CRM for healthcare providers is an approach to learn all they can about their customers and prospects, to communicate relevant, timely information to them, and to track results to make program adjustments necessary [4].

Because patients are the key customers of healthcare settings, the term patient relationship management (PRM) is used for those systems [5].

Role of Healthcare CRM

Stable relationships are formed when both parties in the relationship benefit from it, i.e. both sides fulfill one another’s needs. This principle is true for not only romantic and social relationships but also for business relationships. Therefore, a natural relationship should be created between different parties of the business so that the customers and service providers meet one another's needs and a businesslike relationship is at work. Implementation of health CRM is the key to make a logical relationship between healthcare business and the healthcare needs of the society.

Why Are Small Clinics Important?

In Iran, health business is still more doctor-oriented than service-oriented. Physicians tend to have private offices along with the other activities that they perform, and patients, also, if not in need of urgent assistance, prefer to see the doctor in his/her office before going to any other healthcare centers. In other words, physicians are in the center and patients reinforce this doctor-orientedness. This might have its root in history. It must be taken into account that hospital, considering its modern definition, is a rather new phenomenon in Iran thus, traditionally, Iranian patients tend to see a doctor in the office first, and then the doctor introduces them to one of the several
hospitals he/she works in, if needed. Hence, it is the doctor who has an independent "brand" and the hospital is a dependent entity. Moreover most of the hospitals are governmental and, therefore, are not motivated enough to compete over attracting patients. On the other hand, the majority of the researches carried out in the world in this regard focus on the hospital CRM. It is obvious that more research is needed regarding implication of CRM in non-hospital medical systems such as private offices and small clinics, which are still of great importance in countries like Iran.

The Proposed PRM Framework for Small Clinics

This study aims at designing and implementing health CRM for small clinics (small business) in Iran. It is applicable in two ways:

For Individual Physicians

In this plan, a network-based computerized system will be set up for the doctor, in which the information about a patient seeing him/her and the patient’s treatment schedule will be stored either automatically or manually based on the doctor’s opinion. This treatment schedule will be checked regularly by the system or secretary, and the patient will be reminded of the upcoming stages of the treatment. This will let the patient know that his/her treatment and health matter to the doctor and a sort of mutual trust will grow. Moreover, the physician can access the patient’s medical record more rapidly, which helps the doctor come up with a more accurate direction for the treatment and track any signs indicating that the patient’s health is not improving. This will also result in a better quality and more trusted relationship between the doctor and the patient. (Fig. 1)

For a Circle of Cooperating Physicians

In the circle of cooperating doctors, also, the patient’s file will be shared with the other doctors so that the other specialized doctors can access that and comment on his/her health condition if needed. In this case, it is supposed that the patient’s all medical needs can be met by only seeing one
of the doctors of this circle. Similar to the marketing methods like BOGOF (Buy One Get One Free), the patient will be examined inexpensively and, along with developing the patient’s confidence, it will promote continuing care. (Fig. I)

Conclusion

In conclusion, we believe that implementing small clinics CRM will lead to the following short-term and long-term results:

- Promoting continuing care and improving the health of the society;
- Reinforcing the role of the patient in the doctor-patient relationship and moving towards patient-orientedness;
- Developing the use of IT in health and hygiene issues;
- Promoting competition among physicians and the other health-related service providers;
- Improving the quality of healthcare services;
- Helping doctors to have a quick access to the patients’ records in order to have faster and more accurate diagnosis of the diseases;
- Having a positive impact on the governmental and non-governmental hospital systems in order to change their approach towards patients;
- Reducing dependency upon government with regard to health of the society and defining continuing care as a part of the natural patient-doctor relationship.

References

Solmaz Massah has received her B.S. in electronic engineering from Azad University of Lahijan and her M.S. in industrial engineering, system and productivity management, from Tarbiat Modares University of Tehran, Iran. She is interested in e-Health, Telecommunication, CRM and Business Models. She is now working as a GSM expert in telecommunication industry and also teaching Systems Analysis and Design in University College of Nabi Akram, Tabriz, Iran.

Behzad Karimzad Sharifi has done his B.S. in mechanical engineering at University of Tabriz, Iran. Currently, he is doing his Master's thesis in IT Management, advanced information systems, at Electronic Branch, Islamic Azad University, Tehran, Iran. His areas of interest include Developing Businesses using IT, e-Health, CRM, Decision Support Systems, Expert Systems and also Pump Industry. He is now working as head of sales engineering section in Pumpiran Company, Tabriz, Iran.
Use of eHealth for Health Systems Strengthening in Central Asia

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Abstract: Central Asian region or Central Asia for the purposes of Aga Khan Development Network consists of Northern Areas of Pakistan, Afghanistan, Tajikistan, and neighboring former Soviet republics. The communities residing in these areas are sometimes wholly or partially deprived of advanced health facilities due to difficult mountainous terrains. The Aga Khan Development Network (AKDN) eHealth resource centre (eHRC) uses eHealth to improve the health of communities overcoming the barriers of distance and time.

Both Bamyan and Gilgit Baltistan (GB), share a common limitation in terms of access to quality health care. Communities residing in rural areas of both the regions travel long distances to consult a physician. Also, health providers serving there get isolated due to limited capacity building opportunities. The AKDN eHRC helps address these constraints using eHealth.

In Afghanistan, provincial hospital in Bamyan is connected with French Medical Institute for Children (FMIC), Kabul. Live consultations are provided via video conferencing from FMIC to Bamyan. Store-and-forward consultations are carried out for pathology (via iPath software) and radiology (shared folder). In Gilgit-Baltistan, iPath is used for case consultation, while secondary and tertiary centers use live consultation through desktop based video-conferencing.

The AKDN eHRC eHealth initiatives provide cost effective and time efficient health solution. The success has led eHRC to further strengthen health systems in Central Asia. The eHealth activities in Afghanistan are now extended to Faizabad provincial hospital. Moreover, eHRC is assisting cross-border Health program by linking Gorno-Badakhshan Autonomous Oblast (GBAO) in Tajikistan and Badakhshan province of Afghanistan using eHealth.

Purpose / Objective

Central Asia is the core region of the Asian continent with a large population residing in rural areas. The Central Asian regions of Afghanistan and Northern part of Gilgit Baltistan, share a common limitation in terms of accessibility to quality health care. Afghanistan presents a society that is
struggling post war development, while Gilgit Baltistan region confronts the health inequity due to harsh climate and uneven roads. Communities residing in rural areas of both the regions have basic health facilities but require traveling long distances to consult a physician. Moreover, health care providers serving in remote areas feel isolated from other areas. The Aga Khan Development Network (AKDN) eHealth Resource Centre (eHRC) tackled these constraints by initiating eHealth in both the areas. [1, 2].

Methodology

The AKDN eHRC strives to address health inequity by establishing Telehealth link between different levels of health care facilities for improved patient management, avoiding unnecessary referrals, that ultimately saves patients’ time and cost incurred in going to next level facility [3]. The eHealth initiative also aimed to work towards the capacity building of health care providers serving at different levels for their continuous professional development (CPD).

Both synchronous (live) and asynchronous (store-and-forward) modes of Telehealth are being used. Synchronous Telehealth involved the utilization of video conferencing equipment and software (‘ooVoo’ and ‘Elluminate’) in high bandwidth situation whereas for store-and-forward consultation, a free and open source software ‘iPath” was used in case of low bandwidth.

In Afghanistan, Bamyan provincial hospital (BPH) was connected with French Medical Institute for Children (FMIC), Kabul which is a tertiary health care facility. Live consultations were provided through video conferencing from FMIC to Bamyan in the required specialties mutually identified. Store-and-forward consultations were carried out using iPath for pathology and shared folder for radiology cases. In GB, iPath was used for case consultation for most peripheral health facilities, while with higher bandwidth between secondary and tertiary centers, live consultations were conducted via ooVoo software.

Results

In Afghanistan, from September 2010 to mid of January 2012, there is 1142 live and 1031 store-and-forward consultations conducted. Live consultations have been requested in seven specialties. Each teleconsultation saved over USD225 for the patients and the current cost for health system is USD14 per consultation. The average time saved was 5 days or even more.

In GB, during eighteen month duration 462 cases were reported on iPath on 45 different types of ailments and 25 live consultations conducted
between secondary care centres. The cost saving of per patient was approximately USD 12 - 55 and average teleconsultation cost saved was USD 1.15. The average time saved by patient was 4 days.

A total of 20 eLearning sessions were delivered from FMIC to Bamyan and 15 were conducted in GB.

Conclusion

The eHealth initiatives in Afghanistan and GB not only provided cost effective and time efficient health solution but also have built the capacity of healthcare providers at the remote sites. The initiative has shown great success with high rates of satisfaction among healthcare providers and patients.

Future Direction

The success of eHealth initiatives in Afghanistan and GB has led AKDN eHRC to expand its services. The eHealth activities in Afghanistan are now extended to Faizabad provincial hospital. Currently work has been started to leverage health services in cross border regions of Gorno-Badakhshan Autonomous Oblast (GBAO) in Tajikistan and Badakhshan province of Afghanistan sharing similar natural resources, economic potentials and common ethnic and cultural roots. To evaluate eHealth potential, eHRC team conducted an eHealth feasibility assessment there. A proposal has been designed to improve access and quality of health services in the cross-border region using eHealth solutions with the aim to strengthen health systems and address inequities in health.

References


Shariq Khoja is a physician, with PhD in eHealth from Global eHealth Research and Training Program, University of Calgary. Dr. Khoja has extensive background and interest in using eHealth technologies to facilitate healthcare services and education. His research interests focus on creating evidence and policies to guide the implementation of eHealth in developing countries. Dr. Khoja is leading the ‘PAN Asian Collaboration for evidence-based e-Health Adoption and
Application (PANACeA’), which supports researchers in 17 Asian countries to create evidence for e-health implementation. Dr. Khoja has contributed extensively to literature, especially through the development and validation of eHealth Readiness assessment tools for healthcare institutions. Dr. Khoja holds Adjunct faculty position at the University of Calgary.

Being a strong advocate of integrating eHealth with routine health care, Dr. Hammad Durrani is working as a Manager Research in the Department of Community Health Sciences at the Aga Khan University Karachi Pakistan and 1French Medical Institute for Children (FMIC), Kabul, Afghanistan. He is mentoring two eHealth Projects, being carried out in Philippines, Indonesia, Bangladesh, India and Pakistan which are part of PANACeA project (PAN Asian Collaboration for Evidence-based eHealth Adoption and Application). He is also involved in eHealth Research, conducting systematic reviews on different eHealth modalities (Telehealth and Health Informatics) and is a member of the eHealth Team for the Aga Khan Development Network (AKDN), with responsibilities of planning and strategizing eHealth applications and its concepts in different countries of Asia and Africa where the Network holds its presence.
eHealth in Support of Routine Medical Practice
A Framework for Intensive Patient-oriented Health Wiki: A Responsible Web-based Reference for Looking up Health Problems

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Abstract: Iranian Internet users who look up their health-related questions on search engines need to have access to up-to-date, useful, effective, and concise information concerning their health. This study aims at designing a concentrated cooperative web-based system to answer these questions. This system will be established under the Medical Council of Iran and all the certified experts in the field will be called for cooperation. In addition, this system will be patient-oriented and will only try to answer the users' health-related questions.

Introduction

Technology alters habits and thus leads to a change in lifestyle. Today, Information and Communication Technologies (ICT) and, subsequently, Internet play a crucial role in this regard. Now, for instance, many people seek the answers for their questions through search engines and websites, and one of the most important types of questions they may have is those concerning their diseases and health conditions.

Looking Up Health-Related Questions on the Web

When one has a bad headache, for example, he/she or the people around him/her immediately resort to search engines to look for explanation of this condition, its causes and types, and even ways to get over it. However, the problem is that the Internet is filled with a lot of information which are relevant or irrelevant, correct or incorrect, and reliable or unreliable. The question of reliability and validity can be the most important issue in this regard. Also, the availability of useful information regarding health differs from one language and culture to another. Hence, particularly in the issues concerning health, there is a demand for accurate and high quality information, in terms of both framework and content, in different languages.
**Search for Cancer in Persian language (سرطان)**

For instance, in order to better understand the issue, we have studied the search for the Persian word (سرطان), meaning cancer, through Google Insights for Search. This study only concerns the search for the Persian word and only with Persian alphabet. The specific time range for this study was from 2004 to 2012. The results of this study yield that the search for this word by the Internet users in this time range has had a rather fixed relative frequency. Yet, the more important issues regarding this study are the following two tables. Table I illustrates the issues which are looked up along with the word (سرطان).

<table>
<thead>
<tr>
<th>No.</th>
<th>Term</th>
<th>Exact Phrase in Persian</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Breast Cancer</td>
<td>سرطان سینه</td>
</tr>
<tr>
<td>2</td>
<td>Cancer Symptoms</td>
<td>علائم سرطان</td>
</tr>
<tr>
<td>3</td>
<td>Leukemia</td>
<td>سرطان خون</td>
</tr>
<tr>
<td>4</td>
<td>Cancer Treatment</td>
<td>درمان سرطان</td>
</tr>
<tr>
<td>5</td>
<td>Bowel Cancer</td>
<td>سرطان روده</td>
</tr>
<tr>
<td>6</td>
<td>Stomach Cancer</td>
<td>سرطان معد</td>
</tr>
<tr>
<td>7</td>
<td>Uterine Cancer</td>
<td>سرطان رحم</td>
</tr>
<tr>
<td>8</td>
<td>Cancer Disease</td>
<td>بیماری سرطان</td>
</tr>
</tbody>
</table>

Table II, on the other hand, demonstrates the search for which words along with (سرطان) is increasing. The results of this investigation are important since they reveal that the need for having information about cancer, its signs and symptoms, and its treatment is rising.

<table>
<thead>
<tr>
<th>No.</th>
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<th>Exact Phrase in Persian</th>
</tr>
</thead>
<tbody>
<tr>
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<td>علائم سرطان</td>
</tr>
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<td>2</td>
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<td>Cancer Treatment</td>
<td>درمان سرطان</td>
</tr>
<tr>
<td>4</td>
<td>Bowel Cancer</td>
<td>سرطان روده</td>
</tr>
<tr>
<td>5</td>
<td>Stomach Cancer</td>
<td>سرطان معد</td>
</tr>
<tr>
<td>6</td>
<td>Prostate Cancer</td>
<td>سرطان بروستات</td>
</tr>
<tr>
<td>7</td>
<td>Breast Cancer</td>
<td>سرطان سینه</td>
</tr>
<tr>
<td>8</td>
<td>Skin Cancer</td>
<td>سرطان پوست</td>
</tr>
</tbody>
</table>

**Quality and Validity of Data & Information on the Web**

High volumes of data available on the Web, on one hand, and the fact that anyone having access to the internet can increase these data, on the other hand, have led to a rather chaotic cyber atmosphere. Not only do these facts question the reliability and validity of these data, but they also call for the need to manage such vital information more properly [1]. For instance, when the search for the information about cancer on Google was probed,
only one of the ten results on the first page was from a reliable source in this regard, i.e. The Cancer Research Center of Medical University of Mashhad, and the rest were of less quality and reliability.

Web 2.0 and Wikis

Web 2.0 is a set of economic, social, and technology trends that collectively form the basis for the next generation of the Internet—a more mature, distinctive medium characterized by user participation, openness, and network effects [2].

The emergence of Web 2.0 and development of the cooperative culture in constructing the information on the Web have provided Internet users with many potential facilities which lead to democratization, on one hand, and increase of availability and quality of knowledge, on the other hand. Development of Wikis, particularly its unique instance ‘Wikipedia’, is a clear evidence of this fact. Following Web 2.0, concepts like Health 2.0 and Medicine 2.0 are being designed and developed today.

A wiki is a Web application the content of which is collaboratively added, updated, and organized by its users. A wiki’s content is editable through a Web page interface. The site's users create the content, define the relationships, and establish the links between the site's Web pages [3].

Framework of Health Wiki for Farsi language Web

*Intensiveness and Patient-orientedness*

Investigating the Farsi-speaking community’s tendency to look up their health-related questions on the Web and also the responses they receive, this project seeks to propose a framework for setting up a concentrated health wiki for patients. In other words, the purpose of this study is to design a Web-based responsible source only for the people tending to search for information on the Web and not for medical students and doctors seeking educational information.

Considering the importance of validity and reliability of the health-related information, the primary purpose of this study is not to create a complete wiki but to set up its structure under the country’s Medical Council. In this project, all the doctors who are done with their general practice will be defined as the people who can enter the system and add or edit information on it. However, once the structure and primary information are shaped and created, the system will be gradually changed to a complete wiki, in which all visitors, i.e. non-specialists and patients, can have the opportunity to edit the information and add their experiences about a particular disease to the pages, provided that they are approved by the system administrators.
Advantages of such a system:

- The opinions of all the specialists in the field can be enjoyed, which is the main characteristic of a Wiki;
- Since it is concentrated, it avoids scattered data and information;
- It helps develop a better relationship between physicians who are familiar with IT and patients;
- It is a reliable source for looking up health-related questions;
- By focusing on the information that patients require, it promotes patient-oriented medicine;
- By getting feedback from the users who have had a kind of experience about a particular disease, it can enrich the information.

Conclusion

Based on the primary investigations, there is a need for a reliable and responsible source of information on the Web which can answer the health-related questions of Iranians in Persian language. Due to the lack of such a reliable source, it can be estimated that the inception of such a project will soon be welcomed.

This project, regardless of borderlines, can be implemented in different geographical regions where people speak the same language and helps enrich the reliability of the information on the Web.

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References


Solmaz Massah has received her B.S. in electronic engineering from Azad University of Lahijan and her M.S. in industrial engineering, system and productivity management, from Tarbiat Modares University of Tehran, Iran. She is interested in e-Health, Telecommunication, CRM and Business Models. She is
now working as a GSM expert in telecommunication industry and also teaching Systems Analysis and Design in University College of Nabi Akram, Tabriz, Iran.

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A Systematic Review of IT-based Health Interventions

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Background

The intensification and motivation of participants in health promotion programs is important to counteract most common health risk factors, such as obesity, smoking, low physical activity, excessive alcohol consumption and stress. As they lead to serious chronic diseases, the risk factors are responsible for most healthcare costs. A literature review on a related topic suggests that only 34% of employees on average participate in worksite health promotion programs. Although the use of health promotion programs is recognized, many fail in the successful implementation. Hence, the aim of this systematic review was to analyze the incentive and motivation mechanisms in health promotion programs.

Methods

Studies were identified by a structured search between May and June 2011 using the online bibliographic databases PubMed, JSTOR, WorldCat, and Web of Science. Studies from 1995 to 2011 were included to reflect the state of the art. Different MeSH-terms or keywords were used during the search which was conducted by topics. Therefore, the following terms were used: Health, incentive, motivation, promotion, electronic, IT, computer, online, intervention, and action. To achieve the best results, three keywords were used in combination. This method created a good selection of articles. The restrictions were strong enough to exclude a large number of database articles and to include many important studies for the topic. In order to be included, an article had to: a) deal with a health promotion study, b) contain quantitative information about the participation of an intervention, c) give information on the combination or the study focus of incentives and motivation mechanisms of health promotion programs, d) contain information about the study design, e) be published and peer reviewed and f) be published in English.

Selection Process: The search requests returned 16,845 results for the diverse combinations of the keywords and 194 articles were retained after reviewing the titles. In the next step, abstract and/or full-text reviews helped
to reduce the number to 42 articles. Subsequently, these were reviewed with upgraded criteria concerning the incentive focus in health promotion programs. In this part, double search results and most of the qualitative articles were excluded.

**Data collection:** Next, data was mined from the included articles and a data form was used with numerous determinants reflecting critical facts referencing health promotion program and offered incentives. This involved information such as year of publication, demographics and number of participants, type of intervention, study design, and most important the type of incentive used in the study. If certain information in the nominated articles were not conclusive, the authors debated the available information and, in case of doubt, excluded unclear data from the final analysis. After the conclusion of the data set, the studies were separated into clusters for further comparison. Separate clustering was conducted for the group of “Influence of social support/pressure”, “Difference between public vs. private locations” and “Adoption of appropriate incentive mechanisms”

**Results**

The overall analysis of the 42 reviewed articles showed that the topic of health intervention programs had an increasing number of publications within the last four years. Based on the exclusion criteria, the majority of publications centered on the year 2007, with a slight decrease afterwards. This distribution indicated that the topic of health intervention becomes more and more popular. The underlying trend is based on the necessity to increase productivity and the arising from IT systems. The in-depth review of the paper showed a heterogeneous structure with regard to the chosen research types. Therefore, the articles were clustered into four groups: Literature review, (meta-) comment, experiment and survey. The underlying research types showed a tendency towards experimental designs. This practical focus with controlled environments underlines the necessity for reliable data and the search for efficient mechanisms to increase the current health intervention programs.

By comparing the research approaches in terms of the reviewed paper with an experimental/survey approach, the majority of 74% could be categorized as quantitative research approaches. This leads to the observation of the target sample size for the different papers. Although most of these articles were based on complex experimental setups, the median of the participants was 375. With an $n_{0.25}$ quartile of 181 and an $n_{0.75}$ quartile of 1047, most of these papers contained a large number of participants. Only a few outliers contained more than 5,000 participants. Furthermore, the reviewed paper featured different qualitative results. In order to harmonize their find-
ings, the major findings were clustered to highlight similar implications. Three major trends could be derived: Influence of social support/pressure, difference between public and private locations and the adoption of appropriate incentive mechanisms: Several papers used social support/pressure from the peer group of the subjects in order to increase health awareness. Most of these studies identified social pressure as a motivational factor to increase health behavior. With regard to long-term effects, no further measurements could be observed in the studies. Most of the experimental designs featured a before/after treatment, therefore leaving only short-term implications for behavioral changes. By comparing the overall distribution of treatments, the most common setup for the experiments was either a before/after treatment or a randomized controlled trial (RCT). Before/after in this context describes an observation of a target group with a single treatment. Another important finding in various papers was the behavioral gap between public and private environments. Subjects in the experiments were more likely to participate in a public environment (such as a hospital) compared to private environments, where the topic loses its priority. Interestingly, this was also valid for serious diseases and not only for prevention mechanisms. For example, an IT supported cancer program reports a high usage within the hospital time. However, during the private time at home, subjects were significantly less active. This leads to the conclusion of a necessity for incentives in home/private environments. Lastly, several studies addressed the adoption of appropriate incentive mechanisms. The findings underlined that participants often face lock-in effects and behavioral changes which require appropriate incentives. Small ones are often considered not to be sufficient to break the initial lock-in effect, resulting in a low participation rate or missing motivation. Once this initial motivation was provided, the behavioral change was considered helpful and subjects provide positive feedback. This leads to the conclusion of providing sufficient up-front incentives and the necessity of analyzing the factors determining the subjective “value” perception of these incentives.

Discussion

Current research focused on motivation techniques for patients to participate in health programs. These programs mostly consisted of monitoring tools, data sharing, and feedback mechanisms. Data transparency is especially important since the role of the peer group appeared to be one of the key drivers. Both peer pressure and peer support offered opportunities for improved health behavior. In addition, there is the necessity of health related programs in public environments or at least a form of external support.
Since patients’ free times provide a strong motivation to focus on non-health related topics, patients have to be bound to the programs to ensure frequent participation. Referencing features, several programs offered access from home PCs or even shared the data with trusted relatives. This level of transparency leveraged the positive peer effects and provided a motivation for the adjustment of behaviors. However, many of these programs targeted patients with either a high likelihood for certain diseases or already existing infections. With regard to the health prevention potential, long-term measurements were not provided by this review. Thus, adjustments for long-term motivation need to be evaluated likewise. With regard to the features, incentives are already being used. Their success varied based on the initial lock-in effects of the test-subjects. A positive finding of the papers was the feedback from the patients of certain health intervention programs. Many of the subjects acted as strong promoters and underlined the positive help they received. This feedback could be used as positive word-of-mouth or alumni networking potential in order to provide insights and reduce the initial lock-in effects for new patients.

Conclusion

The literature review showed a dissemination of methods which improved programs over the past five years. Current health prevention programs offer a strong mechanism to motivate patients to adjust their behaviors. Many of the reviewed articles showed a shift towards IT-supported programs. Several indications (such as initial motivation barriers, long-term motivation, home vs. public environment, etc.) about the central role of incentives existed. As part of an efficient IT support, a specification of IT supported incentives (such as virtual status, special rights within a platform, etc.) needs to be analyzed. Future experiments should focus on necessary combinations of incentives to achieve a wide participation rate in health promotion programs and try to include estimation about the utility of IT solutions in these programs.

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Antimicrobial Stewardship through Telemedicine in a Community Hospital in Remote Brazil

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Abstract: Lack of funding and personal are some of the barriers for implementing antimicrobial stewardship programs (ASPs). We describe the implementation of an effective ASP in a community hospital through telemedicine in Brazil. Telemedicine tools have the potential role in ASP implementation on broad scale.

Introduction

Antimicrobial stewardship programs (ASPs) have been implemented to promote the rational use of antimicrobial drugs. The Infectious Disease Society of America has published the recommendations for the institution of ASP [1]. In a survey conducted in 552 American hospitals, 61% reported the presence of an ASP. Community hospitals with fewer than 200 beds were more likely to have no ASP. The main barriers to an effective ASP were lack of funding or personnel to lead the program [2].

Telemedicine has provided access to health care resources, for underserved populations, in isolated or distant areas of the world. Teleconsultation fits well into the prospective audit and feedback to physicians in ASPs. We describe a post prescription review ASP, implemented through telemedicine, in a remote community hospital.

Methods

A descriptive trial was conducted to assess the feasibility of an ASP implemented through telemedicine in the south of Brazil. Hospital São José is, a 50-bed, community hospital for clinical patients in Porto Lucena, a 5,600 inhabitant town, located in the northwestern region of Rio Grande do Sul, the southernmost Brazilian state. At the community hospital there are two physicians attending; a pharmacist provides clinical pharmacy service,
but not ASP activities; and there is no infectious disease specialist on staff.
The Instituto de Cardiologia de Porto Alegre (ICFUC-RS), is a 250-bed, academic, tertiary-care, public hospital, for clinical and surgical cardiology patients, located in Porto Alegre, capital city of Rio Grande do Sul. The teleinfectology project connects Hospital São José, to the 575-kilometer away department of infectious diseases of the ICFUC-RS.

A web-based platform was created to enable the ASP to be implemented in health care institutions of remote towns. Web-based platform functionalities include: on-line chat with the ID physician, point-to-point web-conferencing facilities, and antimicrobial prescription digital order. An ID specialist assesses patient’s clinical information, and a written reply is sent back to the prescriber’s cell-phone via text messages (SMS).

The SSL (Secure Sockets Layer) cryptographic system, guarantees the confidentiality of the project’s data at 256-bit encryption.

Patient’s characteristics were reported as percentages for categorical variables and median and interquartile range for continuous variables. Student $t$-test was used for comparing continuous variables. Two-sided P-values less than 0.05 defined statistical significance. Data was analyzed using SPSS 18.0 version.

On-site qualifying activities, carried out in May 2011 enabled the remote Hospital staff to operate the web platform.

Results

From May 16\textsuperscript{th} to December 15\textsuperscript{th}, 100 prescriptions from 93 patients were included. Most patients were men (54.6%; N=53); median age was 64.0 years (25th–75th percentiles; 50.2–75.7 years).

Sixty-six prescriptions were for community-acquired infections (66.6%). Most antimicrobial prescriptions were for respiratory infections (61%; N=61), bacteremia (10.0%; N=10), and soft tissue infections (6.0%; N=6). For patients with pneumonia, 12.0% (N=7) were classified as Pneumonia Severity Index (PSI) class I, 51.7% (N=30) as class II, 27.6% (N=16) as class III, and 8.6% (N=5) as class IV.

The most prescribed antimicrobial drug was ampicillin (64.0%; N=64), followed by gentamicin (27.0%; N=27), azithromycin (23.0%; N=23), first-generation cephalosporin (8.0%; N=8), ciprofloxacin (7.0%; N=7), and ceftazidime (5.0%; N=5).

All the prescriptions were based on empiric coverage. Forty-nine out of 85 prescriptions (57.6%) were considered inappropriate. Most recommendations were related to: broaden empiric coverage (43.9%; N=40); change administration route (25.3%; N=23); adequate (13.2%; N=12).
The number of macrolides prescriptions, all for respiratory infections, increased in the third, fourth and fifth months and decreased thereafter. Prescriptions considered adequate were 35.7% (N=5) in the first month, 44.4% (N=8) in the second, 29.4% (N=5) in the third, 59.1% (N=13) in the fourth, 60.0% (N=3) in the fifth, 40.0% (N=2) in the sixth, and 0.0% in the seventh month.

Rate of adequacy for doctor A was 63.9% (N=23) and 36.1% (N=13) for doctor B (P<0.001). Overall compliance to ASP recommendation was 100% (100 out of 100 requests).

The median time for a second opinion teleinfectology consultation reply took 26 minutes (25th–75th percentiles; 14–60 minutes).

Discussion

A non-confrontational, postprescription audit, giving a rapid feedback to the prescriber, using the teleinfectology web platform, was successfully implemented at the remote hospital. During the first meetings and on-site training process, the hospital staff, felt comfortable using the platform, and there was a willingness to implement telemedicine as a tool for antimicrobial stewardship. Besides infectious diseases specialist recommendations were fully accepted.

The rate of prescription inadequacy was high, although similar to other studies [3]. Most prescriptions considered inappropriate, were related to a narrow antimicrobial spectrum to cover most common pathogens for community-acquired pneumonia, based on current guidelines [4]. In our evaluation, the lack of macrolides in prescriptions for moderate to severe CAP, was the most common inadequacy. Most patients were categorized as PSI class 2 to 3 (in-patients with non-severe pneumonia), which for, guidelines recommend a beta-lactam and macrolide or a quinolone for therapy.

The development of tools to help decision making, which is sustainable, fully available to physicians, user friendly, which can be used by anyone with an internet connection, at low cost, can overcome barriers related to antimicrobial stewardship implementation [2].

Other studies in the field of telemedicine have shown the benefits of the inexorable inclusion of these tools in the healthcare system. Telediagnosis, teleconsultation and advanced medical intervention techniques, are examples of implemented programs, in the most diverse specialties [6].

Infectious disease specialists’ consultations are common. Informal telephone or sidewalk consultations have shown to occur in a significant number of times [7]. They are especially important in rural areas with limited resources and specialists.
Both formal and informal (telephone calls to a hotline) infectious diseases consultation acceptance have been studied. Hotline consultation had comparable levels of acceptance to formal consultation [8]. Most important, patients’ outcomes, including mortality, were similar when the two consultation standards were compared [9].

This is a descriptive study that aimed to prove the feasibility of an antimicrobial stewardship through a telemedicine tool. Telemedicine has the potential to alleviate the burden on healthcare, related to the lack of programs on antimicrobial stewardship, and can help to spread ASPs on a broad scale.

References:

Applicability of a Formative Second Opinion in the Resolutiveness of the Primary Attention in Healthcare

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Abstract: Telehealth is considered to be a potent tool to enlarge the resolutiveness of locality, providing the integration and discussion of cases as well as the formative second opinion (FSO) among staffs and university centers. This study aims to make known the opinion of the surgeon-dentists registered at Telehealth UERJ/RJ about FSO. Questionnaires semi structured, with open and closed questions, have been applied in 2008 and 2009. Data concerning frequency, percentage and the test $x^2$ have been analyzed with SPSS® 17.0.1 software. 66 professionals answered the questionnaire. The average was 31.43 years old (D.P.±6.347) and 66.7% of the participants were women. 42.4% were specialized in Public Health, Collective Health or Family Care (PH, C, and FC). Concerning the changes in clinical procedure related to FSO, 83.3% reported a positive answer and 72% pointed out that the referral of patients could be avoided whether their doubts were discussed with specialists; 68.2% felt the need to ask for advice with a pal over 4 times per month to ratify their procedure. The diagnoses for buccal lesions (37.8%) and also for periodontal procedures (29.7%) were quoted as the areas of most doubts. The specialization in PH, C, and FC of the professionals showed no expressive statistical difference the need of frequency and accompaniment or changing of the clinical procedure. FSO is an alternative to reduce the referral as well as a possibility for permanent education without shifting the professional. The professionals registered in Telehealth UERJ-RJ have got frequent doubts when making a clinical decision and consider FSO an important alternative for permanent education.

Introduction

Telehealth Brazil Nets in Basic Attention aim at developing action that support attention to health and that permanently educate professionals, viewing education to work, under the perspective of improving the quality of the attendance, of the amplification of the scope of actions offered by these groups, of the changing of practices of the attention and of the
organization of the work process, by means of offering Teleconsulting, Formative Second Opinion (FSO) and Telediagnosis (Edict number 2.554).

According to Campos et al. (2006), the goal of the Brazil Telehealth Program is to improve the quality of the attendance of basic attention, in the Unique Health System (SUS), through the extension of the qualification of the groups of family health, by using technology capable of promoting teleeducation/telehealth with positive impact in the resoluteness of the system and in the attention to health.

To Wen (2003), the FSO is a far way process that has the function of contributing to the continuous and permanent education of professionals, rather than presenting only the solution to doubts, with benefits like the contextualization of knowledge under the focus of a practical application; a read equation of educational frames, according to the needs of the clinical practice; the multi professional feature that surpasses the teleservice area (e.g.s: management in health, communication in health, technology); the possibility to identify the regional problems of infrastructure in health; even as an strategy to establish an epidemiologic vigilance.

Methodology

Retrospective study of analysis of the applied questionnaires to surgeon-dentists who worked in the Advanced Locals of Telehealth during the phase of implementation of the project in RJ, between 2008 and 2009 was performed. Setting up professional profile and opinion about FSO: its importance in the reduction of guide to specialists and reduction of clinical doubts; association of frequency of guides with academic education; and observation of the most doubtful odontology areas. The data were analyzed in terms of frequency, percentage, and by the qui-square test, applying the SPSS program (17.0.1)

Results

A total of 66 professionals answered the forms. The average age was 31, 43 (+6,347) years old, being 44 (66,7%) female and 66 (44,3%) male. Evaluating how long ago they were graduated, it was observed that 60% of them concluded their graduation more than 10 years before, whereas 12% graduated until 5 years before. In relation to their academic education, 68% finished post-graduation courses, being 42,4% specialized in Public/Collective Health/Family Health (SP, C, SF) and 57,6% specialized in other areas.

When asked about the importance of FSO to the solution of cases and the taking of clinical decision, 72,7% pointed out that the guides in attention could be avoided if discussion on doubts occurred with specialists; 83,3%
informed positively their ability to change their clinical conducts based on FSO; and 68.2% affirmed they felt they needed to consult a colleague more than 4 times in a month to confirm and take clinical decisions. Results of the analyses are presented at Table 1 and Figures 1 and 2.

Table 1. Professionals’ opinion about Formative Second Opinion

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing in conduct</td>
<td>n</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>%</td>
<td>55</td>
<td>11</td>
<td>100</td>
</tr>
<tr>
<td>Reduction in guide</td>
<td>n</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>%</td>
<td>48</td>
<td>18</td>
<td>100</td>
</tr>
<tr>
<td>Need to consult colleague</td>
<td>n</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>%</td>
<td>45</td>
<td>21</td>
<td>100</td>
</tr>
</tbody>
</table>

Fig. 1

Percentage of more doubtful areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Diagnostic of buccal lesions</th>
<th>Periodontal procedures</th>
<th>Endodontic procedures</th>
<th>Exodontic procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>37.8</td>
<td>29.7</td>
<td>24.3</td>
<td>21.6</td>
</tr>
</tbody>
</table>

Fig. 2

Relation between having or not specialization in Public / Collective / Family Health and Changing in Conduct or in Guide

<table>
<thead>
<tr>
<th>Changing in conduct</th>
<th>Guide</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialization in other area</td>
<td>30</td>
<td>25</td>
<td>8</td>
<td>3</td>
<td>11</td>
</tr>
</tbody>
</table>
Conclusion

The found data suggest that Telehealth may be a potential tool to enlarge the resoluteness of the local level, since the professionals demonstrated they believed in FSO as a possibility of interaction, discussion of cases, and reduction in guides to specialists.

References


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Application of E-Base of Medical Data of the Institute for Oncology Aad Radiology of Serbia - IORS Hospital Cancer Registry

D. Jovicevic, B. Brankovic, A. Jovicevic

Abstract: Application for medical and non-medical purposes, of the medical data base of the Hospital Cancer Registry which exists in the E-form since 1990

Introduction

Institute for Oncology and Radiology of Serbia (IORS) is a reference institution of a tertial type where cancer patients are treated for malignant diseases and where a highly specialised, specialist-consultative and patient health activities are carried out. A large increase in the number of cancer patients and continuous improvement of therapeutic protocols, necessitate quite a number of medical information, easily accessible and reliable [1]. Medical data are subjected to analysis thanks to data bases. They are underlying all of information health systems and represent the basis of E-cards [2]. These data bases provide numerous possibilities both to every patient and to the health institution itself in terms of planning and defining the strategy on the basis of obtained statistical data on the health situation of the nation, demographic trends, data on available resources, accessability of health care.

Material and Method

The data have been taken over from the Hospital cancer registry that has been kept in IORS since 1980 in a paper form as an e-base exists since 1990. The Hospital cancer registry is important because for every patient that begins treatment in IORS, a defined set of data is entered: identification data, the diagnosis data, data on the therapy applied and risk factors. By the improvement of the basis, the number of variables (data) reached the figure of 140. The e-base of data has 109,000 entries and every year data for about 6,000 newly registered patients are being entered.

Results

Analysis of data is carried out on an annual basis and they are presented in the form of tables. Very important conclusions can be drawn from these tabular reports serving as a basis for guidelines that could help in planning, rationalization and organization of the work process [3]. These reports
provide a detailed account of diseases in newly registered patients. Data obtained in the last year are compared with data from the previous years making it possible to spot deviations quite easily and apply, if necessary, certain measures.

Table 1. Sequence and number of newly registered most frequent localizations of malignant diseases

<table>
<thead>
<tr>
<th>ICD-10</th>
<th>Localization</th>
<th>Newly registered</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>C50</td>
<td>Breast</td>
<td>1213</td>
<td>26.76</td>
</tr>
<tr>
<td>C53</td>
<td>Cervical</td>
<td>451</td>
<td>9.95</td>
</tr>
<tr>
<td>C18,C19,C20</td>
<td>Colon, rectum, rectosigmoid juncture</td>
<td>428</td>
<td>9.44</td>
</tr>
<tr>
<td>C34</td>
<td>Lung</td>
<td>373</td>
<td>8.23</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>2067</td>
<td>45.61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>4532</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

Source of data: IORS Hospital cancer registry, 2009.

On the basis of these data, oscillations in the number of newly registered patients can be established observing thereby increase or decrease in the number of the patients with certain types of cancer. In such a case, preventive measures and education of the population can be undertaken and influence the increase in the number of patients. The diagnosis data indicate at what stage of the diseases patients report, what diagnostic method has been used for establishing a disease and to what extent clinical and pathological diagnoses are congruous - TNM classification. These data are important for medical evaluation and might contribute in evaluation of protocols of treatment and their possible change and addition.

Data on applied therapy can be analysed from the medical aspect. In that way one can keep track of individual types of oncological therapy used, depending on the type of tumor and the health status of the patient at the time when the disease has been diagnosed (Table 2.).

Table 2. Type of the initial oncological therapy

<table>
<thead>
<tr>
<th>Initial therapy</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical therapy</td>
<td>1057</td>
<td>156</td>
<td>1213</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>760</td>
<td>453</td>
<td>1213</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>732</td>
<td>481</td>
<td>1213</td>
</tr>
</tbody>
</table>

Source of data: IORS Hospital cancer registry, 2009.
One can see what type of surgical intervention is mostly present (Table 3.) which is significant in patients diagnosed with breast cancer because this diagnosis accounts for 25-30% of the total number of newly registered at the annual level. For instance, a view taken by WHO which is in favour of using breast conserving surgeries is used in evaluating effects of the introduction of a new approach to surgical treatment of breast cancers.

Table 3. Types of surgical treatment carried out within the initial therapy in patients with breast cancer

<table>
<thead>
<tr>
<th>Type of surgical intervention</th>
<th>ST in IORS</th>
<th>ST in another center</th>
<th>ST total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mast. rad. sec. Patey</td>
<td>0</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Mast. rad. sec. Madden</td>
<td>345</td>
<td>116</td>
<td>461</td>
</tr>
<tr>
<td>Mastectomy subcutanea cum reconstr.</td>
<td>99</td>
<td>2</td>
<td>101</td>
</tr>
<tr>
<td>Mastectomia radicalis e compohore</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Quadrantectomia cum diss.lgl.axillae</td>
<td>302</td>
<td>33</td>
<td>335</td>
</tr>
<tr>
<td>Resectio partialis cum diss.lgl.axillae</td>
<td>32</td>
<td>12</td>
<td>44</td>
</tr>
<tr>
<td>Tumorectomia</td>
<td>59</td>
<td>16</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>393</td>
<td>61</td>
<td>454</td>
</tr>
<tr>
<td><strong>Total number of surgical intervention</strong></td>
<td><strong>842</strong></td>
<td><strong>215</strong></td>
<td><strong>1057</strong></td>
</tr>
</tbody>
</table>

Source of data: IORS Hospital cancer registry 2009.

Risk factors have also been dealt with and they can also provide significant pieces of information on the way and style of life of patients (use of alcohol, cigarettes), on number of childbirths, hormonal status of the woman (being important for taking a decision on the type of oncological therapy to be applied in treatment), etc. Such detailed information can be used in the organizational, medical and scientific purposes, and may indicate a possible change of treatment protocols for cancer.

Table 4. shows the number of newly registered patients in IORS since 1990 classified by localization of malignant diseases. The trend of rising number of newly registered patients until the beginning of 2000 may be noticed.

Table 4. Number of newly registered patients by years

<table>
<thead>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C50</td>
<td>1156</td>
<td>1192</td>
<td>1261</td>
<td>1327</td>
<td>1269</td>
<td>1231</td>
<td>1220</td>
<td>1213</td>
</tr>
</tbody>
</table>
Application of IT in health [4] is of paramount importance since it provides an opportunity to consider and promote medical protocols and watch the health status of population. With appropriate monitoring and valid data, significant contribution can be given to fight against malignant diseases. Likewise, these data can be used by top management for more rational use of all resources, planning of work and development of services.

Thus, IT application in health has also other than financial benefits the ones such as qualitative (organizational and medical).

References


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Biljana Branković is a Master of Management in Health Care, Information Engineering, a specialist of e-business at the position: Chief of the Department for Medical Data Bases (as a part of Services for Organization, Planning, Evaluation and Medical informatics) at the Institute for Oncology and Radiology of Serbia. Her primary field are the e-health, quality of service.

Ana Jovicevic is a medical doctor, specialist in epidemiology, with a Master’s Degree in oncology, working at the Institute for Oncology and Radiology of Serbia as a head of the Department of Epidemiology and Prevention. She is a member of several national expert commitees at the Ministry of Health (for tobacco prevention, oncology, cancer screening) and the secretary of the Serbian Society for the Fight against Cancer.
Autism care 2.0, a New Approach for Mental Health Care

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Abstract: autismcare2.0 is a model for life course guidance, using new media and the possibilities ICT solutions, eHealth, create. It offers the necessary support in all life stages, on all life domains, whenever needed. The model autismcare2.0 focussed on the impact on self-management skills and the treatment period, but also on partnership and empowering a patient and his relatives. All these elements are essential in managing a lifelong psychiatric condition such as autism.

Introduction

Autism (ASD) is a chronic psychiatric condition. People with ASD often need intensive treatment and lifelong support.

The Dr. Leo Kannerhuis developed their model of ‘life course guidance’ as a basis for the treatment and rehabilitation approach for people with ASD. ‘Life course guidance’ offers the necessary support in all life stages, on all life domains, whenever needed. Besides partnership with the family, pro-active monitoring, early support during transitions and patient participation are key-elements of this model. Autismcare2.0 is the new treatment approach, a feasible model of life course guidance, using eHealth interventions to stimulate patient participation and enhance cooperation between the healthcare workers, the patient and his family. The model focuses on both the treatment and self-management period. A Personal Health Portal is the key-application, in combination with eLearning interventions, self-management applications and Telecare. Telecare provides online video or chat contact, between the patient and his healthcare worker, or between the patient and his social (support) network. Doing so a 24/7 network for self management arises in which the patient is the key player.

Cost-effectiveness

In the development of autismcare2.0 and integration in the treatment setting, cost effectiveness is an important issue. In cooperation with the Trimbos Institute, the Dutch Centre of Expertise on Mental Health Care, we developed an instrument to explicit the cost effectiveness of treatment inter-
ventions for autism. This model, the *Autism Intervention Model* (AIM), is used as decision support in the implementation phase and to monitor the effects of the interventions.

Presentation; APPs, AIM and Discussion

In the presentation the autismcare2.0 model, the eHealth interventions and self-management applications will be presented as for example:

- Personal Health Portal
- Telecare application
- Stress management application
- Mobile coach.

We will show the AIM and its use in strategic discussion making. Furthermore we will focus on the implications for the patients and the caregivers and show first practical experiences from their point of view. Finally we will show first results of research.

Drs. Astrid A. van Dijk is the Manager Research and Development Dr. Leo Kannerhuis.

Ms Van Dijk, Master of Science in Nursing, works since 2004 as manager Research and Development at the Dr Leo Kannerhuis, psychiatric hospital for Autism Spectrum Disorders in the Netherlands. She has over 25 years of experience with change management in healthcare and is specialist in implementing innovative treatment methods and evidence-based treatment. In her approach, she always combines changes in organizational structures with changes in professional attitudes and behavior.

Saskia Timmer, Webber autismcare2.0 Dr. Leo Kannerhuis Healthcare innovator with a focus on using ICT as supportive tool for people with autism. Development of the new treatment concept autism-care2.0, concept developer for treatment and self-management ICT applications and implementation of these new eHealth interventions in the treatment program for people with autism within Dr Leo Kannerhuis.
Business Process Oriented Analysis of IT-Safety in Hospitals

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Abstract: The actual process of digitalization and crosslinking in the health business and in hospitals points out the question of data security and in particular the safety of patient data. At the moment there is a leak of practicable concepts, which are qualified to integrate IT-safety specifications into a process-oriented view. The integration of business process oriented risk identification into the process of risk management in the global process oriented hospital organization will be shown.

Introduction

Because of the overall growing digitalization and crosslinking the need of protection of information against threats and leaks is getting more and more urgent. Health Organizations aren’t safe from this development. Instead of that they will feel the impact of the changes more strongly than other organizations or public authorities [1]. On the one side health organizations are under strict financial restrictions, which is a handicap for developments in IT-safety. Is it not possible to keep the publicity out of the specific kind of external environment from healthcare organizations? Furthermore the need of electronic advice in preparation and analysis of data is growing and growing. This applies also to the support of business processes and to management tools, too. Because of these aspects the consideration of data safety and data privacy in the specific regulations of the health market is very important [2].

Actual studies are showing that IT-safety in the hospital business is not very well considered and changes in the technology aren’t considered as well [3]. The diversity of possible data formats in the health business – e. g. paper, electronic documents, films, x-ray pictures – and many possible data transfer methods – e.g. mail, e-mail, other electronic methods, conversations – increase the number of threats and possible leaks and this leads to a more difficult protection of information.

The standards for IT-safety in the health business are the ISO/IEC 27xxx-family; these standards are significant for Europe. A special standard, the
ISO 27799 standard, is introduced only a short time ago. This standard substantiates the ISO/IEC 27002 standard in matters of the requirements to the health care industry.

Information Security Management System (ISMS) in Healthcare

The Information Security Management System (ISMS) is based on ISO / IEC 27001 and is one part of the overall management system. ISMS leads on the basis of a business risk approach, the development, implementation, monitoring, inspection, maintenance and improvement of information security. The management system includes the structure, policies, planning activities, responsibilities, practices, procedures, processes and resources of the organization [4].

The security requirements, business processes and the size and structure of an organization may change over time. For this reason, the ISMS should not be understood as a simple execution of a checklist. A cycle must be applied in all processes of ISMS. This allows continuous improvement of the ISMS. One of these cycles describes the "Plan-Do-Check-Act" (PDCA) – model, according to the representations in the ISO 27799 and ISO / IEC 27001 [5].

As shown above, German hospitals are in a reengineering process. The process orientation gets more and more in the focus of these organizations. Consequently, the analysis would be incomplete if only the IT components were taken into consideration. By the try to improve information security, the need to engage all relevant information assets in the analysis (including business processes) is obsolete. Furthermore, the analysis of processes leads to significantly better results because it also shows the dependencies between information assets.

Process-Oriented Analysis of Information Security at Hospitals

The analysis and presentation of (business) processes in the organization can be performed with different notations and modeling tools. A standard that combines the approach and the software tools together is the ARIS Toolset of IDS Scheer. In particular, the concept of event-driven process chain (EPC) is a very common notation for representing business processes.

The basic goal of the process-oriented representation is to represent the logical flow, the necessary resources and information or data.

The relationship between information security and business process orientation can be represented at different levels. The security management can be regarded as a business process, with all the necessary activities and tasks such as strategic security management, risk management and
developing and implementing security measures. The security management is therefore the object of observation of process-oriented view [6].

The process-oriented analysis and design can be expanded to include security-oriented analysis. This complements the process-oriented view to security objectives. Then the security objectives must be taken into account in the analysis and the design of business processes [6].

In addition to analysis and design you are able to identify risks of information processing in the context of business process modeling. The identification of information assets requires the consideration of all information processed in the process and the determination of the value or the protection requirements of the information [7]. Thereafter, possible threats and vulnerabilities to the security of this information must be identified and documented [5].

Analysis of Information Security in the Medication Process

Information assets have to be identified in the control view and assigned to the appropriate views (such as system view, data view, organization view). The dependencies between information assets can be modeled in each view.

In the next step strategic security objectives must be defined at the strategic level. The general safety objectives are also taken into account. For example, it is necessary to ensure a very high level of protection of personal data, but also the goal of reducing costs.

Once the goals have been detected for each information asset, the next step is to analyze the information assets with a focus on vulnerabilities and threats. The identified vulnerabilities and threats should be documented. We do this by using ARIS software. On the basis of the documented security objectives, vulnerabilities and threats, it is possible to make an assessment of the potential damage (with regard to CIA: confidentiality, integrity, availability).

Risk evaluation is the next step after the identification process. Here the CRAMM – method is used. This method compares the rate of threat and vulnerability on the one side with the extent of damage on the other side. The result of this comparison is a risk value. Then the setting of safety measures in consideration with the risk values is the following step.

Conclusion

This paper describes a method for analyzing information security. It focused on the medication process in hospitals. The goal of the method is to analyze the processes and to document information about security objectives, threats and vulnerabilities. This method allows a carefully
identification of risks which is a solid basis for risk assessment. A major advantage of this approach is that different aspects (such as logic of the process flow, costs, durations, medication safety and information security) of the same process can be depicted in one model.

References


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Abstract: Information and computer technology have permeated every area of healthcare, enhancing at low cost the delivery of front-line medical services. The aim was to develop an e-health platform capable of managing and centralizing physiological information recorded on patient vital signs health monitors. Two integrated softwares were developed to enable the platform to organize, manage and display received information from all connected health monitors, either by cable or Wi-Fi. Both were created using C++ programming language with Windows and MySQL database compatibility. TCP/IP connection management was used between the platform and each monitor, with the assigned tasks of the organization, storage and display of received data. Validation tests were performed. The e-health platform has the capability of managing up to 100 Lifetouch10 monitors over a TCP/IP network, storing 96 hours of data from each connected unit, as well as the health information of each monitored patient. It is able to simultaneously display 12 physiological waveforms and 8 variables from up to 32 monitors in real-time, providing pre-configured technical and physiological alarms and multi speed waveform visualization. The newly developed e-health platform is believed to improve the management and treatment of hospitalized patients.

Introduction

In order to improve healthcare solutions, IT systems are being developed to optimize monitoring systems and e-health applications. From computers to wireless devices, information and computer technology have permeated every area of healthcare, enhancing at low cost the delivery of front-line medical services [1]. Adding to this, e-health applications are evolving from local ECG monitoring to the integration of monitoring systems with data acquisition, patient database and previous medication administration, assisting physicians to improve health care [2-3].

The benefits of remote monitoring systems are recognized by physicians and hospitals around the world, motivating the industry to improve and integrate their products. Devices on the market have now added new physiological variables, such as pulse oximetry (SpO2), electrocardiogram (ECG) waveform and carbon dioxide pressure at end tidal (EtCO2), to their
products, providing better information regarding patient status, responses to therapy, and essential inputs in the event of medical emergencies.

Health monitoring of patients from a distance is part of this new way of providing health care. Based on this scenario, this paper presents the development of a remote e-health monitoring system.

Objective

This project aimed to develop an e-health platform capable of managing and centralizing physiological information recorded on patient vital signs health monitors to better assist health teams in the supervision and administration of patient care in a hospital setting.

Methods

The e-health platform development was divided into four different steps: feature definition, system design, code writing/testing and technical validation. A multidisciplinary team composed of engineers, physicians and computer scientists was assembled and responsible for contributing to all steps.

Feature Definition

A study was performed to establish which physiological variables of hospitalized patients were required to be continuously monitored and in addition the best format for their display. This assessment was based on meetings held between

![Fig 1: Schematic view of the e-health platform: software and hardware connection design](image)
engineers and medical doctors, as well as a search on feature availability of well-known commercial multi-parametric monitors.

System Design

A two integrated software model was chosen in order to enable connection management (Server module) and data display (Viewer module) to be treated separately. This system allowed for multiple connections of Viewer modules and LifTouch-10 monitors to a single Server (Figure 1), centralizing data management.

A MySQL database was designed to permit storage of patient data for later record access. Ten minute physiological variables files were recorded and then organized using a data file system. Future access to these files was enabled via the individual file address, which was previously stored on the database.

Network load and data processing time were estimated using different technical scenarios, in order to define hardware and software specifications.

Code Writing/Testing

C++ programming language was selected due to its capability of controlling hardware behavior at high and low levels, to the wide accessibility of application knowledge being online and to the availability of different Integrated Development Environments (IDE), from which Builder C++ was chosen.

In order to ensure data exchange consistency between softwares, both exclusive and/or polynomial cyclic redundancy checks (CRC) were implemented in the data packet structure of the TCP/IP network communication.

Technical Validation

System performance tests were made at different development stages, enabling a continuous review of the proposed software design. Monitor device emulation software and data packet structure analysis methodology were developed to evaluate data integrity, transmission rate and reliability, software stability and information visualization. These applications allowed different testing scenarios to be simulated, permitting packet content and data flow analysis.

Results

The developed platform has the capability of managing up to 100 LifeTouch10 monitors over a TCP/IP network, storing 96 hours of data from each connected unit, as well as the health information of each monitored patient. It is able to simultaneously display 12 physiological
waveforms and 8 variables from up to 32 monitors in real-time, providing pre-configured technical and physiological alarms and multi-speed waveform visualization.

Conclusion

The newly developed e-health platform is believed to improve the management and treatment of hospitalized patients, having a positive impact on the outcome of diseases and decreasing morbidity and mortality of patients.

References


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Implementation of an Electronic Hospital Information System in a Developing Country: A Case Study of Federal Medical Centere Owerri, Nigeria

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Abstract: Concerned by the overwhelming increase in the population of patients attending our hospitals for medical attention and the problems associated with the sluggish, unreliable and insecure manual (paper work) method of keeping record of patient's information; the need for an electronic information system which makes it easier, more reliable and more economical to keep and retrieve a patients information when needed with high degree of speed, and precision has become inevitable in our medical system. Manual method of record keeping which has been in use in the hospital where this research was carried out was observed to be inadequate, often inaccurate and lacks flexibility. Personal interview carried out on both patients and staffs of the hospital showed that more than 70% of the respondents preferred an electronic system of information storage and retrieval that will reduce the time and energy wasted in sorting out files from heaps of files from racks when a patient is to be attended. Due to these obvious problems, the researcher was motivated to develop software that will handle this problem.

Weakness Identified in the System

As an organization grows in size and complexity, as is the case in the hospital system under study, the volume of data also increases hence a resultant increase in paper work which gives rise to the following problems:

- The mode of operation in the hospital system becomes cumbersome in nature and slow in data processing;
- There is insecure storage of data which can be lost or not easily accessed on demand;
- There is improper documentation of discharged patients;
- Delay in record accessibility due to the large number of files involved; one finds it difficult to find and update any needed file;
- It brings about data redundancy in a situation where by patient are given new files each time they come into the clinic to freshly put down their particulars.
Objective of the New System

The newly proposed system is expected to provide computerizes process for the preparation of clinic informatics system in Nigeria by effectively and adequately organizing the clinic database: the new system is expected to provide an effective database that will organize patient information. It has to:

• Ensure data security and integrity by ensuring that data is protected against misplacement and lost;
• Ensure that records are secured and made accessible only to authorized users;
• Help to eliminate error in data due to manual processing information leading to wrong ward allocation. In order to avoid this, data should be free from error.

Database Specification

The first step in developing the new system is to develop the computer database that will be used to store clinic information [2]. The database was designed using MS-access 7.0 formats using a real data provided by the clinic management. This database contains the required information about the admitted patient and the discharged ones. It organizes and manages information to obtain the clinic report required to support the patient and ward allocation process.

The database was designed as a relational database and all the common files rotate from one table to another [3].

File Conversion

The newly designed system is put into use along with the old system. The conversion procedure alludes to the step and process involved in changing from one of the system to another [1]. The conversion procedure method recommended is the pilot operation method. This method is chosen because it enables the old and the new system to run concurrently during the conversion period so that the strength and weakness of both systems will have respect to each other.

Loading the Software

Create a directory/folder say 'clinic software' on the c:/ and copy the executable file from the CD ROM into the folder.
Running the Software

Once the analyst finished the installation, the user should click on the start button menu, position the mouse pointer to program then point again to folder of the new system and finally click on the executable icon.

Exiting the Software

To exit the software, the user have to pull down the menu, save all works then click exit which will bring the user back to desk top window environment.

References


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Interoperability in Integrated Biomedical Systems

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Abstract: Information and communication technologies have already become inseparable part of healthcare sector activities. We discuss the issues of standardization and interoperability that are crucial for correct interconnection of medical and other devices and information systems and for successful integration of partial solutions.

Introduction

Our work on biomedical research projects has led us to the conclusion that successful integration of partial solutions is strongly dependent on the issue of interoperability of medical devices and information systems. It comprises problems of standardization of data acquisition, communication, processing, and storage; and connected problem: correct data mapping between different ICT applications. The key issue is the ability to understand the semantic content of the exchanged information.

With development of more advanced sensors, body area networks and ICT the focus will be on the integration in larger systems collecting and processing large volumes of data, evaluating more complex situations and scenarios, precise identification of potentially dangerous situations and finding solutions (e.g. alarms in case of health or life threatening events, access blocking in case of security attack). Although many issues have been successfully solved and introduced either in applied research or in development of prototypes or final products there are still many problems on the waiting list.

Technological Trends

If we want to develop flexible eHealth, assistive technology (AT) or ambient assisted living (AAL) systems we have to define standard interface that allows “plug-and-play” type of connection. Especially AT and AAL systems are composed of different hardware and software modules that must communicate. The basic condition is that the receiver understands correctly the content of the message. Thus it is not sufficient to be able to receive the message, i.e. to understand the syntax of the message, but it is...
necessary to understand the semantics. This requirement implies development of data model that maps semantic content from the data received from the devices into an information system that is usually used for collecting and evaluating data from monitored persons. We propose a system architecture allowing above mentioned interoperability. Interoperability may significantly influence effectiveness both of design and development of an integrated system and of its routine operation.

Integrating information deriving from different sources and implementing it with knowledge discovery techniques allows medical and social actions to be appropriately performed with reliable information, in order to improve quality of life of patients and care-givers.

Currently the mobile technologies, sensors and other devices enable collecting vast amount of data of individuals. This multi-parametric data may include physiological measurements, genetic data, medical images, laboratory examinations, and other measurements related to a person's activity, lifestyle and surrounding environment. There will be increased demand on processing and interpreting such data for accurate alerting and signaling of risks and for supporting healthcare professionals in their decision making, informing family members, and the person himself/herself.

Recent development of ICT [1-2] shows that it is almost impossible to design and implement a complex system as fixed to certain hardware, operating system, and infrastructure. Thus it is necessary to develop such architectures that will be easily extensible and modifiable. For easy extensibility the basic requirement is to understand data exchanged between individual parts of the system.

Proposed Architecture

Based on the facts mentioned above we have tried to define requirements and subsequently system architecture that would satisfy these requirements. The proposed architecture [3] covers the whole chain from data acquisition / measurement over data collection, identification, transformation up to evaluation and storage in an EHR system (see Fig. 1). From the description it follows that there must be interfaces between individual modules. To allow the “plug-and-play” approach the interfaces must be based on well defined standards. We have in mind especially following categories: ISO units for measurement of physical quantities, ISO IEEE standards in communication, standard file formats in software area, HL7 standards on the side of information systems. Another inseparable part of the architecture is constituted by data models. The models will ensure correct exchange of data between devices and information systems. This part represents a great
challenge and at the same time the greatest space for future solutions because the correct mapping of acquired data onto a data model that describes electronic health / patient record is not satisfactorily solved yet.

The proposed architecture is not necessarily centralized. It can be composed of highly distributed units utilizing, for example, multi-agent platforms as software infrastructure [4]. For example, it can be used for more efficient data handling. For data storage there can be smaller local storages and a central data storage used for different types of data. Since there can be collected health state data and daily activities patterns the large volumes of data can be stored locally and based on the data analysis during system development the professionals (e.g. medical doctors) can define, which type of data should be sent to a central data storage maintaining electronic health care records.

Conclusions

With respect to future development and possibility to sense and store far more larger volumes of heterogeneous physiological parameters the issue of interoperability becomes more and more important. Interoperability may significantly influence efficiency of both design and development of an integrated system and of its routine operation. It will become more and more important with the development of telemedicine, home care and possibility of remote monitoring of patient state. As the technology is developing very quickly we have to assume that new types of sensors and devices will appear. The newly designed and developed systems must be necessarily created as open modular systems allowing direct connection of the new sensors and devices without any need of modification of the communication and data input. Possibly new data processing module will

Figure 1. Proposed architecture of the chain from medical devices to EHR and HIS

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be added. However if we only replace an old type of sensor by a new one delivering the same data (concerning semantic content) in higher quality there should not be any need for changing the software part.

Presented issues show that successful applications need coherent approach of experts from many different disciplines, i.e. information technology, electronics, communication technology, medicine. Standardization can make the way from an idea to an application much easier and faster. Thus acceleration of standardization process represents a key issue. It is important that involved companies, researchers, and standardization bodies agree and cooperate towards the ultimate goal – defined standards. There has not been space to mention the expressive power of ontologies, their flexibility, extensibility, and their potential in various applications in biomedicine. We should be aware of their potential for future applications. It is expected that new tools will be developed that allow more efficient work with ontologies, including development of virtual ontology libraries, or ontology visualizations.

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Personal Health Record Market Ecosystem: An Analysis of Key Success Factors

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Abstract: Apart from the patient or healthcare system potential benefits, a key question remains: what is the business potential of PHRs (Personal Health Records), is it in a standalone mode, in partnerships with insurers or care provider organizations, or as an integrated tool within a healthcare platform? To answer this question, several existing PHR solutions were reviewed and analyzed, together with the extraction of their Key Success Factors (KSF), using the point of view of Technology for Health Services Providers.

Introduction

Despite an undeniable success in Nordic countries, national Electronic Health Records (EHR) were not so successful in other countries like England or Netherlands [1-2].

In parallel, Personal Health Records (PHR) seem to encounter the same kind of problems as EHR when looking at Google Health service which stopped operating in January 2012, while Microsoft announced that people could easily transfer their personal health information to a Microsoft Health Vault account [3, 4].

Field of Analysis and Definition of Digital Health Records

This paper does not analyze or discuss the role of functionalities of PHRs, neither their key success of adoption, nor their needs or advantages, but does study the Key Success Factors (KSF) for an economical viability of existing solutions.

Here, we will use DHR (Digital Health Records) as a generic term describing all electronic records in eHealth field [5]. DHR thus gathers EMR, EHR and PHR.

To assist in the understanding of health records ecosystem, let us remember some definitions from literature [6-7]:

- EHR (Health Electronic Record) are systematic collection of shared electronic health information and services about individual patients generally provided by governments;
- EMR (Electronic Medical Record) are generally used/owned by health professionals only;
• PHR (Personal Health Record) are health records maintained and owned by an individual. These various types of health records have not the same use, market and maturity and therefore not the same position in the following Hype Curve.

PHR Market Ecosystem: Hype Curve and Market forecasts

Whereas EMR market is in productivity [8], Gartner forecasts PHR market maturity within 5 to 10 years, as shown in Fig. 1.

**Position in the Hype Curve**

Gartner Hype Curves provide a graphic representation of the maturity and adoption of technologies and applications [9-10] versus time. Fig. 1 represents the Gartner Hype Curve for Healthcare Provider Applications and Systems. If every technology generally follows the five steps of the curve indicated in Fig. 1, it must be pointed out that the time scale is relative and varies according to technology.

Whereas EMR market evolves in a mature phase [8], PHRs are positioned in the “Trough of Disillusionment”, meaning that the PHR market is today a nascent one. Even if solutions like DOSSIA, Microsoft health Vault, Kaiser Permanente, etc., already exist, there are also examples of low adoption such as Google Health [3].

In fact, despite some sort of viability, PHRs’ profitability, in terms of financial benefit, is not yet proven even if cost reduction is already perceptible. Therefore, PHRs’ positioning in the “Trough of Disillusionment” reflects why for now the rate of adoption of PHR is disappointing [11] with, for example, 10-15% of adoption in the US.

**Market forecasts**

According to Consulting companies [12-14], the global DHR market can be estimated to reach 14 G€ in 2013, when the EMR one will reach 9 G€, the EHR one 4.9 G€ and the PHR one 5.2 G€.

Whereas EMR forecasts have a reasonable level of confidence considering its maturity emergence, PHR ones are not so reliable due to their status as emerging market. To reach market maturity, PHRs will then need to go through the following phases: (i) Obtain a full adoption by patients (customers), (ii) Get a clear PHRs’ role and ecosystem comprehension, (iii) Get a clear and comprehensive business model, (iv) Have the different actors positioning themselves on the value chain…
Typology of the PHR analyzed in this study

Today, PHRs are ‘percepted’ as connectors by analysts like C. M. Christensen [15] and as platforms by analysts from Intel, Microsoft, DOSSIA, etc. Therefore, we have selected several PHRs, sampling the panorama. These PHRs have then been analyzed and splitted in two groups of push / pull solutions, i.e. pushed by Governments, Enterprises, insurers or organizations… or pulled by Health Portals, Wellness Devices, ePrescription, etc.

Selection of Key Success Factors

In our previous paper [16], eHealth services were analyzed, helping to position the ‘Technology for Health Service providers’ on the value chain. Therefore, eleven KSF could be extracted and selected, identified as the ones allowing these services to be rolled out successfully.

In this new paper, we added a twelfth factor: “Sold with/In support with another service”. This factor is specific to PHRs ecosystem and explains the push/pull segmentation described above.

The key success factors have been described in Table 1.
Table 1 – PHRs Key success factors for 'Technology for Health Service providers'

<table>
<thead>
<tr>
<th>Key success factors</th>
<th>Detailed Description</th>
<th>Recipient</th>
<th>Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government organization legitimacy</td>
<td>When the whole value chain benefits from the legitimacy provided by a governmental organization.</td>
<td>Health org (gov...)</td>
<td>Legal</td>
</tr>
<tr>
<td>A free service for the patients</td>
<td>The patients are attracted by a free service that otherwise would be payable.</td>
<td>Patient</td>
<td>Economic</td>
</tr>
<tr>
<td>A better service for citizens</td>
<td>The new service provides a better service for citizens, in comparison with previous situation.</td>
<td>Patient</td>
<td>Quality</td>
</tr>
<tr>
<td>In-house expertise</td>
<td>The main distributor of the solution has particular expertise in the role he assumes.</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Partners' expertise</td>
<td>The partners have particular expertise in the role they assume.</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Network and Platform management legitimacy</td>
<td>The Telecom operator managing the network and the data hosting platform is legitimate in this role (expertise and capabilities in infrastructure for data hosting and secure data management, governmental agreements...).</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Secure transmission &amp; hosting</td>
<td>The health care data and applications are hosted and transmitted securely by the concerned partners in the value chain.</td>
<td>Providers</td>
<td>Quality, Privacy</td>
</tr>
<tr>
<td>Pre-existing distribution channel</td>
<td>A pre-existing distribution channel with pre-existing clients, providers and distributors can greatly help to deploy an eHealth solution.</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Appropriate interoperability and standardization</td>
<td>Today, appropriate interoperability and standardization seem to be a common concern in e-health and e-wellness.</td>
<td>Patient, Health Pro</td>
<td>Economic</td>
</tr>
<tr>
<td>Cost reduction</td>
<td>Today any government has to face the challenge of delivering affordable healthcare at lower cost (because of population aging, increase in chronic diseases...).</td>
<td>Health org (gov...)</td>
<td>Economic</td>
</tr>
<tr>
<td>Incentives for patients</td>
<td>The patients can be attracted by a free service, by a better service at lower cost, by a new service, motivated by the government, etc.</td>
<td>Patient</td>
<td>Economic, Quality</td>
</tr>
<tr>
<td>Sold with in support with another service</td>
<td>Because patient needs another motivation than PHR itself, the service has to be pushed/pulled by another Healthcare service.</td>
<td>Providers</td>
<td>Economic, Quality</td>
</tr>
</tbody>
</table>

References

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Libra MedTrans started working on a project envisaged for development of a complete network of Tele-Health system in India where 70% of the total population resides in rural areas and only 30% of certified physicians are available to serve them.

The project took its base from this growing disparity between healthcare needs of people living in rural areas and availability of treating physicians who prefer to work from urban areas. Also in big health care centers like AIIMS, there is a daily footfall of around 10000 patients in OPD alone out of which around 60% of the patients visit the center with minor issues like fevers, sinusitis, some common hearing, speech and/or vision problems which at the first place do not require the attendance by such specialized physicians. Also there is a great trauma associated with traveling to such big centers from remote areas and the expanse incurred on such.

With a vision to treat such patients in the vicinity of their villages, it was decided to put up centers that can have a first look at their symptomatology and if minor get them treated there only, else they could be given an appropriate appointment to visit the city healthcare center. This would reduce the patient physician ratio for OPD and only genuine patients would need to visit.

There are two modules attached to this.

First one is a Rural Healthcare Center (RHC) which is a physician-less facility equipped with all diagnostic and tele equipment to include telepresence screens, digital x-ray scanners, ultrasound, ECG machines, PCs along with clinical/pathological technicians.

The second module consists of a Health Command Center (HCC) housed in a city hospital which is connected to the RHC via online interface with a team of physicians.

The baseline health data of all the members living in a particular area is taken and stored in advance on the central server and unique health ID issued. Whenever the registered patient visits the RHC, his disease condition is recorded and appropriate tests conducted via online inputs made by the physicians at HCC. Alongside, the physicians are able to pull up the entire health history of the patient online and after appropriate consultations, they are able to provide treatment modality to the patient in
the form of e-prescription. Also, via this model we are engaging people to go in for regular quarterly health checkups with recording of health parameters on regular basis in order for us to have a large database of disease patterns on zonal and regional levels which can be analyzed on different patterns and appropriate predictions can be made.

We are using the telepresence technology because of its advanced features in terms of continuous online streaming, picture clarity and ability to make an eye contact with the viewer which are the essentials for any physician sitting at a remote facility to make accurate diagnosis of the patient condition.

Manoj Kalra is currently running a successful KPO engaged in the process of creating and maintaining health care data for USA based Ambulatory Surgery Centers. He was appointed as an Expert Member to the core committee of E-Health Diary Project under Institute of Clinical and Medical Research, New Delhi, the apex body in India for the formulation, coordination and promotion of biomedical research and is one of the oldest medical research bodies in the World.

Mr. Manoj Kalra is working towards creating a non-invasive blood sugar monitoring system and a networked group of diabetics with setting up of Diabetes Command Center specific to the needs of this disease.
Social Networks and Telehealth: Enlarging Access to Health Promotion. Telehealth UERJ-Brazil’s Experience in Preventing Childhood Obesity at Schools

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Abstract: Introduction and aims: Telehealth at Schools is a project developed through the integration of health professionals, school staff, students and UERJ’s Telehealth Center team intending to provide educational materials and interactive games for children. In this project, in view of the seriousness of the epidemic of childhood obesity in the world, a site was developed for remote access. The objective of this work is to present the importance of social networks as an effective and rapid dissemination of this site information. Methodology: On August 2011, the site was launched as "Coloring the plate and moving the Shoe" [http://www.telessaude.uerj.br/colorindo-e-movendo/]. Since then, a social networking was implemented and a customized tool was developed for analyzing the website access. Results: During the period of observation 31,551 hits were carried out to the site, with an average of 5.3 minutes of connection. Conclusion: social networks have proven effective in the rapid dissemination of the site, facilitating the diffusion of its content.

Introduction

Telehealth at Schools is a project developed through the integration of health professionals, school staff, students and UERJ’s Telehealth Center[1] team. Its main goal is promoting the use of internet as a means to share educational materials for schools’ staffs and families and offer interactive games for children. It also provides a monthly interactive teleconference by health professionals to remote communities. In this project, in view of the seriousness of the epidemic of childhood obesity around the world, a site was developed for remote access. The objective of this work is to present the importance of social networks as an effective and rapid dissemination of this site information.
Methodology

On August 2011, the site [2] was launched as "Coloring the plate and moving the Shoe" (Figure 1). Since then, a social networking was implemented and a customized tool was developed for analyzing the website access. This project was funded by the Research Foundation of the State of Rio de Janeiro (FAPERJ) [3] and is part of the activities of the Brazilian Telehealth Networks Program [4].

Results

During the period of observation, 31,551 hits to the site were carried out, with an average of 5.3 minutes of connection. The teleconferences disclosure started one week prior the event date, and is increasing progressively since then. The users are making questions and sending comments about the discussions related to childhood obesity prevention.

Figure 1: The website “Coloring the plate and moving the Shoe" [2]
Conclusion

Social networks have proven to be one of the most powerful and effective tools for the rapid dissemination of the site facilitating the diffusion of its content and activities.

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[1] Telehealth Center of State University of Rio de Janeiro (UERJ). Accessible in www.telessaude.uerj.br

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Software for Low Cost Digitalization of Radiographic Films in Teleradiology: Telehealth UERJ – RJ-Brazil

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Abstract: Introduction and aims: the use of low cost technologies for the digitalization of images is essential for the sustainability of Telehealth, especially considering Brazil’s territorial dimensions. This work offers an evaluation of two techniques used for digitalizing conventional RX films: digital cam and an ordinary scanner A4 adapted, using scanRX software, having as a gold pattern an original digital image obtained in RX CR Digital equipment. Methodology: three types of images were obtained – CR, photo and scanner – from 28 patients, recruited at Pedro Ernesto University Hospital (HUPE-UERJ) presenting lungs lesions. Six radiologists evaluated 10 criteria of standard diagnosis (independent and with masking) of pulmonary lesions. The measures of accuracy (e.g. sensibility, specificity, predictive values and likelihood ratio) were rated considering the evaluation of the CR image as gold pattern. Confidence intervals of 95% were rate for each measurement. The agreement among the observers was also calculated via Cohen’s kappa coefficient. Epi dat 3.1 software was used for all the measures. Results: digitalizing with scanRX meant a larger sensibility (83.33% - IC 95% 70,87-95,79) in relation to the digital cam (80.95% IC 95% 67,89- 94,02) yet with no significant statistical difference. Specificity was comparable between scan RX - 93.7% (IC 95% 90,4-96,99) and digital cam -93.86% (IC 95% 89,89-96,67). The specialists analysed the agreement by kappa coefficient, which was better for CR method (kappa=0.76), followed by scanRX method (kappa=0,66) and at last by digital cam (kappa=0,57). Conclusion: This study shows that digitalizing with a conventional scanner and scan RX software is a safe
low cost method of supporting for Teleradiology, once it has got levels of sensibility and specificity high enough for this purpose.

Introduction

The use of low cost technologies for the digitalization of images is essential for the sustainability of telehealth, especially considering Brazil’s territorial dimensions. This work offers an evaluation of two techniques used for digitalizing conventional RX films: digital cam and an ordinary scanner A4 adapted, using scanRX software, having as a gold pattern an original digital image obtained in RX CR Digital equipment. The research, funded by Financier of Studies and Projects (FINEP) [1], was a partnership between High Performance Computing Laboratory (NACAD-COPPE) from Federal University of Rio de Janeiro [2] and UERJ-RJ Telehealth Center [3].

Methodology

Three types of images were obtained – CR, photo and scanner (Figure 1) – from 28 patients presenting lungs lesions, recruited at Pedro Ernesto University Hospital (HUPE-UERJ). The low digitalization process includes a commercial A4 scanner with a transparency media adapter, an analog X-ray film and an image stitching software. The scanner geometry & standard X-ray film is adjusted to stitch 2 or 4 A4 sized partial scans seamlessly

Figure 1: Final stitched image using the scan RX software
into the original large format X-ray, producing a digital image in DICOM format. This optimized image stitching software was developed in this project and is called ScanRx.

Six radiologists evaluated 10 criteria of standard diagnosis (independent and with masking) of pulmonary lesions. The measures of accuracy (e.g. sensibility, specificity, predictive values and likelihood ratio) were rated considering the evaluation of the CR image as a gold pattern. Confidence intervals of 95% were rate for each measurement. The agreement among the observers was also calculated via Cohen’s kappa coefficient. Epi dat 3.1 software was used for all the measures.

Results

Digitalizing with scanRX meant a larger sensibility (83.33% - IC 95% 70,87-95,79) in relation to the digital cam (80.95% IC 95% 67,89-94,02) yet with no significant statistical difference. Specificity was comparable between scan RX - 93.7% (IC 95% 90,4-96,99) and digital cam -93.86% (IC 95% 89,89-96,67). The specialists analysed the agreement by kappa coefficient, which was better for CR method (kappa=0.76), followed by scanRx method (kappa=0.66) and at last by digital cam (kappa=0.57).

Conclusion

This study shows that digitalizing with a conventional scanner and scan RX software is a safe low cost method of supporting for teleradiology, once it has got levels of sensibility and specificity high enough for this purpose.

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[3] Telehealth Center of State University of Rio de Janeiro. BRAZIL Accessible in www.telessaude.uerj.br

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Specifying Workflow Requirements for Holistic Care

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Abstract: This paper is concerned with the development of an approach to requirements elicitation for holistic care processes, involving both health and social care processes, based on business process modeling. The approach seeks to involve users on holistic process management and to provide insights that enable early identification of possibilities and limitations of alternative process designs so that to facilitate taking decisions on improving existing processes and developing new ones using centralized, patient-managed holistic care records containing patient lifelong health and social care information.

Introduction

Currently, many countries are faced with the need to improve health and social care functioning and, especially, with regard to meeting comprehensive care needs required by such people as the elderly and those with multiple illnesses [1]. Hence, health and social care resources need to be used more efficiently and efforts should be devoted towards enabling effective coordination and collaboration among health and social care organizations [2-3]. This requires a holistic approach that takes a horizontal, process-oriented view of health and social care delivery whose activities are integrated to form cross-organizational health and social care processes. Such processes should also be interfaced with the organizations’ existing and diverse record systems where patient health and social care information is stored in order to enable access to patient information by authorized, cooperating individuals and the patient.

Process-based information systems using service-oriented technologies provide an appropriate solution for supporting and automating these processes while also integrating diverse existing ISs using services [4-5]. However, prior to systems development it is required to elicit process support requirements especially since those processes usually span different organizations with different socio-cultural constraints and diverse information systems and since process activities are executed by many individuals with different skills and background knowledge [6]. On these grounds, this paper proposes an approach to specifying collaboration and coordination requirements towards streamlining, integrating and automating holistic care pro-
cesses that use a common holistic care record (HCR) as an information repository [7]. The approach uses process modeling as a means for organizing discussion, debate and argument among users from both organizational domains so that to provide insights that enable early identification of possibilities and limitations of alternative holistic care process designs and that are used to elicit process support requirements.

An Approach to Holistic Care Workflow Specification

Figure 1 illustrates the stages of the proposed approach regarding holistic care process requirements elicitation. Users are involved in the analysis stage and feedback from prototype implementations is used for further analysis and design. In particular, group discussions take place in order to identify holistic care goals, capture and redesign health and social organization processes.

Stage 1 is concerned with developing process models at several levels of resolution in order to represent the interactions among health and social care organizations under review (“as is” models).

Stage 2 is concerned with developing a hierarchical goal model to represent holistic care goals as specified through iterations with users.

Stage 3 is concerned with redesigning the models of existing processes (“as is” models) through iterations with the users in order to achieve the holistic care goals identified in Stage 2.

Stage 4 focuses on mapping the holistic care goals to the processes or process activities of the redesigned process models.
Stage 5 seeks to examine the existing, diverse ISs of health and social care organizations in order to evaluate which application functionality can be exposed as services and linked with process activities and the new services that should be developed.

Stage 6 seeks to examine participating health and social care organizations’ security policies and elicit workflow-based security requirements with regard to process activity executions and patient information accesses.

Stage 7 focuses on defining workflow models corresponding to the redesigned process models and on validating these models through iteration with the users.

The above approach is not a linear but a dynamic, group-based endeavor that can only lead to mature processes through rapid process prototyping, incremental development, iterative validation and refinement.

The Case Study

In order to specify process-support requirements for holistic care processes the proposed approach was implemented to specify process support requirements for redesigning and automating emergency healthcare processes so that to create and empower collaboration and coordination among participating health and social care organizations and improve patient outcomes. The emergency healthcare process under review are concerned with emergency medical cases requiring both medical and social care and consists of pre-hospital and in-hospital care sub-processes performed by Emergency Medical Service (EMS) agencies and hospital emergency departments (EDs), accordingly.

In accordance with the proposed approach, in Stage 1 the process models at different levels of resolution were developed to represent the current state of the cross-organizational emergency care process. In Stage 2 a goal model was created to represent the holistic care goals in the context of emergency care as resulted through iterations with users. In Stage 3 the redesigned emergency healthcare process models were developed. In Stage 4 the redesigned process models were mapped to the holistic care goals identified in Stage 2. After a number of iterations of Stages 3 and 4 of the proposed approach all the high level goals were finally met by the redesigned process activities. In Stage 5 existing application functionality (e.g. triaging) was exported as services and used as process activities implementations. Also, new services were created to retrieve/transform/store patient information in the HCR central repository.

In Stage 6 it was decided to use the existing security policies of EMS agencies and hospitals for controlling accesses to locally stored patient data and to develop a global workflow-based security policy in order to control
process activities executions and accesses to patient data existing at HCR repository. Finally, in Stage 7 the workflow models were developed from the redesigned process models and were validated through iterations with the users based on process simulation and service prototyping.

Conclusions

In this paper an approach for specifying workflow requirements for holistic care using business process modeling is described. The approach promotes active user participation with the objectives (a) to provide guidance for controlling a dynamic and diverse domain, such as that of health and social care with multiple interacting processes and diverse information systems, (b) to elicit process support of redesigned, holistic care processes and (c) to interface process activities with a centralized patient-managed HCR system. The approach is illustrated by an example concerned with emergency healthcare cases requiring both health and social care.

References


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Standard Operating Procedures for Telemedical Care in Emergency Medical Services

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Abstract: The introduction of standard operating procedures (SOPs) in emergency medical services (EMS) provides an opportunity to increase treatment quality and efficiency of rescue operations. This paper presents the concept of SOPs for an application of telemedical care in EMS. We developed SOPs for all main processes and devices used in TemRas (Telemedical Rescue Assistance System) and especially for single disease patterns which will support tele-EMS physicians providing a guideline-oriented patient care during a one year trial.

Introduction

Within the research project TemRas (Telemedical Rescue Assistance System) a telemedical care system, enabling live teleconsultation among EMS teams on site and EMS physicians afar from the patient is developed and implemented to increase the quality of emergency missions in Germany. The objective is the introduction of a tele-EMS physician providing medical support for the EMS team on site by automatically transmitting audio and video data, as well as vital signs and 12-lead-ECG from the emergency site to a teleconsultation centre [1]. The transmitted data as well as additional and more extensive sources of information like poison control centres or medical databases allow the tele-EMS physician to gain a comprehensive insight of the patient and support the EMS team on site according to the necessary treatment. This is particularly shortening the time to definite treatment within EMS and improving the quality of care [2].

Within this paper, the concept of standard operating procedures (SOPs) developed for the trial run of the TemRas project is presented. The SOPs, interactively used by the tele-EMS physicians during teleconsultation, serve as guidelines to result in a consistent, uniform and high quality treatment of the patient by the EMS team on site. Therefore an application is developed
for an intuitive handling of the SOPs whose contribution to a process optimization is examined within a trial run. SOPs have been proved to be efficient and quality-increasing in clinical settings and surgery [3]. These findings are now transferred to an application of telemedicine in EMS.

Basic Idea of Standard Operating Procedures

SOPs have the purpose of detailing the regularly recurring work process that is to be conducted or followed in an organization. They document the way activities should be performed to facilitate consistent conformance to quality system requirements. They may describe e.g. the adequate use of equipment, or guideline-oriented operations. SOPs are intended to be specific to the organization whose activities are described and assist that organization to maintain their quality control and assurance processes as well as to ensure compliance with governmental regulations [4].

SOPs can be very helpful to standardization, integration and transfer of knowledge. They minimize the variation of workflows with different characteristics, and improve the efficiency and quality of services in the organization. Besides, SOPs should be written in a certain styles. The document should be written in a simple, step-by-step, easy-to-read format. Information should be conveyed clearly to remove any doubt as to what is required. The use of flow charts to illustrate the process being described is as important as following the style guide used by the organization [5].

These rules are very significant to SOP’s implementation and followed in this application. The objectives of the TemRas specific SOPs are:

- Transmission of knowledge (training documents) and set of standards in which SOP help making decisions, but they do not replace them;
- Support and assurance of TemRas-related processes during trial run and increase of transparency of health care with the use of checklists;
- Assistance with documentation in the teleconsultation centre.

Methodology

Based on the described requirements and the framework of the TemRas project we identified five content-specific categories of SOPs. A first category contains the general concept of SOP as well as its creation, publication and specifications of the change management process. The successful use of SOPs in the context of EMS missions is facing the challenge of adequate visualization as the tele-EMS physicians follow the SOP simultaneously to teleconsultation. Therefore a one-sided flow chart presenting the particular process in a catchy method with a notation according to DIN standard 66001 which is used in standardization of production processes has been adopted for the use in TemRas (Fig. 1) [6].
Besides the flow chart the actual SOP contains additional information. Other categories contain SOPs for handling the hardware and software of the system in the ambulance and the teleconsultation centre as well as support and maintenance processes. An interdisciplinary team of engineers, computer scientists and physicians have worked together to create and implement the SOPs within the research project TemRas.

The most important SOPs contain medical treatment procedures for several disease patterns which guarantee a guideline-based patient care in the interaction of tele-EMS physicians and the EMS teams on site. These SOPs range from the arrival of the EMS team on site and anamnesis up to the application of medication and the accurate transfer for further treatment. This includes using the different components of the TemRas System. Thus, the tele-EMS physicians derive a high qualified treatment of the patients e.g. for hypoglycaemia, acute coronary syndrome, chronic lung disease or stroke while following established standards like SAMPLE and ABCDE.

Implementation

As described above, the flow chart is the main element of each SOP. Especially the medical SOPs have to be used interactively by the tele-EMS physicians to guarantee a high quality treatment for each patient. Therefore the framework of Microsoft PowerPoint and its slide show format PPS have been used. Each flow chart is complemented with additional hyperlinks and literature to provide the tele-EMS physician with additional information. For important process steps or medicine applications this information is

Figure 1: Elements for SOP flow charts
This structure can be perfectly integrated into the entire software system of TemRas and provides e.g. interfaces for checklists and parts of the documentation. Thus the SOPs guide the physician through all processes of teleconsultation and medical treatment.

**Conclusion and Outlook**

By developing this concept and implementing all necessary SOPs, the basis for the trial run within the research project TemRas is given. SOPs are a main part of training material for the EMS staff as well as the tele-EMS physicians while they become acquainted with the TemRas-specific devices. Furthermore SOPs provide guidance for all processes, particularly the medical treatment algorithms which results in a consistent, uniform and high quality treatment for patients by the EMS team on site. For this application the implementation of SOPs with Microsoft PowerPoint and its PPS files is an optimal solution. It is easy to handle and almost available and capable of being integrated everywhere. The whole concept of SOPs will be validated for its impact on the use of medical treatment via teleconsultation in a one year trial run starting in August 2012.

**Acknowledgment**

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**References**


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Teleradiology at Emergency Units in Rio de Janeiro: Reporting Telehealth UERJ-Brazil Experience on the Issue

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Abstract: Introduction and aim: Brazil is a country with continental dimensions, demanding solutions in low cost technologies in order to provide the sustainability of Telemedicine and Telehealth. For this purpose, a sustainable solution of low cost was developed, concerning digitalization and compactness of radiologic examinations that are further sent for teleconsulting among a general practitioner and a radiologist. This work intends to demonstrate the positive outcomes of the application of this solution in eight Emergency Units in Rio de Janeiro city. Methodology: For digitalization and compactness of the radiologic films switching software entitled ScanRX was developed. For asynchronous teleconsulting a specific websystem (http://www.telessaude.uerj.br/riotelerx/) was utilized. Results: From May to December 2011, 734 teleconsultings were made. Among them, 23% were for a second opinion concerning patients less than 18 years. In the whole, 13% presented diagnosis criteria for tuberculosis and were then sent to referred centers; 75% of the patients showed inflammatory lesions and others sores, presenting a non-specific aspect. Conclusion: The use of technologies speeded up processes and qualified the medical assistance at Emergency Units.

Introduction

Brazil is a country with continental dimensions, demanding solutions in low cost technologies in order to provide the sustainability of Telemedicine and Telehealth. For this purpose, a low cost sustainable solution was developed, concerning digitalization and compactness of radiologic examinations that are further sent for teleconsulting among a general practitioner and a radiologist. This work intends to demonstrate the positive outcomes of this application in eight Emergency Units in Rio de Janeiro city. The pilot project is supported by the Telehealth Center of State
Methodology

Emergency Units [UPAs, in Portuguese] are structures of intermediate complexity between Basic Health Care Units and Emergency Hospital Admissions. Together, they compose the Brazilian network of Urgency Care Attention, maintained by the Ministry of Health in Brazil. They are part of the pre-hospital fixed component, implanted in locations or units strategical for the configuration of Urgency Care Attention, analysing the risk emergency protocols at all the units before hospital admission, as ruled by the Brazilian Policies to Urgency Care. There are no radiologists at those units, although examinations concerning general radiology happen regularly. A pilot project in Teleradiology was created, in order to qualifying the medical attendance. For digitalization and compactness of the radiologic films switching software, entitled ScanRX, was developed. For
asynchronous teleconsulting, RioTeleRX, a specific webservice, was developed and utilized (Figure 1).

Results

From May to December 2011, 734 teleconsultings were made. Among them, 23% were for a second opinion concerning patients less than 18 years. In the whole, 13% presented diagnosis criteria for tuberculosis and were then sent to referral centers. 75% of the adult patients and 87% of the child patients showed inflammatory lesions and others sores, presenting a non-specific aspect.

Conclusion

Teleradiology is able to accelerate and qualifying the health attendance, including in emergency cases.

References

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Tele-Regulation as a Means to an Efficient Management

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Abstract: Municipal Secretariat of Health of Rio de Janeiro city is committed to the implementation of a health system of quality, in order to turn it efficient and democratic. For this, the axis is the strengthening of basic attention and also of the organization of networks for health attention for the Municipality System, adopting innovations that allow its improvement. An example of this is the Health Family Strategy (ESF). This study intends to point out the preliminary outcomes of the project in progress to verify the potency of the regulating function mediated by teleconsulting, once it may turn such function more rational and give support to decisions concerning Primary Health Attention – APS. The pilot project takes place at a basic health unit, counting on 6 staffs of ESF, and using a varied flow chart. To give the user some reference to the secondary/tertiary levels, the attending physician makes a request at SISREG III and also contacts the consultant physicians, specialized in Family and Community Medicine. This contact is made through the web, via Adobe Connect – software that provides synchronous interaction of audio and video – for cases discussion. At this occasion, doctors might decide trying on a therapy still unused or concluding for the need to maintain the reference. The most often requested specialties were orthopedics, angiology, neurology and dermatology. Eighty-two cases were discussed and in 18 (22%) of them, the doctors made the option for a new therapy before carrying on with the reference. In 63 of the cases (77%) there was agreement about the referral. The preliminary analysis about the potentialities of this model of tele-regulation indicates it is practical, efficient, self-sustainable and universal, providing the management of health attention, qualifying the reference, contemplating the permanent and continuous education and also receiving the demands of the health staffs and of the people, considering the several levels of the health system.

Introduction

The advancements obtained with the implantation and the development of the Unique Health System – SUS, in Brazil and in the city of Rio de Janeiro are relevant, and direct to a higher degree of growing up, by the adoption of innovations that allow its improvement as the Family Health Strategy. The
Ministry of Health, when assumed this strategy as being structural for a new model of attention, permitted positive changes in the main indicators of health, as the evaluating researches demonstrate; result also presented in several countries that invested in Primary Health Attention, with important impact in the reduction of costs of the systems, besides increasing the cover as well as the resoluteness. The persistence of challenges to the development of SUS has led to debate about the offer, production and needs of health and the organization of a health service net, which allows the access of users to necessary, humanized and qualified care, within a model of effective management. Yet, it includes the need of structuring and establishing health services integrated nets in all levels of attention, sharing among them the responsibility for the population health care. The Teleconsulting intends to attend the professionals of SMSDC, focusing the actions based on formative second opinion that permits the interface of information and management of health care, offering support at distance to the professionals who directly assist people, families and communities attended on their health needs and to quality of reference to the other levels of the system. The aim of this paper is to present the preliminary results of the developing project to verify the potentiality of the regulating function mediated by Teleconsulting, turning this function more rational, giving support to the decision in Primary Health Attention.

Methodology

The pilot project was developed in a Health Basic Unit, with six groups of Family Health, using differentiated flow charts. In order to refer to user to the secondary / tertiary level, the assistant physician makes a request in the System of Information to Regulation – SISREG III, and contacts with counselor physicians, specialized in Community and Family Medicine, via web, in the program Adobe Connect, which allows synchronic interaction, with sound and video, to the discussion of cases. In this interaction, physicians will be able to decide whether they try a new therapeutics, not yet used, or to conclude for the need to keep the reference.

Results

The preliminary results point out that specialties that had more requests for attendance were orthopedic, angiology, neurology and dermatology (Table 1). 206 cases were discussed and in 9 of them (4%), the physicians decided to try a new therapeutics before going on with the reference, and in 183 cases (89%) there was accordance to guiding. 13 (6%) refuted the second opinion (Table 2).
Conclusion

The preliminary analysis about the potentialities of this Model of Teleregulation indicates that it is practical, effective, self-supported and universal as long as it permits the management of attention in health, it
It qualifies the reference, it allows continuous and permanent education, it welcomes both the health groups’ and the population’s needs. Besides that, it considers the diverse levels of the health system.

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Trauma Telemedicine: Providing Real-Time Solutions to Real-Time Problems

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Abstract: As injury statistics and workforce shortages continue to rise worldwide, innovative solutions are of the essence to address contemporary challenges in trauma care. Telemedicine provides the unique opportunity to extend the reach of trauma and critical care specialists in real-time and regardless of distance. For the past five years, we have implemented a teletrauma program at a large, urban Level 1 trauma center. Our robust research program investigates the effectiveness and usability of telemedicine in various capacities within the trauma and critical care environment. Our objective is to incorporate telemedicine into all aspects of the trauma care continuum - from the pre-hospital setting to the operating room. We currently provide remote support to distant sites twenty-four hours a day, seven days a week. Distant sites can connect though the network for consultations when expert care is needed, to exchange vital patient information, or to participate in educational and training opportunities. Clinically, we have tested the use of telemedicine in the resuscitation environment, operating room, intensive care unit, and simulated and real mass casualty/disaster scenarios. Activities such as educational seminars, case reviews, consultations, daily patient rounding, triage, and inter-facility transfers are now being done through telemedicine. Given our location as a gateway to Latin America and the Caribbean, our scope of work allows for international collaboration as we connect with sites on a weekly basis through our main continuing medical education initiative. The telemedicine linkages and infrastructure we have developed have also supported the disaster relief operations in Haiti after the earthquake. By evaluating telemedicine solutions in both civilian and military settings, we have gained practical experiences that translate into the optimal delivery of trauma care, education and information exchange.

Introduction

Traumatic injury is a leading cause of death worldwide and providing rapid, accessible and quality trauma care remains a global health priority. It is estimated that 5.8 million people die from injury annually, with many more left with permanent disabilities [1]. Injury disproportionately affects the young, with unintentional injuries such as road traffic accidents, falls,
and drowning accounting for 90% of deaths among children [2]. What is more alarming is that these statistics are expected to rise. Road traffic accidents alone are projected to rise from the ninth to the fifth leading cause of death globally by 2030 [3]. While the demand for trauma care increases, the number of trauma experts is declining resulting in critical discrepancies in care. Researchers estimate that there will be a 7% deficit in general surgeons by 2020 and close to 20% by 2050 [4].

Telemedicine offers the unique opportunity to extend the reach of trauma care regardless of time and distance. For the past five years we have implemented a teletrauma program at a large, urban level I trauma center. Through a series of grant-funded research studies and initiatives, we aimed to use telemedicine for the treatment, diagnosis and monitoring of patients. Due to the time-sensitive nature of trauma, real-time, live videoconferencing and mobile solutions are predominantly used. This allows for live interactions with clinicians, as well as provides instantaneous availability of medical information.

As a result of newly established infection control protocols at the trauma center, the first telemedicine initiative became the use of a mobile videoconferencing system to conduct daily patient rounds—or ‘telerounds’—in the trauma intensive care unit (TICU). The TICU team began using a telemedicine cart equipped with a laptop, monitor and camera to stream live video of patients at the bedside. This innovative approach allows clinicians to discuss patients from a remote location, possibly reducing the risk of infections associated with heavy bedside traffic. Today telerounds is standard practice in the TICU, however a mobile robotic platform can be controlled remotely has replaced the telemedicine cart.

With support from the Department of Defense’s Telemedicine and Advanced Technology Center (TATRC) we received funds to study the usability and clinical effectiveness of a mobile, robotic communications platform. The robot and control station are linked via the internet over a secure broadband connection. When seated at the control station, a trained physician can drive the robot to visit and consult with patients and medical staff. Over a 16-month period, 114 teleconsultation cases were performed from the trauma resuscitation unit or operating room at the trauma center. Once notified of an incoming trauma, the remote physician connected from the control station through a laptop computer to conduct his assessment. Clinicians completed a survey after each telemedicine encounter, consisting of technical questions, user satisfaction and qualitative feedback. Effectiveness was measured by systematically comparing both the local and remote clinician’s patient notes to determine what gaps, if any, existed in regards to information exchange, judgment and clinical decision-making.
Conclusions from these studies suggest that a two-way, mobile robotic system is effective in a trauma environment and that a patient can be evaluated and managed remotely.

Besides conducting patient assessments remotely, we have also evaluated the use of mobile systems in the operating room (OR) for telementoring and consultation purposes. Using videoconferencing capabilities, the remote clinician can connect to view activities and communicate with the local. We have conducted usability testing of a variety of equipment including cameras, robots, carts and control stations. The biggest challenge in the OR is implementing systems with the appropriate view of open field surgical procedures. Systems must be compact as to not interfere with OR staff, yet be able to reach beyond the vertical height of the operating table for the remote physician to see clearly.

Finally, we have tested telemedicine videoconferencing applications for triaging patients during simulated mass casualty scenarios. Management of mass casualty incidents requires attending to multiple victims with varying levels of injury. Results from these studies show that remotely located trauma specialists are able to accurately manage and triage victims, and at times with greater accuracy than a local officer. Perhaps being removed from a stressful environment impacts the decision-making process. The technology used- mainly tablets, videoconferencing and portable cameras- for these exercises is simple, inexpensive and can be readily deployable with little training. These studies have grown to include collaborations with other state agencies and trauma centers statewide to better understand how telemedicine can assist during disaster response phases. Experiences with telemedicine during simulated mass casualty events were put to the test during the 2010 earthquake in Haiti. A telecommunications link was established via two donated portable satellite dishes and mobile telemedicine kits which allowed clinicians to triage patients more effectively, call for more medical supplies and medications, as well as consult with specialists regarding patient care.

Today our teletrauma program efforts continue to extend the reach of trauma care and education. We currently have the capability to provide remote consultations to distant sites on an around-the-clock basis. Distant hospitals can log into our network bridge and participate in existing clinical and educational programs, such as our International Trauma Tele-Grand Rounds. This program connects medical institutions across several countries through videoconferencing to discuss complex trauma cases and critical care topics.

Future directions for our trauma telemedicine program involve evaluating the effects of telemedicine on processes of care, patient outcomes, and cost.
Another area of interest is to further evaluate the use of telemedicine in mass casualty environments, particularly with mobile hand-held devices. There is still much work to be done with telemedicine for trauma, critical care and disasters. However, progress made thus far shows that the possibilities are there to permanently change how trauma care is delivered.

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References


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eLearning
Comparison of the Digital Video Transport System (DVTS) and High Definition H.323 System for Telemedicine

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Abstract: We compare the performance of the DVTS and high definition H.323 system for both slides and videos with sound. The results show that the H.323 system is superior at 4 Mbps and 1.5 Mbps to the DVTS at 30 Mbps for point-to-point connections. However, at 0.5 Mbps for the H.323 system, the quality of the two systems is equal. In a 4-point connection, the DVTS yields better video quality than H.323 at 2 Mbps ($p = 0.03$), although slides and sound show no difference. These results suggest that with point-to-point telemedicine activity, a high definition H.323 system is recommended. However, the DVTS is still a better choice for video transmission in a multipoint setting.

Introduction

The digital video transport system (DVTS) and high definition (HD) H.323 video conferencing system are two key solutions in our telemedicine activities. For ten years, the DVTS has been well accepted in the medical community for remote education, especially in Asia. Providing good enough quality for medical applications, it requires a high bandwidth network and sophisticated preparation. Meanwhile, H.323 has been used as a convenient system in worldwide teleconferences, and the recent enhancement of the H.323 system from standard definition to HD promises higher video quality in a low bandwidth network.

Methods

Experimental Design

The DVTS and HD H.323 system were compared with respect to four different settings as shown in Table I. In each experiment, the content listed in Table II was used in order.
Table I: Experimental design

<table>
<thead>
<tr>
<th>Test</th>
<th>DVTS</th>
<th>HD H.323</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: point-point</td>
<td>30 Mbps</td>
<td>4 Mbps</td>
</tr>
<tr>
<td>2: point-point</td>
<td>30 Mbps</td>
<td>1.5 Mbps</td>
</tr>
<tr>
<td>3: point-point</td>
<td>30 Mbps</td>
<td>0.5 Mbps</td>
</tr>
<tr>
<td>4: 4 points</td>
<td>30 Mbps</td>
<td>2.0 Mbps</td>
</tr>
</tbody>
</table>

Table II: Content used in the experiments

<table>
<thead>
<tr>
<th>Content</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slides</td>
<td>Seven slides with text (font size between 14 and 40) and images of endoscopy and pathology.</td>
</tr>
<tr>
<td>Videos</td>
<td>A recorded surgical video and an animation with sound (resolution 1280 x 720 pixels).</td>
</tr>
</tbody>
</table>

Equipment

The DVTS (System 1) was set up according to the DVTS setup manual (http://www.aqua.med.kyushu-u.ac.jp/eg/html/eizo/DVTSsetupEN/7.pdf). In the 4-point test, a DVTS multipoint server (Quatre: Information Service International-Dentsu Ltd., Tokyo, Japan) was used.

The HD H.323 (System 2) comprised the Polycom HDX 9006 (Polycom, Inc., CA, USA) at Kyushu University, Japan, and the Sony PCS-XG80 (Sony Electronics Inc., San Diego, CA, USA) at Cho Ray Hospital and VinaREN in Vietnam. For the 4-point test, a Multipoint Control Unit (MCU) 3545 (Cisco Systems, Inc., San Jose, CA, USA) was prepared.

A liquid crystal monitor was used for evaluation at each site.

Procedure

There were 46 participants in total: 24 medical staff and 22 local engineers. Ten participated in test 1, 10 in test 2, 18 in test 3, and 8 in test 4. The Taiwan National University in Taipei joined test 4 as the fourth station.

In each test, first the slides and then the videos were shown for 90 sec each from system one, followed by the same procedure from system two. The whole process was repeated twice. Participants were not informed of the system and rated the quality based on a 5-point scale.

The academic network was used to ensure stability, and the network performance was monitored throughout the experiments.

Statistical analysis

Results are expressed as means ± SEM (standard error of mean). A Mann–Whitney U test was used to assess the difference between the two systems. Slides were rated based on three criteria: text, image, and color,
and videos on sharpness, movement, and color. The data for comparison were derived from the sum of the three criteria.

Results

In the point-to-point connection, the HD H.323 system at 4 Mbps and 1.5 Mbps performed better than the DVTS for both slides and videos (Figs. 1-4). However, the DVTS was evaluated as being equal in quality to the H.323 at 0.5 Mbps with points of 10.9±0.5 and 11.2±0.9 for slides (p=0.79), and 11.3±0.5 and 11.1±1.0 for videos (p=0.97), respectively. In the 4-point connection, the DVTS yielded better video quality than the HD H.323.
system at 2 Mbps, whereas there was no difference for slides (Figs. 5-6). The sound quality was determined to be equal (p=0.39).

Discussion

In comparing these two technologies, several issues need to be considered. The first is bandwidth [1]. Even with a smaller bandwidth, H.323 was evaluated to be superior to the DVTS with a point-to-point connection. This can be ascribed to the recent advancement of compression technology for H.323. On the other hand, superiority of the DVTS in a multiple setting may be the result of the difference in MCUs. Quatre, the MCU for DVTS, can stably control multiple streams of 30 Mbps and the merged video images are sent back to the original sites with minimal loss of quality, whereas the MCU for H.323, which only handles much smaller bandwidths, is unable to preserve good video quality. Thus, there appear still to be some limitations on the MCU for H.323.

Cost is another important issue [2]. Although the DVTS only needs common, easily available equipment such as personal computers and audio-visual instruments, H.323 systems, especially the HD versions, are still very expensive. Nevertheless, in terms of preparation, the all-in-one structure of the H.323 system may have an advantage. Under the various conditions, it should be noted that quality control of the network is very important to achieve the highest efficiency. In this respect, the research and education network offers greater advantages than the commercial network, although it is also true that this large, stable network is only available in key academic centers in urban areas.

Besides the two systems compared here, there are other promising technologies that are currently available [3]. These include H.264 with newer compression technology, various HD streaming technologies addressing the increasing demands for even higher quality in clinical medicine, and mobile platforms for ubiquitous telemedicine in the future.

In conclusion, the HD H.323 system is recommended for point-to-point connections, whereas the DVTS system is a better choice for video transmission in a multi-point setting in telemedicine.

References


Improving Hand Hygiene Compliance by eHealth Initiatives: At Distance Education Program

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Introduction

Hand hygiene, is the most important measure to reduce HCAIs and colonization with multi-resistant micro-organisms [1]. The World Health Organization (WHO) Alliance for Patient Safety "Clean Care is Safer Care" vigorously recommends the adoption of alcohol-hand rub by all health care workers (HCWs) [2]. This practice has been adopted by many hospitals [3]. However, in most of times HCWs compliance rates to hand hygiene is disappointing [4].

Improving compliance requires leadership, collaboration, accessibility of hand hygiene products, feedback on compliance and infection rates, and individual accountability [5-7]. Previous studies found that significant improvements in compliance might be obtained during a hand hygiene campaign. However, compliance improvement is often not sustained over time, or else the follow-up was so short that long-lasting improvement could not be evaluated [8].

We conducted a quasi-experimental study, based on a remote education intervention to improve hand hygiene compliance in an intensive care unit (ICU) at Hospital de Clínicas de Porto Alegre (HCPA), a tertiary care center in Brazil.

Methods

Hospital de Clínicas de Porto Alegre, a 749-bed university tertiary level public hospital is located in the city of Porto Alegre, Brazil. Our ICU is divided in three wards, one for clinical and surgical patients with 13 beds, another for clinical and surgical patients with 11 beds, and one for coronary and cardiac surgery patients with ten beds.

Trainee nurses observe hand hygiene compliance in our hospital since 2006. The ICU staff is aware of this observation. However, they did not know the time periods when observations were made, and who was
responsible for each observation. During all morning and afternoon shifts of the five-week days, 20-30 minutes interval, observations are made. Monthly feedback (meetings and hand washing rates results posted at the entry of ICU) is given to the ward. Annually, educational meetings for all ICU staff are scheduled to reinforce the routines and review indications for hand washing. In 2009, all ICU staff was trained for the WHO five moments for hand hygiene and the educational material released was also based on these five moments.

On December 2010, a new way of education form was proposed for the ICU staff. The unit was chosen because of the observation of hand hygiene rates were already established in that unit, and the staff had already completed the on-site training program through 2006 to 2010. The remote hand hygiene compliance program was composed of three stages of a 20-30 minutes quiz formulary, which was answered during the healthcare worker shift, at any time, from December first to January 30th. If the professional scored 80% or more right answers, he was approved. Support material was available for consultation: national and international guidelines, hospital recommendations, power point presentation about the importance of hand hygiene, a video showing the steps for good hand hygiene, totaling a 3-hour course. The healthcare worker was encouraged to complete the three steps, but if he was approved in the first step he could choose to not follow to the next steps.

The proportion for hand washing compliance was made by the division of the number of hand washed opportunities by the total number of opportunities for hand washing. Time series segmented regression analysis was used to determine significant changes in level and trend of hand hygiene compliance from June 2006 to November 2010 (54 months - first stage period), and from December 2010 to November 2011 (12 months – second stage period).

One-way ANOVA analysis with two-sided Tukey’s multiple comparisons test was performed to compare mean differences in compliance between groups of professionals.

All P values less than 0.05 were considered to be statistically significant. All collected data were stored at excel and analyzed using SPSS 18.0 program (SPSS).

Results

From June 2006 to November 2010, 27,278 opportunities for hand hygiene were observed. From December 2010 to November 2011, 9,833 opportunities were observed, totalizing 37,111 opportunities.
A total of 227 professionals were included. Of these 200 (88.1%) were from the nurse staff and 27 (11.9%) were doctors. Considering the entire ICU staff 100% of nurse staff was included and 57.4% of medical staff applied for the course.

From the 145 professionals who completed a course introduction formulary data the mean age was 39.9 years, they have been working in our hospital for a mean of 10.0 years, and 92.0% of them had had any type of hand hygiene training before.

From the 227 professionals who applied, 21 (9.2%) did not conclude the course; one hundred and ninety six (86.3%) of professionals were approved; and 11 (4.8%) were not approved. For the nurses 77.5% (N=176) were approved and 74.1% (N=20) of the doctors were approved.

Overall compliance in the pre-intervention period was 55.9% (54 months) and increased to mean of 75.0% in the subsequent 11 months (P<0.001). By segmented regression analysis there was a level increase after initiation of remote education program (level change from 0.05 to 0.68; P<0.01). However, there was no increase in hand hygiene compliance thereafter (slope change from 0.068 to 0.07; P=0.67) – Figure 1.

**Discussion**

Noncompliance with hand hygiene practices is a universal problem. There is a large variation in the rate of compliance to hand disinfection, varying from 4 to 100%, with a median rate of 40%, or even lower in intensive care units (30-40%) [4]. Several factors affect compliance rates. This is the first study to determine the impact of a remote education program on hand hygiene compliance rates in a continuous way throughout.

![Figure 1. Hand hygiene compliance (%) in Intensive Care Unit, before, and after remote hand hygiene education program in December 2010](chart.png)
five years of observation.

Many factors appear to play their role in affecting compliance: physicians are associated with lower rates of compliance [5-6]; dirty tasks situations [5, 7] moments involving after patients’ contacts are associated with better compliance, also [7]. Other types of interventions that have been implicated in improving compliance include: introduction of an alcohol-based hand rub and improved accessibility to materials [8-9] and use of performance feedback [10-11]. Our intervention managed to improve compliance after five years of a constant rate. There was an immediate increase after the beginning of the education and also, these increased rates was maintained twelve months after remote intervention.

There is no definition about which is the optimal mode of education about hand hygiene that impact on increasing rates of compliance and reduction of hospital infection or multi-resistance rate, although one of the main reasons for this improve in hand hygiene was the number of professionals who were trained. All the nurse staff was trained. Considering this professional category is the one that most touch the patients we expect to have an impact in reduction of infection transmission.

We continue to observe and give feedback to the units in relation to hand hygiene. This might have contributed to the maintenance high rates of adhesion accomplished by the remote course. Van de Mortel et al., proposed an optimum time to repeat performance feedback in order to maximize hand hygiene compliance. In their study, compliance decreased significantly after 12 months of feedback, suggesting that feedback should be repeated at least within 12 months after last intervention [10].

Our study has some limitations. Despite the daily observation, each shift observation covered only half an hour of opportunities to hand hygiene. The differences among each observer could have affected accuracy. The hawthorn effect could have resulted in a super estimation of real compliance data. However, the continuous and the power of the amount of observations made, may have limited the impact of these potentially biases.

In summary, a remote education program in 2010 improved hand hygiene compliance in our ICU. Continuous observation enabled us to give systematic feedback to the wards, which contributed to maintenance of compliance after intervention.

References


Infoculture: A Barrier for the Access to Permanent Education?

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Abstract: Telehealth Brazil Project offers seminars, discussions and answers online, based on evidences about different issues on health. This study intends to evaluate how the surgeon-dentists registered in Telehealth-RJ use the technologies of information (TI) available. During the phase of implementation of the project, from 2008 to 2009, questionnaires with open and closed questions were applied to all the active dentists at the health units. Data were analyzed using SSPS® 17.0.1. 66 questionnaires were obtained. The average age was 31.43 years (±6.347). 66.7% (n=44) of the dentists were females. When asked about the TIs they used for qualification and uploading knowledge in health, 80% stated they employed an e-environment (sites, periodicals), 87% used press materials (books, magazines), 70% took part in congresses and lectures, and 41% used to discuss cases with their colleagues and also in study groups. Considering the frequency of access to Internet for study, 21.5% used to make it once a week and 55% once a month. This frequency was statistically associated to the age of the participants. 98% of the interviewed has got an e-mail box and 43% open it two or three times a week. 32.3% of the professionals never accessed the Virtual Health Library (VHL-BIREME) homepage, the same happened in relation to the Ministry of Health homepage (27.7%), both Brazilian sites. The professionals have got the possibility of permanent education without shifting, what promotes the improvement of resolutiveness and quality of the service at basic attention. For a better participation of the target-audience, however, it is important to develop this new methodology of information and education. At the moment of implementing the program, the access of the professionals to e-tools for information was satisfactory, although it is necessary to promote the stimulus to groups still not totally accustomed to those important e-tools for permanent education.

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Introduction

The Ministry of Health published on February 14th, 2010 the Edict number 402. The latter institutes a nation-wide, Brazil Telehealth Program giving support to the Family Health Strategy, considering the need to implement the Program from the evaluation of the Telehealth Pilot Project in Support to Basic Attention, established by the Edict number 35 from January 4th, 2007; and taking into consideration the importance of improving the quality and increase the participation through the support to professional decision. Yet, in October 2011, two Edicts were established. The first one, No. 2.546, redefined and extended the Program that turned out to be named as Telehealth Brazil Nets National Program. The second one, No. 2.554 established the requalification of Health Basic Units Program, viewing the improvement of attendance quality, the extension of the scope offered actions by these groups, the changing of attention practices and of the work process organization, from the offer of Teleconsulting, Formative Second Opinion and Telediagnostic [1].

Although one may talk too much about the usage of Telemedicine and Telehealth to improve the effectiveness of a health system, as well as the benefits that they may generate, it has room to remember a fundamental fact: the new technologies only get the maximum of their potential when there is a commitment of human resources in their use and an effective integration among participant institutions, in the sense of adding efforts so that results are multiplied [2-3].

The coming of information and communication technologies (ICT) brought new perspective to education at distance (EAD). However, using the ICT as a support to EAD only placing the students to face information, problems and objects of knowledge, may not be enough to involve them [4-8].

Methodology

Retrospective study by means of analyzing questionnaires that were applied to surgeon-dentists in activity at the Telehealth Advanced Locals in Health Basic Units during the phase of implementation of the Telehealth RJ project, between 2008 and 2009. The semi-structured questionnaires with open and closed questions looked for information about the professional profile, the academic education and the access to the Information and Communication Technologies (ICT). Data were analyzed in terms of frequency, percentage, and by the qui-square test, applying the SPSS (17.0.1).
Results

A total of 66 professionals answered the questionnaires. The average age was 31,43 (+/- 6,347) years old, 66 (44,3%) of them were men. As to the means used in modernization of knowledge in health and qualification, the results can be observed in table 1.

Table 1. Means used to modernize knowledge in health

<table>
<thead>
<tr>
<th>Means</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic mean</td>
<td>52</td>
<td>80%</td>
</tr>
<tr>
<td>Printed: magazines, books</td>
<td>57</td>
<td>87,7%</td>
</tr>
<tr>
<td>Congresses, courses, speeches</td>
<td>46</td>
<td>70,8%</td>
</tr>
<tr>
<td>Groups of study, colleagues discussions</td>
<td>27</td>
<td>41,5%</td>
</tr>
</tbody>
</table>

The frequency of access to the Internet for studying may be observed in table 2. It was confirmed that for those who were born after 1975 the access to the Internet for qualification showed to be more frequent, being this association statistically meaningful (p<0,05) (graphic 1).

Table 2. Frequency of access to the internet for studying

<table>
<thead>
<tr>
<th>Frequency of Access</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>14</td>
<td>21,5%</td>
</tr>
<tr>
<td>More than once a week</td>
<td>19</td>
<td>28,8%</td>
</tr>
<tr>
<td>Once a week</td>
<td>17</td>
<td>26,2%</td>
</tr>
<tr>
<td>Once a month</td>
<td>12</td>
<td>18,5%</td>
</tr>
<tr>
<td>Did not answer</td>
<td>4</td>
<td>6,5%</td>
</tr>
</tbody>
</table>

Graphic 1. Association between frequency of access to the internet for studying / qualification and birth
In relation to the access to the pages of Ministry of Health and of the Bireme for studying, the percentage can be observed in graphics 2 and 3.

Graphics 2 and 3

Conclusion

One may conclude that, at the time the program was implemented, the access of professionals to the electronic tools to obtain information showed to be satisfactory, being necessary to promote the stimulus for one group that is still less used to this important tool of permanent education.

References

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Laparoscopic Surgery Education and a Multinational Project for Distance Learning

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Abstract: E.S.L.S. (European School of Laparoscopic Surgery) in Brussels and the co-organisers İSTEM (İstanbul University Continuing Medical Education and Research Center) and ELCD (Turkish Association for Endoscopic Laparoscopic Surgery) in İstanbul built a Multi-National Project for teaching at distance videoscopic surgery to different applicant countries, particularly the Euro-Mediterranean ones, with the supports of the "webtelesurgery.com" platform. The main objective is to promote the exchange of knowledge about videoscopic surgery and to establish a surgical network with a good-quality moving image over broadband internet access. Having the "Portable Wireless Live Video/Audio Transmission System (IMD) and using Digital Video Transport System (DVTS), the audio and video content from operation room can be transmitted easily to the remote sites. Surgeon applicants who have a computer and basic internet connection will be easily connected online to the operation and conference rooms, and follow in real time and even use it interactively. Low-bandwidth, internet-based telemedicine is effective and inexpensive. Surgeons living in remote areas, distant countries and especially those with limited resources can follow the videoscopic courses, meetings, and live surgeries organized by experienced centers, on their computer screen, in real-time and interactively.

Introduction

Videoscopic surgery is one of the most important innovation in surgery, and has brought great benefit to patients thanks to its minimally invasive character. The procedure is done without opening the abdomen or chest, thanks to a miniature camera and special instruments in small diameter. Using the mini incisions of 3-15 mm instead of large incision. The postoperative pain and complications are minimal, and the patient is able to leave the hospital quickly and may return to work as soon.

Videoscopic surgery was popularized with the first laparoscopic cholecystectomy that performed Dr. Mouret in Lyon, in 1987 and this field
was rapidly developed. There was great progress both technically and in the number and diversity of operations. Nowadays, it is possible to achieve almost all operations via videoscopy by experienced surgeons.

From the outset, the training and education of this new surgery were the first to solve problems for novice surgeons. The initial courses first, then the advanced courses, were practically the only way to learn this new surgery, for senior and junior surgeons who were trained previously in conventional surgery. Then the videoscopic surgery was taught during the internship, so the initial courses were much reduced.

To this day, there are several training centers in different countries which continue to teach and train videoscopic surgery. For example, E.S.L.S. in Brussels and ISTEM & ELCD in Istanbul are two examples among all the centers.

The European School of Laparoscopic Surgery-E.S.L.S. at the Saint-Pierre University Hospital in Brussels directed by the Professor Guy-Bernard Cadière exists for more than 18 years and is one of the oldest and the most important School of laparoscopic surgery in Europe. The very best experts of the world have come to teach there. Since its beginning, over 5000 fellows and surgeons have followed the courses. For years these courses are endorsed by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) and by the European Association for Endoscopic Surgery (EAES). The courses are also transmitted at distance in University Centers around the world including ‘Third World Countries’.

The Medical Education and Research Center of Istanbul University-ISTEM directed by the Professor Levent Avtan, is one of the best known, being a very active academic center for telemedicine, education and teaching at distance in the country. The center has a meeting room with telemedicine links to the operating rooms of the hospital. It is situated in Istanbul Çapa Hospital and is connected to other hospitals in Turkey and in different countries abroad in order to allow organization of periodic educational courses and others activities.

The Turkish Association of Endoscopic Laparoscopic Surgery – ELCD, whose President is Professor Cavit Avci, a pioneer in videoscopic surgery, has a leading position to teach and train the minimally invasive surgery in Turkey.

ISTEM and ELCD have decided to teach surgeons how to perform minimally invasive surgical procedures since 1992 in Turkey. They organized periodical videoscopic surgery courses (basic and advanced) and have trained more than a thousand of surgeons giving each of them a certificate endorsed by the Istanbul University and the European Association for Endoscopic Surgery (EAES). In basic laparoscopic surgery
courses, it is important for the participant to first have workshop practice in a trainer box as well as live surgical practice on animals like pigs, before performing on the patients.

On the other hand, the telecommunication technology has made great strides in recent years. Tele-teaching and distance learning has taken a great importance and was well suited for the education and training of surgery. Accordingly, in the last ten years, applications of tele-conferencing, tele-assisting and tele-mentoring have been successfully used, during our videoscopic surgery courses.

In tele-mentoring application, the surgeon performing the laparoscopic surgery on a patient for the first time is supervised by an experienced surgeon via visual and audio connection. Thus, the operating surgeon who has less experience, can benefits from the knowledge of the experienced surgeon by interacting with him, in real time connection. In this way, the practicing surgeon is gaining experience on the new techniques while performing live surgery in a safe and secure way. On the other hand, the new laparoscopic techniques performed on patients, by expert centers like “European School of Laparoscopic Surgery in Brussels” and other centers, are shown and taught to surgeons from distance places by using online tele-transmission system, during the advanced courses.

Methods- Organisation

As the two training centers in Brussels and Istanbul, after having sufficiently test and experiments, we decided to realize a Multi-National Project for teaching at distance videoscopic surgery to different applicant countries, in particular Euro-Mediterranean, with the supports of “webtelesurgery.com" platform (Fig.1).

“Webtelesurgery.com” is an online free platform for training-education-communication-participation of surgery, especially videoscopic surgery. It has been created by the Prof Cavit Avci and his team of ISTEM in Istanbul and is managed by an “International Educational and Evaluation Board”. Its main objective is the edit and dissemination of medico-surgical knowledge, in collaboration with major Scientific Associations and Centers of Excellence in Europe and others. The choice of transmission method is “a
We are connecting the operating rooms and conference room via hospital network which will be connected to our “Portable Wireless Live Video/Audio Transmission System (IMD). We usually use Digital Video Transport System (DVTS) to convert digital video signals directly into Internet Protocol format without any analog conversion. It is the key to be sure that the quality of the image won’t be lost. The DVTS is a software application used for sending and receiving digital video streams through the internet. It uses differentiated data transmission to send full-resolution video images to remote sites. It is an open source freeware, that can be downloaded from a web site.

The video content will be sent via the broadband internet dedicated, minimum 2 Mbps, to our main servers, and then, everything will be distributed to individual receivers (Fig.2). Surgeon applicants having a basic internet connection must register in advance to obtain an access code. With this code, they will be easily connected online to operation and conference rooms and thus follow in real time and even interactively (if they want they can ask questions by phone or chat).
Summary

Today, videoscopic surgery is widely used in the world and its trainings still have a great importance. Telemedicine and Distance Education have a predominant role in the training of surgeons particularly for videoscopic surgery. European School of Laparoscopic Surgery (E.S.L.S.) in Brussels and ISTEM & E.L.C.D. in Istanbul, are well-known in their respective countries, about Videoscopic Surgery. Those 3 institutions have recently created a project about tele-training and tele-teaching. They have made a contract with MMESA (Mediterranean and Middle Eastern Endoscopic Surgery Association) for making videoscopic surgery in between distanced places. The courses and the activities of education in well known European institutions, using webtelesurgery.com platform, are being sent by broadband internet system to the countries of MMESA. The applicant surgeons can be connected very easily to be able to use the courses and trainings at a very low cost effect, needing a computer and simple internet connection. This is why we are expecting a very good progression and continuation for this surgical method.

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Additional info: Dr. Avci is a Chief Editor of: Videoscopic Surgery-Textbook (in Turkish); Endoscopic-Laparoscopic and Minimal Invasive Surgery-A periodic Journal (in Turkish) and The Surgical Practice Series “VIDEO-ATLAS”. He is a co-editor of The World Journal of Video Surgery (Regional Editor for Turkey); Hepato-Gastroenterology (Regional Editor for Turkey); Journal de Pathologie Digestive (Correspondant étranger) and The European Journal of Coelio-Surgery (Scientific Commity).
Proposal for a Course Script and Model in a Virtual Learning Environment

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Introduction

Professors, professionals and students involved in Distance Education (DE) usually do not have the structure and dynamics for the efficient use of technological tools, such as software and systems, to harness their full potential [1]. This study presents a script to offer an online course based on a simplified model for the use of a VLE.

Method

This research methodology consisted of the use of nursing content to offer an online course as one part of a workshop for undergraduate nursing students in Brazil and Portugal, where the main tools available in the Moodle VLE were explored. In the process of constructing and transforming the content developed in partnership with faculty and technical staff, the stages of production were recorded and specific procedures to be performed by faculty, students and technical staff were determined. The procedures, steps, estimated timeframes for accomplishing the activities, formats for disseminating the content and evaluation criteria were analyzed, to support the creation, development and dynamics of the structural plan. While the course was offered, the content was gradually addressed, according to a previously established schedule, and the teaching staff was guided to participate in interactions with students and other team members. The planning had limitations that were considered for the development of the product.

Results

The study’s final product is a model of the structure and dynamics of an online course to be used in teaching institutions with the possibility of establishing guidelines for DE programs. The experience showed that the creation of online courses requires the incorporation of recommendations,
parameters and the definition of metadata in detail following the international standards used in DE. We recommend creating the module ambience where students are able to work on the activities used in the applied course. The activation of the content can be total or partial. We also recommend that tutors be present in all the synchronous activities and on a daily basis verify that the participants access the course and report ‘nonattendance’ to professors. For that, one can use the tools ‘activity report’ and ‘access statistics’. The color patterns and positions of titles and subtitles were already created in the environment; only the content of the labels needed to be changed. In the study, the exercises schedule was created in the model with previously established evaluation criteria and can be freely modified by the professor or the local administrator at the professors’ discretion. The templates already included spaces reserved for visual identity (label) and text concerning usage rights. All the files for guides and content models are editable but it is recommended to export them to PDF format before including and activating them for students. In this way, installing specific text processors in the users’ machines is not required and original content is protected from adulteration. The model is limited to five types of interactive activities but the Moodle VLE permits many other formats of activities. The use of the main tools is recommended as well as freely including content for each application of the model. The model cannot be used directly with other VLEs but it can be adapted, requiring only that the indication of paths and format of the tools be altered. The models of the documents are in standard PDF format compatible with any VLE. Activities were developed according to the principles established by IMS and Advanced Distributed Learning [2] in agreement with the usability recommendations of Nielsen [3], Nielsen and Loranger [4], Nielsen and Norman [5], the ergonomic criteria and interface design of Scapin and Bastien [6] and Bastien [7] and technical standards ISO 9231-11 [8]. This process resulted in a model with a simplified format, simplified work process in an optimized number of steps, direct-use interactive tools, synthesized content and informative material with clear and objective language. Errors were identified in the content preparation phase to be included later in the VLE and corrected during the test phase. However, the need for a better-structured instrument to record and control tests emerged. Even though the failures were resolved, there was a need to structure the processes using complementary control instruments together with a checklist. The solution used in the model was a checklist for the actions taken by professionals, technicians and students, but we consider its application to be viable together with content management software. Failures were detected during the dynamics of the event in which one part
of the content became hidden and students could not view it. This failure occurred due to a mistake that occurred when one part of the content was updated. To avoid this type of event, we propose verifying the checking procedures and then repeat the tests. The daily verification of course progress and participant attendance was an important task performed by the technical administrator. This procedure enabled the detection and rapid correction of failures without impeding student access. The evaluations performed by students were positive, though some reported problems in the VLE’s automatic registration and difficulties uploading files containing tasks. The problem was solved by the local administrator who was informed by one of the professors to whom the students first reported it, which indicates the need for everyone to be involved in detecting the difficulties reported by students and ensuring timely responses to avoid demotivation and increased ‘nonattendance’. The tool used to include readings was inadequate when we wanted to know who accessed the readings and how many times. The developed model proposes the individual inclusion of readings as “tasks” and not as “labels” as originally used. This change ensures individual records of when readings are accessed and supports professors as they compose the bibliography for the course and to verify the level of student motivation. We verified that the instruments and methods of evaluation used were appropriate and the results obtained were also appropriate for the direct analysis of data. The difficulties found by the technicians were related to a lack of clear recommendations to professors and students based on better-structured processes. These difficulties were addressed with the development of technical recommendations documents, workflow design, and with the construction of rapid reference guides. Even though the study was conducted with a population of students, the reports of professors were also recorded. They verbally expressed some difficulties, especially in relation to the identification of interactive tools and how to use them, though in general we found the use of the VLE to be productive and a low level of difficulty was identified in the operation of the course. With regard to the infrastructure used, the University of São Paulo has software, hardware and data network in quantity and quality sufficient to provide online courses to the academic community because it maintains equipment within the market’s most current standards and network bandwidth above that found on average in Brazil. The technical teams of the computer centers and units are well structured and are located close to users and focused on technical support while simultaneously performing other technical functions related to technology utilized. There were initial difficulties concerning the recognition and implementation of technical procedures, which indicate the need to improve work processes, training the team, and adapt it to support
DE. The size and format of material was appropriate and presented technical demands in relation to access compatible with the students’ places of access. We verified that students were successful in independently accessing equipment, places and bandwidth used. Instructional design was performed without previous training and by people who do not specialize in this function. This was a deliberate choice in order to demonstrate the possibilities of adapting functions in teams that are not completely structured with well-defined positions. We also observed that the strategy of maintaining a registration list in an electronic registration system outside the VLE ensured better communication with the students before offering the course. The information obtained in the electronic form complemented data collected in the VLE registration tool and enabled sending notifications and instructions before the course started when students did not even have access to the system. Personal contact with professors within the classroom who disclosed in advance that the VLE course would be offered and contributed to the process of divulging the course’s existence and aroused the interest of students to the course. Therefore, it is essential, whenever there is a possibility to personally publicize the courses, to use this strategy and collect data on those interested and clarify the course’s objectives. For the application of the model to be successful, it is essential to have an organizational structure with a technical-administrative body and instructional design area for manipulating the content and to guide professors in the use of VLE and the online course. The script and model developed in this study serve a specific use in the Moodle environment. However, we believe its use is viable in other VLEs, with some adaptations, because we identify significant similarities in the functioning of processes of registration, availability, and monitoring of course dynamics among the various systems.

Conclusion

The script and model developed in this study can be applied to different modalities of courses and fields of knowledge and serve for specific use in the Moodle environment. We believe, however, that it is viable for other VLEs after some adaptation, since there is significant similarity among the various systems in the functioning of processes of registration, availability, and monitoring of course dynamics. This study does not address the application of the proposed model after the inclusion of improvements indicated in the script. Hence, there are possibilities for empirical studies addressing the evaluation of this model and comparing it with the various other models of distance learning courses.
References


Telehealth as Professional Update: The Experience of Telehealth-UERJ-RJ- Brazil Networks Program in Distance Education Courses

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Abstract: Introduction and aims: UERJ-RJ Telehealth Center uses telehealth as a means of service and distance education. This study aims to present the experience of sharing distance courses for updating of the health professionals who take part into Telehealth UERJ Networking. Methodology: Distance courses exclusively, running 15 hours, self-managed by the students, certified by Rio de Janeiro State University (UERJ). Qualitative and objective evaluations were made at the end of the course for certification. Results: 20,369 enrolments were taken within the 29 courses offered from June 2010 to December 2011. Among the candidates, 47% were nurses and 14% physiotherapists. The index of absenteeism was 88% among nurses, mainly. There was amendment of around 1% of the participants considering the qualitative evaluations. Conclusion: Telehealth, as a distance education tool, is progressively providing changes of attitude into the several health careers.

Introduction

According to the World Health Organization (WHO), Telemedicine and Telehealth comprehend the use of technologies of information and communication to the exchange of effective information for diagnosis, prevention and treatment of diseases; add to this the permanent education to health services suppliers, and also their use for research and evaluation purposes. The goal is improving the health professional attendance to the population and communities through professional training and refresher courses in health area.

Brazil is a country with continental dimensions, and for this reason it still presents asymmetry concerning health services supply. That is why Telehealth is proving to be a better solution for shortening distance, breaking geographical frontiers, reducing the real time attendance spent, via specialized teleconsulting, and providing classes, training, professional development and courses at distance, so that the professional does not have
to move to take them. For this purpose, Brazilian Federal government has launched two programs nationally integrated in Telehealth: one, the University Networks in Telemedicine (RUTE) [1], responsible for interconnecting university hospitals with national and international centers of excellence. RUTE is supported by the Brazilian Ministry of Science and Technology and Innovation (MCTI). The other program is Telehealth Brazil Networks [2], supported by the Brazilian Ministry of Health uniting the University Nucleus of Telehealth to centers and remote municipality health unities. This Brazilian Telehealth Networks is enabling and refreshing the professionals and also qualifying the medical attendance at SUS (Brazilian Unified Health System) using mainly the web as a means of communication among groups. At the moment, Brazilian Federal Government together with the Ministry of Communication is implementing the PNBL, i.e., a program intending to provide broadband to 40 million Brazilian residences until 2014.

UERJ Telehealth Center (placed in the State University of Rio de Janeiro) leads all the governmental programs in Telehealth, making available several tools for synchronous and asynchronous communication among health professionals. At the scope of Telehealth Brazil Networks, the UERJ-RJ Telehealth Center offers many activities concerning tele-education, such as training and seminars by teleconferences, highlighting the university extension distance courses for professional refreshing and recertification. This work aims to present the positive outcomes of implementing distance courses for professional qualifying purposes, considering the Telehealth context into the Brazilian governmental program.

Methodology

Distance courses, organized exclusively in a virtual learning environment [4], were implemented using open source software (Moodle, Martins Dougiamas, Perth, Australia). The courses were divided into two subgroups: top-level professionals and mid-level, not being allowed access to mid-level to upper level courses. They run 15 hours, included 10 recorded classes and bibliography material, and were managed by the students themselves; they were certified by Rio de Janeiro State University (UERJ). Qualitative and objective evaluations were made at the end of the course for certification.

Results

20,369 enrolments were taken within the 29 courses offered from June 2010 to December 2011. Among the students, the nurses and the physiotherapists were the prevalent [Grafic 1]. Others health professionals related could access the mid-level courses as: dental hygienist, health
assistant, pharmacist, speech therapist, physical education instructor, psychologist, dietitian and food technician, occupational therapist and music therapist. The index of absenteeism was 88% among nurses, mainly. There was amendment of around 1% of the participants considering the qualitative evaluations. 73.2% of the partakers were in remote municipalities, away from the capitals of Brazilian states.

Conclusion

Telehealth, as a distance education tool, is progressively providing changes of attitude into the several health careers mainly in remote locations. It also promotes interactivity for clearing up any doubts by teleconsulting, as well as the creation of a Telehealth network.

References

[3] Teleheath Center of State University of Rio de Janeiro (UERJ), www.telessaude.uerj.br
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Telehealth UERJ RJ-Brazil Networks: The Impact of Using Technologies for Teleconsulting

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Abstract: Introduction and aims: Telehealth UERJ is working on the perspective of “WHO” for service and second opinion in health for remote areas, using technologies of information and communication. This study intends to present the outcomes obtained and the differences when using synchronous or asynchronous teleconsulting. Methodology: for asynchronous teleconsulting a web system was developed and for the synchronous, the software Adobe Connect Pro, installed into a web server, was employed. Results: from March to December 2011, 1,128 synchronous teleconsultings and 843 asynchronous were requested, reducing in around 67% the need to guiding patients to primary care. Conclusion: Telehealth is allowing an improvement at health systems through the acceleration of processes and reduction of geographic limits.

Introduction

Telehealth Center [1] of State University of Rio de Janeiro (UERJ) implemented solutions for teleconsulting, according to the guidelines of Telehealth Brazil Networks Program [2], under the main perspective of primary attention in public health. For this purpose, several means for synchronous and asynchronous communication among participants of the area were made available. Telehealth UERJ is working on the perspective of WHO (World Health Organization) for service and second opinion in health for remote locations, using of information and communication technologies. This study goal is to present the preliminary results by using teleconsulting and also pointing the differences when using synchronous or asynchronous teleconsulting.

Methodology

The IT (Information Technology) team has developed a software for asynchronous teleconsulting on the web. This software was placed at a virtual environment of an open source software (Moodle, Martins Dougiamas, Perth, Australia) customized by Telehealth Center IT team (Figure 1), in order to optimize the register and the single access of the...
users to teleconsulting a pedagogic material, such as recorded classes and seminars by teleconference and distance courses.

For synchronous teleconsulting the software Adobe Connect Pro, installed
into a web server, was employed (Figure 2). The access to synchronous teleconsulting system was free, and the answers returned to the participants in no more than a couple of days. A previous scheduling for synchronous teleconsulting was made by teleconsultors of UERJ Telehealth Center.

Results

From March to December 2011, 1,128 synchronous teleconsultings and 843 asynchronous were requested, reducing in around 67% the need to guiding patients to primary care. A qualitative evaluation of teleconsulting showed the opinion of the professionals who used it; 78.9% said it is an adequate supporting tool; 3.2% found it inadequate, and the others did not answer the questionnaire.

Conclusion

Telehealth is allowing an improvement at health systems through the acceleration of processes and reduction of geographic obstacles.

References

[1] Telehealth Center of State University of Rio de Janeiro (UERJ), www.telessaude.uerj.br

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Telehealth UERJ RJ-Brazil: The Impact of Using Technologies for Health Education

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Abstract: Introduction and aims: Telehealth UERJ is focusing at the perspective of “WHO” for service, education and collaborative research using technologies of information and communication. This work intends to present the impact of using telehealth as a support for countries in development. Methodology: Qualitative and quantitative data of the projects supported by UERJ’s Telehealth Center were analysed from May to December 2011. Results: 16,554 health professionals are registered at Moodle platform: 16,445 are Brazilian and 109 are foreigners from Argentina, Bolivia, Canada, Chile, Colombia, Germany, Spain, Panama, U.S.A., Portugal, Belgium, Peru, France, Romania, Switzerland, Guatemala, Guinea-Bissau, Hong Kong, Russian Federation, Malaysia, Angola, Mozambique, Belize, Bhutan, Cape Verde, Afghanistan, Costa Rica, and Italy. Most of the professionals were nurses (36%), physiotherapists (21.3%), nutritionists (8.75%), doctors (7.69%), dentists (2.45%) and others, as psychologists and social assistants (23.51%). All in all, there are 445 recorded classes, 31 distance courses, 93 seminars on particular topics and 4 recorded congresses. Conclusion: Telehealth is modifying positively the paradigms for health education.

Introduction

UERJ Telehealth Center [1] (placed in the State University of Rio de Janeiro) leads all the Brazilian governmental programs [2, 3] in Telehealth, making available several tools for synchronous and asynchronous communication among health professionals. At the scope of Telehealth Brazil Networks, e.g., UERJ-RJ Telehealth Center offers many activities concerning tele-education, such as training and seminars by teleconferences, as well as recorded distance courses for professional refreshing and recertification. The materials as a whole are recorded and made available on a virtual learning environment [4] implemented, using an open source software (Moodle, Martins Dougiamas, Perth, Australia) with free and exclusive access for health professionals. This work goal is to present the impact of using telehealth as a support for countries in development focusing at the perspective of WHO (World Health Organization) for
service, education and collaborative research using information and communication technologies.

Methodology

Brazil is a country with continental dimensions, and for this reason it still presents asymmetry concerning health services supply. That is why Telehealth is proving to be a better solution for shortening distance, breaking geographical frontiers, reducing the real time attendance spent, via specialized teleconsulting, and providing classes, training, professional development and courses at distance, so that the professional does not have to move to take them. For this purpose, Brazilian Federal government has launched two programs nationally integrated in Telehealth: one, the University Networks in Telemedicine (RUTE) [1], responsible for interconnecting university hospitals with national and international centers of excellence. RUTE is supported by the Brazilian Ministry of Science and Technology and Innovation (MCTI). The other program is Telehealth Brazil Networks [2], supported by The Brazilian Ministry of Health uniting the University Nucleus of Telehealth to centers and remote municipality health unities. This Brazilian Telehealth Networks [3] is enabling and refreshing the professionals and also qualifying the medical attendance at SUS (Brazilian Unified Health System) using mainly the web as a means of

Figure 1: Virtual environment of learning including recorded tele-education activities and a teleconsulting asynchronous system
communication among groups. At the moment, Brazilian Federal Government together with the Ministry of Communication (MC) is implementing the PNBL, i.e., a program intending to provide broadband to 40 million Brazilian residences until 2014. On the other hand, globalizing Telehealth demands cooperation and integration among countries. For this, teleconference systems, by web and videoconferences, were used. All the synchronous activities have been recorded and organised in a virtual environment of learning [4] together with a teleconsulting asynchronous system (Figure 1). Data were analysed qualitative and quantitatively, including all the projects supported by UERJ’s Telehealth Center from May to December 2011.

Results

16,554 health professionals were registered at Moodle platform until December, 2011: 16,445 are Brazilian and 109 are foreigners from Argentina, Bolivia, Canada, Chile, Colombia, Germany, Spain, Panama, U.S.A., Portugal, Belgium, Peru, France, Romania, Switzerland, Guatemala, Guinea-Bissau, Hong Kong, Russian Federation, Malaysia, Angola, Mozambique, Belize, Bhutan, Cape Verde, Afghanistan, Costa Rica, and Italy (Figure 2). Most of the professionals were nurses (36%), physiotherapists (21.3%), nutritionists (8.75%), doctors (7.69%), dentists (2.45%) and others, as psychologists and social assistants (23.51%). All in all, there are 445 recorded classes, 31 distance courses, 93 seminaries on particular topics and 4 recorded congresses.
Conclusion

The use of Telehealth is modifying positively the paradigms for health education, especially in what concerns to the real implementation of a world-wide Telehealth network.

References

[1] Telehealth Center of State University of Rio de Janeiro (UERJ), www.telessaude.uerj.br

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The Art of Learning and Integrating: Improving Quality and Affordability of Health Care through the eHealth Package

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Introduction

Over the past years, IICD and its partners gained valuable experiences with applying ICT to overcome various challenges in sector health in Africa, including Tanzania, Ghana, Malawi, Mali, Uganda, Zambia and Zimbabwe. The major challenges in the implementation of both telemedicine and health management information systems (HMIS) in health facilities can be summarized as a “fall back” from enhanced performance with the eHealth applications to a lower level. Happily, this is not the general pattern, but there are a number of incidences and they need to be addressed. In doing so, a number of new and important insights were developed that are relevant to ICT development in the health sector world wide.

In this study, we focus on Tanzania, where IICD works closely together with the Ministry of Health and Social Welfare, the district health authorities in Mwanza and Christian Social Services Commission and the Evangelical Lutheran Church. IICD assisted in the development of a national eHealth strategy and HMIS applications and telemedicine applications in over 30 health facilities. Mobile and tablet applications are under development and focused at dispensary and community level. The analysis of the Tanzania case is based on observation, interviews, four focus group sessions and two partial studies on a number of actual cases.

Influences That Reduces Performance

HMIS implementations are based on a participatory change management approach. This approach was developed in Tanzania [1-2]. This proved useful and resulted in a high level of ownership with the staff of the health facilities. As a result the HMIS operates well, it generates substantial additional income, reduces losses, eases work and results, according to the patients, in improved quality of care and shorter waiting times. The approach was also tested in Malawi with similar positive results.
Nevertheless in a number of cases, the performance started to deteriorate over time. A system perspective helps to understand the reasons. Health care can be conceptualized as a system. Change within a system always calls for reactive forces that search to pull back the system to the previous status quo, either conscious or unconscious and often the outcome of the a myriad of interactions. This is even logic, as it also explains the stability of the system. What main influences could be detected that pulls back or inhibits performance improvement? A quick and not exhaustive scan learns that the main negative influences are the following:

- External influences like electrical power problems, or lack of medical supplies at national level;
- Insufficient clarity in business case. While clear for HMIS, this especially applies to telemedicine, not only about how costs and benefits are distributed, but also the rules and procedures as well as other incentives for professionals like telemedicine being a part of certification and continuous professional development;
- Staff turn over, insufficient training etc.
- A whole set of influences can be contributed to reactive forces that search to restore the previous situation. These influences can be attributed to malicious behavior like new management moving in that prefers a lack of transparency for their own purposes. But negative influences also come forth from the mismatch between the ‘old system’ and the new one. For example national procedures that are still old-fashioned, like the health reporting that uses different colored sheets, which is less easy to reproduce exactly by computer. A very important aspect is that successful eHealth applications require paradigm and attitude shifts from the health workers, especially medical doctors. Shifts include from “isolated” to team player and more emphasis on evidence based, feedback and professionalism. As the role and the status of the medical doctor are partly culturally defined, this change requires a redefinition of identity. In education, this also proofed for teacher a not so easy task. Another aspect is the changes in organizational dynamics due the ICT applications.

There are also positive influences that stimulate the use of eHealth applications like HMIS and telemedicine these include the potential financial gains, to ease work and staff shortages, the need for health information for planning at district and national level, the attractiveness of ICT for staff, especially younger health workers.

By better understanding both negative and positive influences, IICD was able to conceptualize a new, improved approach towards HMIS and telemedicine that takes these influences into account: the eHealth package.
Concept of the eHealth Package

The eHealth package builds on IICD’s experiences with applying ICT-based solutions to the health sector. The novel aspect is to embed the participatory ICT design approach in a comprehensive organizational change models. This results in careful scaffolding of different eHealth solutions and organizational interventions in one comprehensive package. Moreover, the need is to develop a sound business case and to address the positive and negative influences in the external environment. This conceptualization is elaborated below.

Embedding the Participatory ICT Design Approach in an Organizational Change Model

From its experience and from literature, IICD had developed a very successful participatory ICT design methodology for sector-wide ICT applications, the so-called Round Table process [3-4]. This resulted in the smooth implementation an eHealth application like HMIS. But the aforementioned problems with continuous performance improvement, taught that more has to be done. This especially applied for telemedicine for which the business case is less clear and which requires substantial organizational and procedural changes within a health facility and some specific institutional changes in the wider environment. Therefore the participatory ICT designs approach in an organizational change model. This generic organizational
change model [5] recognizes that performance is a function of changes in the characteristics of:
- Service delivery and support processes;
- Culture, sense making and human interactions in general;
- Human resources;
- Organization and leadership.

Combining Best Practices with eHealth Applications and Organizational Interventions

These changes cannot come overnight, but have to be nurtured in a mutually reinforcing process. eHealth applications are supportive in this process. For example HMIS addresses directly support processes of service delivery. Using a participatory design approach influences strongly culture, sense making and human interactions in general - an area of great importance that stimulates hierarchy and isolation, or team work and continuous quality improvement. Telemedicine, on the other hand, complements human resources along with expert systems on mobile phones. Therefore the two eHealth applications should be scaffold to assure the proper organizational conditions are in place and to create a mutually reinforcing change processes.

The eHealth package is the best solution to bring the desired change about. HMIS helps to structure management, provides evidence of improvements and functions as the financial engine for eHealth applications as it generates substantial additional income. Based on the infrastructure and achievements generated through HMIS, telemedicine and eLearning can be incorporated in the daily operations in a professional manner. This learning trajectory is reflected in the step-wise approach of the eHealth package. Besides eHealth applications additional interventions are required like peer learning, structured management reports, focus groups and change teams contribute to a bottom up process of change and much desired change in attitudes like a move towards team work and quality of care. Bench marking provides a mirror to check performance against results elsewhere of comparable health facilities.

Making a Sound Business Case

To ensure financial sustainability of the eHealth package it is advised to apply HMIS in combination with WebERP. Increased income through better capacity use, less leakages and corridor clinics, might result in –very indicative 20- 40% income increase. This allows generating additional income not only to maintain the ICT infrastructure, but also provides funds for gradual improvement as well. Moreover, the reports and feedback
generated, allows management to become structured and evidence based. For telemedicine the improved data and financial administration, allows to make small payments to consulting doctors and hence to integrate it in their daily work as a part of their duties.

Addressing External Factors

External factors are addressed through a close collaboration with the district and regional health authorities. Also collaboration with health financiers (mostly insurers) is important. This is further cemented by customizing and automating the medical reports and payments according to the preferences of the financiers.

IICD and its partners actively supported the development of the national eHealth strategy and could integrate the lessons learnt into this strategy.

Trajectory of Implementing the eHealth Package Within a Health Facility

To successfully implement an eHealth package, the start should be made with the health management information system and financial applications. Once this trajectory is well on its way, telemedicine and eLearning can be implemented. The implementation of the total package contains about 40 steps and takes at least two years.

The main steps for the HMIS trajectory are summarized in the table below:

- Step 1 to 5: Awareness raising, participatory session with management and staff on priorities, functionalities and way of implementation, including contracting.
- Step 6 to 9: Joint implementation planning, training, organization of the automated data flow and development of a baseline.
- Step 10 to 14: Implementation, trial periods and gradual transfer to fully digitalized data registration and processing (manual back up available).
- Step 15 to peer learning, improved reporting, focus groups, business planning and continuous improvement.

It should be noted that the basic trajectory of the eHealth package is standard, but there is a lot of flexibility possible to adapt it to the specific situation.

Results

This approach has been developed by the Lake Zone (DHMIS) program and the ELCT program. So experience is still limited. Consolidation in some health facilities indicated a good a pick up of performance. The first new implementation in Mugana (Bukoba area, Lake Zone) went very smooth. The second implementation is planned for in Sengerema hospital
(Mwanza area) in March 2012. An impact study is planned to start mid 2012.

References


[3] IICD, the Round Table process, see www.iicd.org


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University Network in Telemedicine (RUTE) and Telehealth Brazilian Networks: Telehealth UERJ RJ-Brazil

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Abstract: Introduction and aims: RUTE is a Brazilian network, funded by the Brazilian Ministry of Science and Technology, specifically designed for the communication among university hospitals and international excellence centers; it is also connected to remote municipalities via Brazilian Telehealth Networks Program, funded by the Brazilian Ministry of Health. Into this telehealth net, 3 special interest groups – SIG (Pediatric Radiology, Psychiatry and Intensive and High Complexity Nursing) act for education and collaborative research. This study intends to demonstrate a fusion of technologies for teleconference as a means of integrating groups. Methodology: the connection for SIG’s is made through videoconference demanding high speeds as well as specific equipment while webconferences uses just a computer with internet. In a new way, Telehealth UERJ has put video and webconference together providing that every part with no videoconference system could access SIG’s. Video and webconference are combined capturing the audio and video from the videoconference system itself, and then they are sent to the workstation and distributed to the points linked to the webconference. Results: From May to December, 2011, 56 teleconferences were held employing web and video conferences concomitantly. In them, there was at least 1 point in each state participating, in average. In addition, some videoconferences counted on the participation of Canada, U.S.A., Germany, Chile, Bolivia, Colombia, Argentina, Guatemala, Panama, Spain and Australia. Conclusion: A worldwide network in telehealth is being created.

Introduction

RUTE [1] is a Brazilian University Telemedicine Network, funded by the Ministry of Science and Technology, specifically designed for the communication among university hospitals and with national and international excellence centers. This university network is also connected to remote municipalities supported by Brazilian Telehealth Networks Program [2], funded by the Ministry of Health. Brazilian Telehealth
Networks Program is offering training, professional refreshing and teleconsulting to professionals in remote geographical localities. UERJ Telehealth Center [3] of State University of Rio de Janeiro leads all governmental programs in Telehealth, making available several tools for synchronous and asynchronous communication among health professionals. Into the groups coordinated by UERJ, 3 special interest groups – Pediatric Radiology, Psychiatry and Intensive and High Complexity Nursing – act for education, services and collaborative research. This study intends to demonstrate the preliminary results of the fusion of two technologies for teleconference as a means of integrating groups.

Figure 1: Teleconferences employing web and video conferences concomitantly. The web conference communication is made by a chat

Methodology

The Special interest groups [SIGs] are concerned with some particular interest in health services, telehealth infrastructure or legislation. Normally they work on education, services or research. Telehealth Center of State University of Rio de Janeiro [3] has been working on twenty-eight SIGs, but only three of them used video and web conference in association: Pediatric Radiology, Psychiatry and Intensive and High Complexity Nursing. The connection for SIGs among university hospitals is made through videoconference demanding high speeds as well as specific equipment, while for the webconferences among universities and remote
munipalities, only a computer with internet is necessary. To associate these technologies, UERJ-RJ Telehealth Center included an endpoint, linked to a work station with a web server, in order to transmit the webconference’s audio and video to remote points. For that management, the software used was Adobe Connect Pro (Burlington, New Jersey USA), installed in a Dell server, Windows Server 2008, Intel Xeon Processor E5450, 3GHz, and RAM memory of 4GB. The combination of both technologies was made capturing the audio (using a sound board) and the video through a capture card. Secondly, they are sent to a workstation and distributed to the points connected to the web conference. The remote access is made through a web browser and an add in that opens the virtual room of the webconferences.

Results

Figure 2: Areas attended by the fusion of both technologies

From May to December 2011, 56 teleconferences were held employing web and video conferences concomitantly (Figure 1).

In them, there was at least 1 point in each state participating, in average. In addition, some videoconferences counted on the participation of Canada, U.S.A., Germany, Chile, Bolivia, Colombia, Argentina, Guatemala, Panama, Spain and Australia (Figure 2).

Conclusion

A worldwide network in Telehealth is being created, connecting people around the globe, so that they may share information, exchange experience and learn with each other, what allows professional refinement and a better care, especially of the population located in remote areas.
References

[1] University Networks in Telemedicine http://rute.rnp.br/..

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Evidence of Telehealth Outcomes
A Research Initiative toward the Remote Chronic Disease Management: The CHRONIOUS Project

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Abstract: Population ageing is increasing the incidence of chronic diseases, while a shortage in health resources forces to find other appropriate ways to treat and manage chronic patients. In 2008, under the 7th Framework Program of the European Commission, a consortium of European research labs, universities and private companies has launched CHRONIOUS, a highly innovative ICT research initiative that aims to implement its vision for ubiquitous health and lifestyle monitoring of people with chronic diseases, in particular suffering from Chronic Obstructive Pulmonary Disease (COPD) and Chronic Kidney Disease (CKD). The project is now in the final validation phase that will be concluded within May 2012.

CHRONIOUS aims to develop a smart platform composed of a wearable set of sensors for monitoring vital parameters and activities, and a home monitor able to administer questionnaires and to collect ambient and physiological parameters of COPD and CKD patients, in order to identify abnormal health status and to prevent acute conditions. Data are acquired using multi-parametric monitoring sensors, mostly wearable, and they are managed according to clinical guidelines and a clinical decision support system. The software modules enable the empowerment of the patient and guarantee information and functionalities critical for healthcare professionals. Expected results are twofold. From a clinical point of view, after a successful technical validation, 30 COPD patients and 30 CKD patients in four pilot sites in Europe (3 in Italy, 1 in Spain) are testing the CHRONIOUS platform; clinical results will be presented. From a managerial perspective, a multi-scenarios exploitation strategy has been developed for the two markets that have been identified (telemedicine and wellness) taking into account the role played by National/Regional Healthcare Service, private healthcare insurances, General Practitioners and professional athletes. Preliminary exploitation strategy and business plan have already been prepared and they will be reviewed and updated according to the results of the final validation.
The CHRONIOUS Project

Chronic diseases are by far the leading cause of mortality in the world, representing 63% of all deaths [1]. Because of the deep impacts that chronic diseases have on national economies, they represent one of the biggest challenges for the next years. Indeed, the ageing population is increasing the incidence of chronic diseases, while a shortage in health resources forces to find other appropriate ways to treat and manage chronic patients.

CHRONIOUS is a European project that aspires to implement an adaptive and ubiquitous platform aimed at monitoring health status and lifestyle of people affected by chronic diseases. For implementation and validation purposes the system has been focused on patients suffering from Chronic Obstructive Pulmonary Disease (COPD) and Chronic Kidney Disease (CKD). A consortium of European research labs, universities and private companies has conducted the project that is now in the final validation phase and it will be concluded in 2012.

The CHRONIOUS system is composed of a wearable platform equipped with sensors for physiological parameters acquisition (pulse oximeter, electrocardiogram for 3 ECG leads, abdominal and thoracic bands for breathing volume signal), which are collected through a Bluetooth connection by a Personal Digital Assistant (PDA). Other external devices (body weight scale, blood pressure monitoring device, glucometer, environmental air quality etc.) are connected through a Bluetooth interface or USB to a touchscreen computer (PC) which is also used to administer to the patient daily specific questionnaires about mental status, physical activity and food and drug intake. Acquired data are transmitted to a central server on which an intelligent system is implemented.

The aim of the project is to perform a deep and crossed analysis of all the acquired parameters and to support the physician in the therapy optimization and patient monitoring for the early identification of critical situations.

Clinical Results

During a first phase we tested the accuracy of the signals acquired by the wearable system under the supervision of health care professionals, at the Careggi Hospital in Firenze (Italy). Sixteen COPD patients wore the CHRONIOUS system together with reference standard sensors for two hours in different postures. We tested the accuracy of pulse oximetry, electrocardiographic and breathing signals, which showed a mean error of 1.19% for SpO2, 0.73BPM for heart rate and 0.05L for breathing volume. The electrocardiogram showed a good quality signal. During the second
and final validation phase, which started in 2011, 30 COPD and 30 CKD patients are using the whole CHRONIOUS system at home for four consecutive months in four pilot sites – 3 in Italy and 1 in Spain. Up to now 2 COPD patients dropped out due to acute events caused by comorbidities and 1 for lack of compliance to the system. The results of the final validation will available within the first half of 2012.

Business Exploitation

The solution developed has two main areas of application: the telemedicine market (TM) and the wellness market (WM). The TM represents the “natural” opportunity for the exploitation of the CHRONIOUS platform, while in the WM it may have the role of a lifestyle support system for healthy people that aim to prevent health problems and pursue a general wellbeing.

Among the identified possible scenarios for both the markets, for TM two scenarios consider the provision of the CHRONIOUS telemonitoring service paid by national healthcare systems (Fig. 1) or by private medical insurance companies. The third scenario focuses on the role of General Practitioners (GPs) and considers CHRONIOUS as the tool that can enable and support a "Shared Care Scheme" [2] within an Integrated Care Pathway. The fourth scenario envisages the introduction of the CHRONIOUS system for supporting the specialist in treating overweight and obesity.

The first two scenarios address COPD patients management through the remote monitoring and the inclusion in a disease management program, the combination of which reduces the number of hospitalizations [9-10]. The potential users were estimated considering the prevalence of COPD between 45 and 80 years old according to the scientific literature [3-8] and possible percentages of market penetration (Fig. 2); three cases were considered: an optimistic level (10%), a neutral level (6%) and a pessimistic level (3%).

![Figure 1 - Telemonitoring service scheme](image-url)
Estimated patients for 2015 considering a neutral level were 322,597 for Europe, 80,763 for Italy, 55,423 for Spain, 149,194 for Germany, 128,682 for UK and, finally, 54,230 for France. A reimbursement fee for the telemonitoring service was hypothesized considering similar experiences in Europe.

**Figure 2. Demand estimation methodology**

**Conclusions**

Results of CHRONIOUS project are twofold. Clinically, the acquired signals showed good reliability and stability in time. From a managerial perspective, market and service analysis highlighted good exploitation opportunities, especially in telemedicine market for COPD patients. The results and conclusions will be reviewed within 2012 according to the final validation.

**Acknowledgment**

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**References**


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Simona Solvi holds a Master Degree in Management, Economics and Industrial Engineering, at the Polytechnic of Milan in 2011. She discussed a thesis entitled: "Health Technology Assessment in hospitals: first results from a behavioral perspective". From fall 2011, she works at the Polytechnic of Milan as research fellow. Within the project Tele-HF, telemedicine for heart failure, she deals with the project management and organizational, economic and user satisfaction assessments with respect to the telemedicine service. She also participated in a European project working for the performance analysis of the market (telemedicine) and the competitive positioning of leading companies.

Leonardo Govoni gained the Master degree in Electronic Engineering at Politecnico di Milano, started a Ph.D. program in Biomedical Engineering at TBMLAB, Politecnico di Milano titled “Development of new technologies for the home monitoring and treatment of patients with chronic respiratory disorders” which was concluded on December 2011. He is now involved into the final steps of the European Project Chronious, collaborating with the MIP – Politecnico di Milano.
Challenges in the Implementation of the Diagnostic and Treatment Expert System of Hypertension in Pregnancy

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Abstract: This paper outlines the challenges the Reproductive Health Division (RHD), at Moi Teaching and Referral Hospital (MTRH) based in Eldoret town, are facing in implementing and adopting for use, the Diagnostic and Treatment Expert System for Hypertension in Pregnancy (HIP). In this paper, we also recommend and outline strategies that the Division needs to deal with either directly or indirectly and have them put in place for the successful implementation of the developed system.

Introduction

The use of electronic tools [1] in delivering health care is rapidly emerging as an international priority in nations at all levels of development. The government of Kenya [2] has found it crucial to revitalize the health sector by improving service delivery by developing efficient, accessible, equitable, secure, and consumer friendly health care services enabled by ICT. In 2004, the World Health Organization presented challenges that developing countries face in adopting e-healthcare and electronic health records in particular. Likewise, many researchers have also identified challenges associated with e-healthcare adoption in developing countries [3-4]. However, these challenges are not tailored to a specific country. This paper therefore outlines challenges specific to the Reproductive Health Division (RHD) and at the same time outlines the solutions.

Current situation

Hypertension in Pregnancy (HIP) is the most common medical condition encountered at the RHD and is a daily event. The medical personnel mentioned that out of 20 expectant women, at least one is diagnosed with HIP.
Lack of a legal framework (eHealth adoption policy) The RHD currently does not have any legal framework or policy on eHealth guiding on the adoption of the DESHIP. The recommendation to counter this problem would be for the hospital’s and RHD policy makers to put in place appropriate legal framework by developing an eHealth policy to govern the adoption and use of the system.

Limited ICT Hardware: The RHD currently has only one desktop computer positioned at the Head nurse’s office which does not deal with the diagnosis of patients directly and is being used for capturing patient information once they have been seen by the doctor and diagnosis given and thus not well prepared in adopting and using the DESHIP. The recommendation here would be for the RHD to put measures in place by ensuring that the appropriate ICT infrastructure is in place such as purchasing high end computers (three to four for starters) positioned in the sectioned dealing with diagnosing patients.

Lack of appropriate software to run the system: In order to run the system, the RHD would have to ensure that the appropriate software is in place which in this case is the SWI-Prolog, yet the only computer in the RHD did not have it installed. Therefore it is recommended that the systems developer should make the SWI-Prolog available, and allow for staff training on the use the system and the training.

Lack of human capacity trained on the use of the DESHIP: One of the requirements for the user to be able to use the system in that they need both medical skill and computer however most of the medical personnel, did not have basic computer training to enable them use the system. Therefore the systems developer should conduct end user training on using of the DESHIP mainly because the user interface runs on a Windows XP platform, running SWI-Prolog Multithreaded, Version 5.10.2, with command line interface capabilities.

Lack of awareness among policy makers and target users: The recommendation here is the systems developer in conjunction with the hospital’s head of ICT department create eHealth awareness among the MTRH’s poli-
cy makers and the target users of the system at the RHD on the developed DESHIP and make them aware of the potential benefits of its use in the diagnosis and treatment of HIP through awareness seminars and workshops.

Lack of funds: The hospital has not allocated any finances towards the adoption of eHealth mainly because of the budget allocation from the Ministry of Health (MoH) is not sufficient in the day to day operation of the hospitals such as purchasing of medical equipment and drugs and paying the doctors. To get more funding from the MoH, for the purpose of eHealth, the hospital has to convince and demonstrate to the MoH, the benefits and it importance of eHealth by justifying their location and having convincing personnel who can justify for an increase in their allocation of finance. The RHD could also engage in income generating activities.

Conclusion

The DESHIP when implemented will help cover for the shortage of specialist obstetricians in the RHD and help in offering expert guidance on the diagnosis and treatment of HIP at the RHD since most of the medical personnel have less than 5 years experience and the specialized training (Masters degree level) in the management of HIP.

References


Clinical Decision Support Based on Practice Guidelines: A Business Case on Prostate Cancer Treatment

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Abstract: Normind has developed a pioneering approach to clinical decision support. Intégre’s artificial intelligence produces guidance in real time for making the best decisions according to relevant rules and best practices. A prostate cancer diagnosis and risk valuation application has been designed for the EAU. The solution is about to be deployed in 5 European countries.

As for any type of cancer, there are many therapeutic advances for the management of prostate cancer. They have to involve a permanent change of practice in order to deliver the most appropriate care.

The French Association of Urology (AFU), the European Association of Urology (EAU) and Ipsen have decided to work together to create a tool to manage and monitor therapeutic choices using most recent guidelines.

To be efficient, that tool should include several major requirements:

• Be a real clinical decision support system, suitable for the doctor-patient relationship,
• Be a guide during the consultation and not after,
• Help to decide, even with incomplete data or inconsistencies,
• Propose an intuitive human-machine interface (hmi), to deliver information and advice,
• Be updated in regards to the evolution of the guidelines, in a simple way, with no engineering support,
• Let each practitioner mastering his decision and expertise.

Technology’s Principles

UroDigitalGuidance is software that was developed using Normind's Intégre® rules engine.

This works in a very simple way: at any step of a reasoning process, Intégre evaluates consistency between all available information and detect possible errors. When an inconsistency is observed among patient's data, therapeutic choice and guidelines, Intégre raises an alert. The practitioner then can either take into account this alert and explore further the situation to identify the contradictory information or ignore it to follow his own
judgment. Even in that case, Intègre keeps helping by reasoning with this inconsistent information.

Intègre conforms thus to the real practice of each expert, without constraining the expertise, while providing him up to date guidelines.

What is Artificial Intelligence?

In this document AI is a series of computer methods and techniques that can use statistical, mathematical or experiential rule-based descriptions of real world problems; to provide guidance for, or a forecast of, what is likely to happen based on learning from experience in using that guidance or forecast in the real world.

Why Is AI Important and Valuable?

AI makes possible the development of software applications dedicated to specific domains such as diagnosis by, first, modeling the knowledge and constraints and, second, delivering specific tools letting the expert master his decision. Intègre acts like a Global Positioning System, providing advice about actions to engage with and information to elicit. Yet, at any stage, the expert is free to follow the advice, or not, and engage in those actions or not. More, while deciding outside the scope of the guidelines, the engine continues to guide the professional and learn from their actions.

This is highly valuable as decision-support for therapeutic choices. Intègre operates patient data analysis and supports consultation notes and records using best practice guidelines. Combining real practices to the concerned referential in a given context (specialty, pathology) UroDigitalGuidance enables the managing of each patient’s case the best way for that patient individually.

The Solution

Based on EAU European guidelines, 550 rules have been defined, in two months, to deliver software with an appropriate human-machine interface (HMI) designed with the urologists. This HMI is configured with Diagnosis, an interface configurator provided by Normind.

Along with guidelines, several nomograms are available to help practitioners evaluate risks of possible therapeutic choices. A table of PSA values is also available with a graphical view of PSA values and PSA doubling time evaluation, which is important information in the decision process.

The modelisation of the guidelines and the configuration of the HMI did not require any software development. The work focused only on the definition of logical rules from the guidelines and the design of the
interface. This explains why the software could be delivered so quickly with a perfect adequacy to the practitioners needs.

In future releases of the application, scientific societies may themselves take over changing rules resulting from the latest scientific advances.

**Deployment**

The first release is under deployment for 1000 urologists in 5 countries. The software will be connected to a unique database to collect data from practice. This will provide to scientific societies a unique support for practice and guidelines assessment. This database will provide a unique collection of data, which will link real practice, therapeutic choices, and practice-guidelines variations.

Normind is in position to provide an innovative technology in order to establish a virtuous circle between healthcare players. All, practitioners, scientific societies and pharmaceutical industry, will then have an extremely powerful tool to leverage scientific progress and quality of care, in a minimum of time and with no computer expertise needed.

Integrate decision support engine in large healthcare systems, more generally at the point of care during the consultation, will improve existing practice alignment with national guidelines and recommendations to deliver
high quality care. Providing real time diagnosis and prescription recommendations during the consultation, whilst preserving clinical freedom, will lead to spread the usage of guidelines, latest evidences and best practices, as well as it will foster the data collection on medicines usages, efficiency or undesirable effects.

Acknowledgment

We thank the French Association of Urology (AFU), the European Association of Urology (EAU) and Ipsen for their contribution to that project.

References


Denis Pierre, Normind's Founder and CEO
PhD in Computer Science, he gained significant experience in the fields of multi-agent technologies, semantics, knowledge representation and machine learning. During 6 years he managed a research and development team to deliver applications in areas such as knowledge management, elearning, project management or document management. He was an active partner in "Agentcities" a European project, and member of the Foundation for Intelligent Physical Agents, international standards organization for agents and multi-agent systems. During two years, he was member of a French prospective group on multi-agent systems (OFTA) and co-author of the final report. He has delivered scientific advisory operations for large companies such as France Telecom R&D and Thales Communications. In 2003, Denis founded Normind.
e-Health and the Disaster Management Cycle

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Abstract: Evidence indicates the frequency, severity, and number of natural disasters has been increasing in recent years, and many countries struggle with effective disaster management. Disaster Management Cycles (DMCs) are frameworks that help countries (and organizations) respond to disasters. They can provide a structured way to plan for, respond to, and recover from all disasters (not just natural disasters).

Also increasing is the use of Information and Communications Technology (ICT) to facilitate disaster management (e.g. to enhance efficiency of response, interagency communication, and sharing of data). Yet use of e-Health - the specific application of ICT to address health and healthcare needs - has not been systematically examined within the DMC. This study examined common DMCs and sought to develop a simplified DMC to aid future research to understand where and how e-health might have application in disaster management.

Introduction

The term ‘natural disaster’ describes a “situation caused by the impact of an extreme event on a vulnerable population, population group, or person that exceeds the capability of the affected to cope without external help” [1]. Evidence indicates the frequency, severity, and number of natural disasters has been increasing in recent years, and many countries struggle with effective disaster management [2]. About 92% of deaths related to natural disasters occur in low and middle income countries [3].

Disaster Management Cycles (DMCs) are frameworks that help minimize impact, maintain control of prevailing circumstances, and attempt to prevent future casualties and damage by learning from past experiences. They are designed to provide a structured approach to planning for, responding to, and recovering from many types of disaster (not just natural disasters).
The use of Information and Communications Technology (ICT) to facilitate disaster management (e.g. to enhance efficiency of response, interagency communication, and sharing of data) is increasing. Indeed one application, access to information, has been described as ‘essential as access to water, food, and medicine’ [4]. Most applications have focused on the ‘response’ and immediate ‘recovery’ phases. However, although use of e-Health (the specific application of ICT to address health and healthcare needs and comprised of telehealth, health informatics, e-learning, and e-commerce [5]) has been identified [6] it has not yet been systematically examined to maximize integration within the DMC.

Understanding where and how e-Health might have application is hampered by the many DMC models available, and inconsistency in description of phases of response. A revised DMC was needed to facilitate planned research to examine where and how e-Health might best be incorporated in disaster management.

Methods

Literature searches were performed using PubMed and Google Scholar. The search strategy combined ‘disaster management cycle’/‘natural disaster management strategies’, ‘models of disaster management’, ‘disaster plans’ and ‘disaster mitigation’ with ‘eHealth’, ‘e-health’, ‘telehealth’, ‘telemedicine’, or ‘health informatics’. Google searches of WHO (World Health Organization), and PAHO (Pan American Health Organization) websites were also performed. Seventy-five abstracts were identified and read. Some described the potential or use of ‘ICT’, but none described structured integration of e-health within the DMC. Of 26 selected and reviewed in full, data was extracted from 7 regarding published DMCs and associated phases within these cycles [1, 2, 7-11]. These were critiqued and insight was used to develop a revised DMC model.

Findings

Some of the DMCs examined were designed as comprehensive tools, while others were more conceptual in nature. The former characteristic was considered a weakness; although a well defined and clear DMC model is highly beneficial, complexity can constrain utility. Additionally, some DMCs were cyclical in format while others were layered or linear. The number of ‘components’ (phases / elements / steps / stages) within each DMC also varied. Finally, the literature showed inconsistency in the terms, concepts, and descriptions of components with phase, stage, and activity often being used interchangeably across DMCs, creating confusion.
A New Model for Disaster Management

Based on the review, a simplified DMC model (Fig. 1) and defined terminology was developed for application in exploring where and how e-health can best be incorporated. For consistency it is recommended ‘phase’ refer to the main elements that make up the DMC, with ‘stage’ referring to components within a phase, and ‘activity/ies’ referring to specific responsibilities of individuals or entities.

This new model includes essential phases and different paths not always present in other models. Three phases (detection, early warning, and risk reduction) are included, and other phases have been rearranged into a new order with ‘preparedness’ and ‘rehabilitation’ positioned in parallel to indicate they differ and may take place simultaneously.

Figure 1: Proposed Generic Disaster Management Model

Below, a brief description of each phase is provided:

- **Emergency Response**: Refers to the actions performed immediately, or within the first few hours, of a natural disaster event, including evacuation procedures, search and rescue (SAR), and emergency health assistance.
- **Recovery**: Refers to the period where humanitarian assistance is provided in an attempt to return individuals to a safe environment.
and state of psychological well being. Coordination and information sharing are also of top priority.

- **Mitigation**: Refers to planning and prevention activities that help decrease the vulnerability of the population or infrastructure.
- **Risk Reduction**: Refers to actions taken to help reduce risks of further harm to a population, infrastructure, or society.
- **Preparedness**: Refers to education, training, and practice (mock disasters) initiatives that prepare a population to survive and cope with a future natural disaster. This is an ongoing activity. Where a locale has experienced a recent disaster, preparedness should take place concomitantly with the rehabilitation phase (below).
- **Rehabilitation**: Refers to the re-building of infrastructure as well as activities that help individuals, families, and society re-coup from physical and mental injuries, shock, or despair. It is the phase where focus is on returning the community/ies to normality.
- **Detection**: Refers to activities undertaken to predict, as far as is possible, the likelihood of a pending or imminent natural disaster.
- **Early Warning**: Refers to steps taken to alert the public to an imminent threat allowing for adequate preparation or evacuation to ensure the safety of as many individuals as possible.

**Discussion**

Chronaki et al. [6] suggest that all disaster situations can benefit from application of ICT solutions, and describe their use in combination with disaster management as fundamental. The same can be said of e-health (one specific area of ICT application), yet focused study of integration of e-health within DMCs has not occurred. Potential benefits of integrating e-health include: improved response times; more effective ‘first response’; reduced mortality; development of more rugged, reliable, and redundant technologies; and enhanced preparedness through e-learning and virtual training approaches. To realize these benefits in ‘the heat of the moment’ e-health must be integrated within DMC and DM practice before a disaster strikes – not ‘piloted’ during the aftermath of a disaster as has often been the case.

**Conclusion**

A simplified DMC has been designed containing ‘phases’ common among most disaster management models. This model will facilitate examination of where and how e-health can be applied and integrated within disaster management – the next phase of research [12].
Acknowledgment

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References


e-Health and the Haddon Matrix - Identifying Where and How e-Health Can Assist in Disaster Management

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Abstract: Natural disasters have gravely and recently afflicted the most developed to the poorest of nations around the globe. e-Health is one tool to support disaster management. However, despite increasing use of e-health in mainstream healthcare, and despite application of some e-health tools in disaster settings, there has been no systematic examination of where and how e-health might be optimally applied in disaster management.

This paper introduces the Haddon Matrix, and explains its value as a tool for researching the use of e-health in disaster management.

Introduction

Governments and organizations struggle with disaster management (DM) in the face of adversities ranging from terrorist attacks to earthquakes, with such catastrophes gravely affecting the most developed to the poorest nations. Recent examples include: the drought and famine in East Africa; forest fires in Canada, the USA, and Australia; floods and mudslides in China and Pakistan; earthquakes in New Zealand and Haiti; and Earthquakes and Tsunamis in Chile and Japan, to identify just a few.

Healthcare, an essential element of disaster management, has proven problematic even for developed nations responding to major disasters, as exemplified by Hurricane Katrina (Southeast Louisiana, USA) in 2005 [1]. A relatively new approach to healthcare is e-health (the application of Information and Communications Technologies (ICT) specifically to health and healthcare). e-Health has been applied to DM, primarily during the disaster response and recovery stages, but not routinely nor throughout the Disaster Management Cycle (DMC).
e-Health is believed to offer great potential at all stages of the DMC, but understanding exactly how has remained difficult to judge. This research sought an evidence-based approach to development of a tool by which to systematically examine potential roles of e-Health at different points in the DMC.

Methods

A literature search sought to locate tools for identifying e-health needs assessment in disaster management. No such tool was found, but coincidentally one potential tool - the Haddon Matrix (HM) - was identified in association with public health readiness [2-3] and disaster response [4].

A focused literature search was performed using PubMed (scientific) and Google (grey). Keywords were: ‘Haddon Matrix’, ‘disaster management’, ‘natural disasters’, and ‘e-Health’. No articles were identified matching ‘Haddon Matrix’ with ‘e-health’, ‘telehealth’, or ‘telemedicine’ indicating there was value in exploring its application.

Of 38 documents located, 18 articles were chosen for review of the full papers or articles. Of these, 12 were selected for analysis. The components within each Haddon Matrix model were examined to understand their function and to determine their potential value for inclusion in a new Haddon Matrix model for incorporation of e-health into disaster management.

Results

The HM was originally an injury prevention tool that analyzed in three rows the ‘phases of injury’ (pre-event; event; post-event), and in four columns the ‘factors influencing the outcomes of the event’ (human factors; agent/vector factors; and environmental factors, (a) physical, b) socio-cultural) – see Figure 1. It was intended as a research tool to identify modifiable factors that lead to undesirable outcomes, and therefore the HM is well suited for the desired task described below.

When used as a tool for research in the area of disaster management, the literature examples did not include e-health activities as factors in any of the cells; however, our review revealed opportunities for the incorporation of e-health factors. The HM has been adapted for use with e-health, and applied in a preliminary fashion to identify possible e-Health interventions for an earthquake and a Tsunami setting:

‘Pre-Event’ e-Health Opportunities

In the pre-event ‘human factors’ cell of the Matrix, relevant factors will include risk assessment, risk communication, surveillance, primary
prevention, initial and ongoing preparedness training for public health responders, and interagency first response planning [2]. The pre-event ‘agent/vector’ cell will include factors related to monitoring prevailing conditions (e.g. weather) to be able to make predictions regarding future conditions. Pre-event ‘physical environment’ factors will include available clinical infrastructure, vulnerability of food and water supplies, transportation infrastructure, and proximity of each community to a potential event [2]. Pre-event ‘social environment’ factors will include: development or maintenance of a culture of readiness among health and other first responders and the public (readiness exercises and drills); awareness of functional and communication role(s) during emergency response; maintenance of communication skills and equipment; development or maintenance of baseline community trust in public health and other response agencies; public acceptance of pre-event risk communication; culturally based pre-event risk perception; public awareness of large-scale threats; preparedness and resource allocation (budget); demographics of the community/ies [2], and collaboration between authorities [3].

‘Event’ e-Health Opportunities

Important event ‘human factors’ will include risk communication, decontamination and treatment, shelter, post exposure prophylaxis, crisis-phase mental health response, crisis-phase interagency first response collaboration, training activities for health care professionals directed specifically at disaster preparedness [5], epidemiological workup, and evacuation. Event ‘agent/vector factors’ will include disease or injury caused by the disaster, description of the disaster (for example, magnitude,
epicenter, risk of Tsunami for an earthquake), potential for further disaster detection, psychosocial impact of disaster, and acute health needs. ‘Physical environment factors’ will include emergency response clinic setup and operation, emergency access to medical supplies, clinical surge capacity, shelter availability, and emergency accessibility of transportation. In the event ‘social environment’ cell, important factors will include: community response to crisis; risk communication; community adherence to public health guidance during an event; culturally based crisis-phase risk perception; and access of community to crisis response clinics [2].

‘Post-Event’ e-Health Opportunities

In the post-event ‘human factor’ cell it will be important to include consequence-phase risk communication, application of lessons learned to improve response systems, consequence-phase mental health response, post-event health surveillance, mitigation and cleanup, after action assessment and follow-up, effective post event risk communication, and ongoing mental health support and follow-up [2]. The post-event ‘agent/vector’ cell will include factors such as the long-term psychosocial impact of the disaster. The post-event ‘physical environment’ cell will include application of lessons learned to better safeguard vulnerable infrastructure. Finally, the post-event ‘social environment’ cell will include factors such as community response to post-event risk communication, willingness of health responders and public to embrace lessons learnt, re-establishment of community trust in health and other response agencies, and culturally based consequence-phase risk perception [2].

Discussion

Barnett et al. [2] described the utility of the Haddon Matrix as follows: “By dissecting a problem into its dimensions of time and contributing factors, the Haddon Matrix can be applied as a practical, user-friendly interdisciplinary brainstorming and planning tool to help understand, prepare for, and respond to a broad range of public health emergencies.” These same attributes make the HM a very promising option for research on the inclusion of e-Health in disaster management. It provides a systematic process that allows the user to examine factors in different phases of the disaster event, thereby providing a better understanding of those factors that might be modified through inclusion of an e-health solution.

Many of the factors identified in all phases of the new tool are modifiable. This could be accomplished through communication or educational interventions (directed towards healthcare providers, first responders, and the public), but also through practical design considerations of e-health
infra- / info-structure and service provision (post-event access to virtual health services, mobile clinics, m-health, tele-monitoring of patients) – any factor that has the potential to be meaningfully helped by e-Health.

Conclusion

A revised Haddon Matrix (the e-Health Disaster Management Matrix; e-HDM) has been developed to serve as an evidence-based tool by which to investigate the role of e-Health in disaster management; specifically to identify factors modifiable through implementation of e-health approaches and solutions. Preliminary application of the e-HDM shows there is significant opportunity for such systematic examination.

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References

Impact of Motivational Interview to Increase Teleconsultations Requests: Analysis of an Experience in Minas Gerais

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Abstract: The Telehealth Center of the Federal University of Minas Gerais School of Medicine (NUTEL) has been developing teleconsultation. The possibility of health professionals discussing clinical cases with specialists increases the effectiveness and adds quality to primary care; however the number of teleconsultations requests was considered low. NUTEL offers teleconsultation system with a team of medical specialists. To increase the number of requests a person was trained to make telephone calls and send electronic messages to the health professionals, starting in May 2010. Interviews were conducted and further meetings were held and travels to the municipalities also took place. There were reports of ignorance about the use of the system, lack of time to use, connectivity problems, lack of physical infrastructure, high job demands and lack of incentive by the manager. The complaints were analyzed and solved within the possibilities. The number of teleconsultations increased from 72 in 2007 to 1690 until October 2011. There was an increase in the number of monthly teleconsultations and a reduction in the reply time after the intervention. We have concluded that it is possible to increase the frequency of teleconsultations requests by changing organizational aspects of healthcare services and using the motivational interventions.

Introduction

Recently we have seen a remarkable growth in the diffusion of information and communication technology (ICT). It has been fuelled by technological investments, social, cultural and economics changes around the world. Despite significant progress in public health, patient assistance has not improved in many countries. Many preventable diseases are not decreasing and the gap in health care between poor and rich people continues to grown.

The need to developed and organize new ways of providing health services has been accompanied by major advances in ICT, enabling better support for health services and systems [1].
The Telehealth Center of the Federal University of Minas Gerais School of Medicine has been developing activities involving teleconsultation. The possibility of health professionals discussing clinical cases with specialists increases the effectiveness and adds quality to primary care. Nonetheless, the number of teleconsultations requested by municipalities was considered low.

The purpose of this paper is to describe the interventions aimed at increasing the number of teleconsultation requests by municipalities of Minas Gerais State, Brazil.

Methodology

It is a descriptive study about the experience of increase the movement of organizational and motivational interventions for the use of teleconsultation system by the health professionals in Minas Gerais State.

NUTEL offers teleconsultation system with a team of professionals on duty providing services on internal medicine, pediatrics, gynecology, obstetrics, dermatology, dentistry, nursing, physiotherapy, pharmacy, nutrition and clinical pathology, in addition to over 46 medical specialists.

To increase the number of requests a person was trained to make telephone contact and send electronic messages to the health professionals, starting in May 2010.

Interviews were conducted with managers, family health team coordinators and health professionals. Further meetings were held and travels to the municipalities also took place.

Results

There were reports of ignorance about the use of the system, lack of time to use, connectivity problems, lack of physical infrastructure, high job demands and lack of incentive by the manager.

The complaints were analyzed and solved within the possibilities. System access conditions were improved and the managers became aware of the potentials benefits of telehealth and the importance of its use.

The number of teleconsultations increased from 72 in 2007, to 456 in 2008, 864 in 2009, 1006 in 2010 and to 1690 until October 2011. There was an increase in the number of monthly teleconsultations and a reduction in the reply time after the intervention.

Discussion

The World Health Organization (WHO) [2] is confident that the major expectations regarding public health will be met in the 21st century as a result of improved access to resources – both qualitatively and
quantitatively, which will then be available to most of the world population. WHO encourages its members to adopt telehealth as a policy and strategic tool to plan and implement health actions worldwide.

Health care based on Family and Community Medicine can qualitatively improve with electronic medical management, support systems for clinical decision-making and adequate information flow from family and community doctors to other professionals in the health care systems, and vice-versa.

The challenge of incorporating telehealth resources in the Brazilian Health System (SUS – Sistema Único de Saúde in Portuguese) is linked to the objective of strengthening the public model already established. It is also linked to the objective of reinforcing the role of primary health care in a context where professionals are still not adequately trained, both from the point of view of dealing with clinical issues at this level of attention and of promoting health [3]. Telehealth services are expected to contribute to gradually create primary care networks to remedy the lack of services available, to overcome the isolation of scattered populations and to open avenues for civil societies’ participation and empowerment.

It is necessary to train the staff to be involved in the system teleconsultation, answering questions while raising awareness about the importance of its use for the increase of numbers and quality of services provided. Technical problems may result in a difficult access and managers should support and encourage health professionals to use the tools of telehealth. Some cultural barriers regarding the use of ICT must be overcome. The preview experience with the ICT could modify the using of technological innovations [4].

With regard to the organizational aspect, a study analyzing the Belo Horizonte’s experience with the implementation of teleconsultations reports that the highlights were the quality of the teleconsultants and the ability and speed to diagnose a case as positive aspects. The negative aspects are related to the incompatibility of daily schedules with the actual teleconsultations. The fast incorporation of technologies as a positive aspect, whereas the problems related to connectivity weigh in as a negative aspect [5]. In another qualitative study, the reports of the specialists were analyzed. It revealed that the professionals attributed greater value to the job because of access to innovative technologies, the permanent network of exchange with universities, and the interaction between primary and secondary care, which helps with diagnoses and increases resolution [6].

This study showed that is necessary to use motivational interview to increase the teleconsultations requests by the professionals. This way it is
possible to identify technical difficulties and reduce cultural and organizations barriers.

Based on present study we have concluded that it is possible to increase the frequency of teleconsultations requests by changing organizational aspects of healthcare services and using the motivational interventions. Teleconsultation and webconferencing are important activities in the training of family health teams and the improvement of patient care. The introduction of telehealth grants primary care professionals with the access to specialists to discuss clinical case in order to either improve the services they provide to a given patient or opt for further referral to a specialist.

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Global eHealth Strategy - Policy, Implementation and Deployment
A Feasibility and Acceptability Study of the Provision of mHealth Interventions for Behavior Change in Prehypertensive Subjects in Argentina, Guatemala and Peru

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Background

In Latin America, adult mortality due to cardiovascular disease (CVD) is estimated to increase 145% between 1990 and 2020 [1]. Furthermore, CVD imposes a heavy toll on already over-burdened health care systems, and affects the economy and well-being of individuals, families, and the community at large. Pre-hypertensive individuals are at high risk of progressing to hypertension and developing CVD. Early interventions to increase the practice of healthy lifestyles in these high-risk individuals can reduce blood pressure (BP), decrease the rate of progression of BP to hypertensive levels, and even prevent hypertension entirely [2,3]. However, current primary care systems in developing countries lack preventive programs targeted at pre-hypertensive individuals.

mHealth is emerging as a useful tool to address several healthcare system constraints in the developing world, such as a limited health care workforce, and financial resources, a high burden of disease combined with high population growth, and the challenge of extending health care to hard-to-reach populations[4]. Studies in developed countries using mHealth to promote behavior changes such as weight loss, increased physical activity, and smoking cessation have shown positive results [5,6]. One common trait among mHealth interventions that have successfully promoted behavior change has been the use of interventions tailored to accommodate varying states of readiness for behavior change among the targeted recipients [7].
The aims of the present study are to present an integrated platform for the provision of mHealth interventions tailored for lifestyle modification in individuals with pre-hypertension living in low-resource urban settings in three countries in Latin America, and to determine the feasibility and acceptability of this platform among callers (users) and participants.

Materials and Methods

The platform was designed to be used by nutritionists (callers) to promote and support the practice of healthy lifestyle practices among individuals with pre-hypertension (participants), based on their expert counseling through one-to-one telephone calls and short text messages (SMS) tailored to the participant’s condition. Target behaviors included the reduction of sodium intake, increased intake of fruits and vegetables, the reduction of simple sugar and saturated fat intake, and physical activity promotion. The web-based platform provides the following services: 1) participant information for the caller to tailor the counseling, 2) agenda for monthly calls, 3) data collection during the telephone call and 4) the customization of SMS to adjust the messages to individual’s stage of change regarding the target behaviors. Fig. 1

Participant Information: Physicians and nurses working in health centers in Argentina, Guatemala, and Peru carried out anthropometric and blood pressure (BP) measurements; administered a questionnaire to collect demographic and socio-economic characteristics, utilization of health services, assess dietary habits, physical activity and other lifestyle characteristics, including cellular phone use. Data were entered in OpenClinica clinical trial software, and selected patient data were imported into the platform. Then a record was generated for each participant, containing clinical information (name, sex, age, telephone, body mass index, BP, etc.) required for the one-to-one phone calls. Information
regarding the stages of change (pre-contemplation, contemplation, preparation, action, maintenance), based on the Transtheoretical Model (TM) was included to help the caller understand the participant’s readiness to change target behaviors [8]. In order to do this, an algorithm was developed for each stage of behavior change related to target behaviors. Algorithms were reviewed and validated by nutrition, psychology, physical activity and mental health experts in each country.

**Agenda for calls:** The proposed mobile counseling (MC) intervention involves twelve calls at monthly intervals during a year. Users at each site can use the search engine to see the list of participants they have to call and enter data of the call (e.g. if the participant was contacted or not, if they left a message to the participant, etc.). An agenda within the platform was designed to automatically display the day of the next call, while also allowing the option to schedule a specific day and time for the next call with the participant.

**Data Collection during calls:** MC was based on Motivational Interviewing (MI) principles to promote behavior change related to healthy lifestyle habits [9]. Each call followed MI counseling protocol. Data generated during the session was entered into the platform by the user during the phone call in a template that also serves to guide the current as well as next phone call. A report is generated for each phone call, so the caller can review it for the next phone call.

**Customization of text messages (SMS), content and delivery:** SMS messages on target behaviors were developed for each stage of change following the TM using material based on formative research conducted in each country. Content of all text messages was reviewed by experts in nutrition, physical activity and communication. Messages were validated through semi-structured individual interviews to assess comprehension and appeal. Sixty-four final messages for each country, gender-specific were appropriate, and included in the platform. After the initial phone call, each participant receives a weekly text message (4-5 SMS monthly). All the information obtained from an individual's previous call about the stage and readiness to adopt healthy life-style changes regarding the target behavior discussed in the call was assembled using specific algorithms to generate customized SMS messages. Frontline SMS software was used to deliver SMS generated by the platform [10].

**Pilot study of the intervention:** To test the intervention and the platform, eligible adult (30-60 years old), pre-hypertensive men and women were recruited in health centers of low-resource urban settings in Guatemala, Peru and Argentina to participate in a one-month pilot study. During the study participants received a short introductory call where the nutritionists
presented the study, followed by a second call where they received counseling on one of the target behaviors, followed by two customized SMS. An evaluation survey was carried out to evaluate intervention exposure and reactions to each intervention component, by callers (users) and participants. For analysis, Stata Statistical Software version 11.0 (Stata Corp, College Station, Texas) was used to generate means and standard deviation to describe participants characteristics; and process indicators. Results are presented as pooled analyses between the three countries.

Results

**Subject:** Six nutritionists, two from each country, participated in a three-day training session that included the use of the platform software and coaching sessions according to the MI technique. Between November and December 2011, 45 pre-hypertensive individuals were included in a one-month pilot study, 12 in Guatemala, 17 in Peru and 16 in Argentina. Mean age of participants was 45.5 (SD 8.8) years old, 64.4% were female, and 75.6% had 7 or more years of schooling. Mean systolic and diastolic blood pressures were 127.2 (6.8) mmHg and 78 (7.3) mmHg, respectively. Mean BMI was 31.7 (5.8) and mean abdominal circumference was 101 (11) cm.

**Process indicators:** The mean number of phone calls for the introductory call were 2.3 (1) and 1.7 (0.6) for the MI counseling call with a mean duration of 20 minutes. 38 participants (85%) received both the introductory call, an MI call and were sent two SMS. 2 participants could not be contacted on their mobile phone, and 5 were contacted but the MI call could not be completed within the month of the pilot study. Based on open-ended interviews following the pilot intervention, all users mentioned that the platform was easy to learn and use and expressed that it helped them to guide their telephone counseling session with participants. Most of the time users stated no problems with navigating the platform or reading the display, including participant’s results or data entry. Based on semi-structured phone interviews with participants following the pilot study, they expressed that the counseling call and SMS were useful and motivated them to change the target behavior. Some participants reported interruptions during the counseling call. Specifically, some subjects had problems with their cellular signal, so the initial counseling call was interrupted and had to be re-scheduled. Interviews also showed that not all participants received the two SMS, as planned, and that this was mostly related faulty cellular phone signal. Other problems included one subject’s SMS mailbox being full, and instances of shared, lost, or stolen mobile phones.

Discussion
A platform to support the provision of a mHealth intervention to promote lifestyle modification was easy to use by nutritionists to offer behavior change during counseling calls in the pilot study. Participants accepted a mHealth intervention and found it useful to motivate them to adopt the promoted changes. Limitations regarding the delivery of mHealth interventions in our settings were mostly related to problems with the cellular signal, patterns of cellular phone use, and lost or stolen phones.

Conclusion

The results proved the functionality and acceptability of the platform as a useful tool to support the provision of mHealth interventions for lifestyle modification in these countries.

References


Andrea Beratarrechea is an investigator of the Institute of Clinical Effectiveness and Health Policy (IECS) and the study coordinator for Argentina of a study to promote lifestyle changes through mobile health funded by the Global Health Initiative of NHLBI within the Global Health Activities in Developing Countries to Combat Non-Communicable Chronic Cardiovascular and Pulmonary Diseases (CVPD) – Centers of Excellence. Her research is focused on epidemiology of chronic diseases, risk factors and interventions to prevent and control chronic diseases in low and middle income countries as well as in health communication techniques reducing behavioural risk factors.
Deploying Innovative Mobile-based Telemedicine Systems using Open Source tools in Resource-poor Areas of the Philippines

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Introduction

The healthcare situation in the rural areas of the Philippines has remained unchanged over the past five years. There is a continued lack of doctors and hospitals to serve the 50 million Filipinos living in the rural areas of the country [1]. There have been previous projects that attempted to address this situation using available Information Communication Technologies, the primary technology being the use of Short Message Service (SMS) based systems for the transmitting of information [2]. The shortcoming of SMS based systems is the very limited amount of information (160 characters per message) that can be sent through the system.

Since then, there have been advances in technology such as Android based cell phones. These phones allow intuitive, user-friendly applications to be built, that can capture detailed patient information and store the data on the phone. These records are then transmitted to a central Electronic Medical Record system, through various methods of transmission.

With these new technologies available, doctors can now receive detailed information to make a more accurate diagnosis, and can service many more patients since the technology extends their reach remotely.

System Outline

The Sana Mobile Telemedicine System is a standard-focused open-source system that allows for the creation of highly customizable workflows that are loaded onto the phone (Android application), connects to a back-end electronic Medical Record System (OpenMRS), and allows for reliable operation on unreliable networks through its synchronization, packetization and multi-modal transfer abilities [3].

The Sana Mobile Telemedicine system has the following features [4]:

- It interfaces with point-of-care diagnostic tools through the attachment of portable medical devices to the mobile phone;
- It allows guidelines, checklists, medical procedures and protocols to be saved on the phone, bringing evidence based Medicine into the hands of a health worker or nurse at a clinic;
- It streamlines triage and referral system which includes initial assessment, initiation of diagnostic procedures, appropriate physical examination, and documentation;
- It facilitates coordination of care, care standardization and quality monitoring through the use of Electronic Medical Records.

**Components of Sana**

There are four components of Sana. These are: the Sana Android Phone client, the Mobile Dispatch Server, the SMS Server, and the Electronic Medical Record System [5].

**Phone Client – Android Phone**

The Sana phone client is an application written for the Android phone. This phone client allows multiple procedures to be stored onto the phone. Examples of procedures are: Hypertension questionnaire, Shortness of Breath Evaluation. The Health care worker opens the Sana phone clients, selects a procedure and follows the workflow hard coded into the procedure when interviewing the patient. The Sana application guides the Health Care worker through the step-by-step questionnaire [6].

Once the health care worker completes the form for a patient, information is stored on the phone and then uploaded to the Electronic Medical Record System through multi-modal transfers: data is transferred using multiple...
interfaces, including GPRS, 3G, WiFi, SMS and USB cable depending on the size and quality of data [3].

Mobile Dispatch Server

The Sana Mobile Dispatch Server gives the Sana system the capabilities of synchronization, and packetization. These are two very important capabilities as the system is meant to be used in remote areas where there might be little or no mobile telephone network connection. The Mobile Dispatch Server also sends notifications from the Electronic Medical Record System, back to the phone via SMS, through the SMS server. The Mobile Dispatch Server is the bridge that connects the Android phone client to the OpenMRS, Electronic Medical Record System [5].

Electronic Medical Record System - OpenMRS

OpenMRS is an Open Source Electronic Medical Record System that is based on the idea of a concept dictionary, and has the following features, among others [7]:

- Supports open standards for medical data exchange including HL7;
- Central concept dictionary: Definitions of all data (both questions and answers) are defined in a centralized dictionary, allowing for robust, coded data;
- Patient workflows: An embedded patient workflow service allows patient to be put into programs and tracked through various states;
- Support for complex data: Radiology images, sound files, etc. can be stored as “complex” observations.

Results and Discussion

Multi-Organization partnership

The pilot implementation of the Sana Mobile Telemedicine System in the Philippines is a multi-organization partnership that is grouped into three areas: The Implementation and Operations Partners, the Social Partners, and the Medical Partners [8].

Implementation & Operations Partners: Asia Pacific College (APC) – Academic Partner to provide research and development resources for the Sana project. Integrated Open Source Solutions (IOSS) – I.T. Solutions provider to manage the project, and provide maintenance and support. CS Foundation, Inc. – Funding source to pay for the project pilot. Social Partners: Center for Community Transformation (CCT) – Manila based Non-government Organization with a nationwide membership of over one hundred thousand. Negros Women For Tomorrow Foundation (NWTF) – Bacolod based NGO that helps women achieve self-sufficiency and self-
reliance. Medical Partners: The Doctors that participated in the pilot implementations were the in-house doctors of each of the NGO’s.

**Actual Pilot Implementation**

At the start of the project, the hypertension procedure was agreed upon by the two organizations as the procedure that would be used for the pilot. IOSS was able to customize the hypertension procedure according to the requirements of the two partner NGO’s. The hypertension procedure was piloted with the members of each of the two NGO’s, and the results of the pilot were discussed after the pilot was completed. Based on interviews of the participants in the project, the Community Health Workers adapted quickly to the Mobile Application (within one or two days). Major complaints were with regards to delays in transmission and receipt of data due to lack of a cell phone signal in some pilot areas [9].

A key component to the success of the pilot was the iterative process used in refining the Hypertension Procedure based on constant feedback from the users. Each organization is now preparing for full implementations of Sana and integration as part of their strategy for delivery of medical services to their members.

<table>
<thead>
<tr>
<th>Hardware Costs</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Android Smart Phone (10 units)</td>
<td>107</td>
<td>10</td>
<td>1,072</td>
</tr>
<tr>
<td>USB GSM Model (1 unit)</td>
<td>18</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>SMS Server (1 unit)</td>
<td>268</td>
<td>1</td>
<td>268</td>
</tr>
</tbody>
</table>

**Table 1- Costs of Implementation based on the deployment of Ten Android Phones for one year, within each organization (CCT, NWTF)**

**Monthly Recurring Costs**

<table>
<thead>
<tr>
<th>Monthly Recurring Costs</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Private Server</td>
<td>15</td>
<td>12</td>
<td>182</td>
</tr>
<tr>
<td>Monthly SMS cost</td>
<td>16</td>
<td>12</td>
<td>193</td>
</tr>
<tr>
<td>I.T. Maintenance Support</td>
<td>536</td>
<td>12</td>
<td>6,430</td>
</tr>
</tbody>
</table>

**Software License Cost**

<table>
<thead>
<tr>
<th>Software License Cost</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Source Software</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total Costs**

| Total Costs                          |               |          | 8,162       |

Conclusion

Based on the Five (5) Elements of Telemedicine [10], the Sana Mobile Telemedicine project is able to address each element. The use of an Open Source Software development platform allows various specialized groups to collaborate and build on top of each group’s expertise. This is so well characterized in the Sana Mobile Telemedicine project, which makes use of several Open Source technologies to come up with an effective, working, low-cost solution to provide Remote Medical Diagnosis in low resource areas not only in the Philippines, but for the rest of the world.

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Acknowledgment

My sincerest thanks go to Merlin Teodosia Suarez for being my mentor and guide in writing this paper. Thanks also go to CS Foundation Inc., and Integrated Open Source Solutions for the continued development and implementation of the project. Finally, to Asia Pacific College, for the support given with regards to the time spent working on this project.

References


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Dr. Leo Anthony Celi is an internist in an intensive care unit (ICU) and an infectious disease specialist, who has practiced medicine in 3 continents, giving him broad perspectives in healthcare delivery. He pursued a master’s degree in biomedical informatics at MIT and a master’s degree in public health at Harvard University. His research projects are in the field of clinical data mining, health information systems and quality improvement. He is now on staff at the Beth Israel Deaconess Medical Center ICU and the Laboratory of Computational Physiology at MIT. He also directs Sana (sana.mit.edu) at the Computer Science and Artificial Intelligence Laboratory at MIT.
Telemedicine Regulation - How Not to Do It: A South African Experience

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Abstract: Telemedicine requires an enabling legislative and regulatory environment if it is to flourish. A recent case in South Africa in which the regulatory authority, the Health Professions Council of South Africa has ruled a telephone service to be unethical is discussed. In developing countries where legislators and regulators may have little experience in or awareness of telemedicine, telemedicine advocates need to pro-actively engage with regulators to ensure that pragmatic solutions are found that will protect the public while at the same time facilitating the telemedicine use.

Introduction

Africa like many other regions of the developing world needs assistance. Its burden of disease is great, its people poor and there are too few healthcare professionals [1]. The use of information and communication technologies in medicine raise legal and ethical issues related to telemedicine which are well documented. Resolving these in a pragmatic way that will on the one hand protect the public and on the other the practitioner, while at the same time enabling and facilitating the practice of telemedicine is a challenge globally. In developing countries the problem is exacerbated by lack of expertise and experience of regulators and legislators in this field. Policy makers too are struggling to formulate eHealth strategies and policies and this does not assist the regulators.

The telephone has long been used in medicine [2]. There are a number of successful telephone based telemedicine services in different parts of the world. In April of 2011 a group of doctors launched a telephone based telemedicine service in a number of pharmacies in South Africa. Nurse practitioners employed by the pharmacies see patients who seek help and if the nurse feels it is necessary for the patient requires further medical treatment, the patient is referred to their general practitioner, a public hospital or clinic facility, or offered a telephonic consultation with a doctor on call. If the telephone consultation option is chosen the patient talks to the doctor and the nurse performs basic investigations and observations as required and relays these to the doctor. The doctor follows a triage protocol and determines if the patient requires a medical consultation, if the
consultation and diagnosis can be safely made over the telephone or if it warrants referral for a conventional face to face consultation.

The Regulator

The Health Professions Council of South Africa (HPCSA) is a Statutory Body tasked with licensing medical and other healthcare professionals and regulating their clinical practice. Following a press statement issued by the Society of General/Family Practitioners raising concerns about, “the diagnosis of disease based on the examination of patients by third parties such as nurses and pharmacists within a pharmacy and communicated telephonically to medical practitioners” the HPCSA responded with a media statement under the heading, “HPCSA condemns unethical telemedicine practice” [3]. The HPCSA raised issues of breach of doctor-patient relationship and informed consent and re-iterated that, “...’as a general rule’ health care practitioners were required to do a physical examination and assess a patient in order to make a correct and proper diagnosis”, a view supported by the South African Medical Association. It was also noted that the HPCSA was, “...still developing guidelines (in addition to those already developed by the national department of health for underdeveloped communities)” [4].

Several issues emerge: the requirements for: (i) a face to face consultation; (ii) physical examination; (iii) a doctor patient relationship; (iv) informed consent; (v) patient confidentiality; and (vi) separate guidelines for the public and private sectors.

South Africa does not have specific law or regulations governing the practice of telemedicine. In 2008, the HPCSA drafted Guidelines for the Good Practice of Telemedicine in South Africa which have yet to be published. The draft guidelines are flawed because the definition of telemedicine does not refer to the use of information communication technology. As a result the provision of a prescription, written on paper to be taken to a pharmacy, would constitute telemedicine [5].

In the absence of regulations or guidelines telemedicine should be regulated by reference to the Constitution which incorporates a Bill of Rights and existing health legislation. The Constitution provides for both positive and negative rights, meaning that there are multi-layered obligations on the state and creatures of statute, such as the HPCSA, to fulfill and protect those rights.

The Constitution of South Africa

The Constitution makes specific references to healthcare and gives definitive guidelines. Section 27 (1) (a) of the Constitution states “everyone
has the right to have access to … healthcare services, including reproductive healthcare” whereas Section 27 (2) provides that “[t]he state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of…” this right.

Equality in healthcare implies that the level of healthcare and services afforded a citizen should not be dependent on geographic location or socioeconomic status. Telemedicine offers a way of reducing the current inequality in healthcare imposed by poverty and location. Section 27 (2) places the responsibility on the State to progressively achieve these rights. How is this to be done?

It can be argued that it is a function of the HPCSA, as a creature of statute, to progressively achieve these rights. Government has stated that telemedicine is a national priority, and it is and has been part of the health system and healthcare delivery since 1999, but there is no current, specific, or detailed, national eHealth or Telemedicine Policy.

Ethical Guidelines for Telemedicine

The HPCSA appears to have difficulty in coming to terms with telemedicine. It believes that telemedicine needs to be regulated, but is struggling to do so [6]. This may be due, in part, to a one size fits all approach to regulation and the perception that telemedicine is something new and unproven, thus requiring regulation to protect the public. It has been argued that ethical guidelines should be based on deficiencies, if any, in existing ethical guidelines [5].

The existing guidelines produced by the National Department of Health for phase one of the National Telemedicine Programme are apparently adequate for patients served by the public sector, but not for those in the private sector. These guidelines produced in 1999, are largely drawn from a code of conduct for manufacturers of telemedicine devices and videoconferencing equipment and are not all relevant [7]. A problem with the current situation is that the telephonic telemedicine services under review, while meeting the existing ethical guidelines of the DOH, are apparently being judged according to criteria that have not been made public.

The HPCSA’s interpretation of a consultation which requires a prior doctor patient relationship, a face to face interview and a physical examination, have profound implications for the practice of telemedicine in South Africa. In store and forward telemedicine there is no interview or examination by, or contact with, the doctor to whom the patient’s case is referred nor is there a direct relationship or necessarily a prior relationship with the patient. But diagnosis, treatment and management can be provided
or advised depending on the circumstances. Most teleradiology in both the private and public sectors is a form of store and forward telemedicine and this would have to stop. The same holds for videoconferenced consultations.

The Way Forward

Why and how has this situation developed? It is our contention that the regulators do not have the necessary awareness of, or experience, or expertise in the field of telemedicine. As a result they are adopting a very conservative and even anti-competitive approach which may be in conflict with the Constitution and Government’s averred policy. A consultative process has begun to resolve the issues. This experience of failure of the regulators to understand telemedicine may well occurs in other developing world countries. National Telemedicine Associations or telemedicine advocates need to engage with regulators to assist in the developing enabling legislation and regulations that are required to facilitate telemedicine use.

References


Maurice Mars is Professor and Head of the Department of TeleHealth at the Nelson R Mandela School of Medicine at the University of KwaZulu-Natal, where he was previously Professor and Head of the Department of Physiology. His department initiates telemedicine and tele-education services and he has established postgraduate programmes in both Telemedicine and Medical Informatics. Mars serves on the joint WHO Global Observatory for eHealth and U21 Global eHealth Policy Committee, chairs the ISfTeH’s Education Working Group and serves on the Editorial Board of the Telemedicine and eHealth Journal.
Towards to an International "eHealth Insurance" for Taking Improved Support for Health care in Developing Countries

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Abstract: In response to the problems of caring for the acceptable health care costs and improve quality for life in developing countries, I suggest the implementation of an "eHealth Insurance" as international system. The paper presents the development of eHealth insurance under the project called “Net.Insurance”. Net.Insurance can be an online system for the federated companies of insurance including community of health care and the policyholder.

Introduction

Africa is faced with a great problem. “… In particular sub-Saharan Africa faces many challenges; extreme poverty, a disproportion burden of disease, rapid population growth, a shortage of skilled human resources, and irregular or absent power supply” [1]. The major challenge can be founded in (WHO) [2-4].

Also, the problem of the disparity of development or of polarity North-Southern can render difficult the cooperation or the partnership. Africa countries are in a continuing major problem of to mastery the technological transformation, the ability to adapt ICT to real needs. To paraphrase Coiera [5], ‘if physiology literally means’ the logic of life", and pathology is ‘the logic of disease’, then let us say ‘eHealth is the logic of healthcare’.

eHealth is the cost-effective and secure use of information and communication technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education” [3]. The use of information and communication technology (ICT) in health is expected to increase productivity of the health system, improve quality, and ensure equity [6]. International research partnerships help to identify feasible, cost-effective, sustainable interventions for major health challenges in the developing world” [7].

Quality of Medical Care should be defined specifically to include all the elements of quality care. Continuous quality improvement means improving the processes used in fulfilling each element of quality care. Goal is to decrease complication rate, morbidity, mortality and cost of care [8].
Which advanced technologies may result in an acceptable health care costs and improve quality for life?

From Tunisia to South Africa: The majority of these countries are expressed as developing countries. The majority of these countries have an unstable economy characterized by a very low per capita income. The majority of these countries have virtually no industry leading technology. The majority of people in these countries, both urban and rural areas, lack access to health care quality even when they can afford.

Therefore, I suggest the implementation of "eHealth Insurance" as international system that can collaborate with already national system would be a way to minimizing the cost of health.

Why do people need international medical insurance?

Each year, millions of people travel outside of their home countries beyond the boundaries of their Medical Insurance. They are concerned with potential out-of-pocket expenses that could result from an injury or illness abroad” [9].

The paper presents the development of eHealth insurance under the project called “Net.Insurance”. The Net.Insurance can be an online system for the federated companies of insurance including community of health care and the policyholder. You may find in this paper the aims, the methods, the information architecture and technologies and the result to be achieved so far.

Development of an eHealth Insurance: Net.Insurance

Aims

The aims of the project are the development of innovative eHealth technologies that are products and services of international health insurance.

In according with IAIS [10], “in principle, there are considerable benefits for insurers, intermediaries and consumers alike from the development of the Internet. The use of information networks has the potential to make the offering of insurance products more efficient and less costly than before. Insurance companies and intermediaries are provided with the technical capability to reach many millions of potential policyholders with good quality information on their products and services”.

The project will investigate mostly the different type of risks to be covered and the insurance law in European Union and in Africa. Consequently, the project will provide ideas for elaborate a guidelines for eHealth insurance.

The eHealth insurance will be achieved through the development of the Net.Insurance system that can provides real-time, direct and secure
exchange of data or messages between information systems of “federated” insurance companies and can allow policy holders to apply for an online health insurance and obtain services related to their needs. Additionally, the project will develop a health insurance card that will be a key for the policy holder to manage personal information and to obtain services related to their needs.

Methods

The project will provide answers to the questions, “which strategies can handle international health insurance techniques and innovative eHealth technologies?”

The first research strategy adopted for the project is to understand health insurance techniques used in European Union and in some Africa countries. It can be related to the following terms [11]: deductible, co-payments, out-of-pocket, lifetime maximum, exclusions, pre-existing conditions, waiting period, coordination of benefits, grace period and federated companies.

The second strategy adopted for the project is to describe eHealth technologies enable to deliver better and more efficient services adopting and implementing the following principles: transparency, privacy and data protection, client-centered and real-time.

Information Architecture and Technologies

The core technologies to be used in order to implement Net.Insurance are: system software (programs to carry out basic computing functions and operating systems), networks and data communications, Internet, intranets, and extranets, clinical and insurance data management, users’ interactions (input devices, output devices, external storage devices, mobile personal computing devices). The health insurance card will be a secured card that will contain digital certificates, used by means of a card reader or an online system, to access the services provided by Net.Insurance.

Results to Be Achieved So Far

The mains results to be achieved so far include:

- The guidelines on international health insurance techniques;
- The Net.Insurance system;
- The health insurance cards and their related applications;
- The demonstration scenarios of applicability of the Net.Insurance.

Conclusion

The eHealth Insurance through international cooperation can allow national and international health insurance systems to work together for minimizing health care costs and improving quality of life. Setting up such
insurance systems to provide coverage against the financial, social and health risks of illness are core elements of social protection in developing countries.

Acknowledgment

Acknowledgments to the European Commission (Directorate-General Information Society and Media) which allows me the grant to present the project at the Second Edition of the Global eHealth Strategy Symposium. Thank you also to Frederic Lievens for all the advice and encouragement.

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Innovative Policies and Solutions for Healthcare
Construction and Evaluation of a Website on Health of the Elderly

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Introduction

The Internet is not new; it has existed since the late 60's and became popular in the late '80s, with the emergence of the World Wide Web (web). In Brazil, nursing has used the Internet to provide health education for nurses and nursing students on, for example, post anesthetic recovery room [1]. This study aimed to build a website on Health of the Elderly and evaluate it with nursing students from a public university in the state of Piauí, Brazil.

Methodology

Five phases of the methods to build a learning environment via web [2] were used. Phase 1 was to identify target audience and define goals and content. Phase 2 defined programming language and types of media. Phase 3 implemented the environment with a Virtual Learning Environment (VLE). Phase 4 assessed the appropriateness of the medias, working links, data visualization and freedom for navigation. Phase 5 evaluated the adequacy of the goals and content. A data collection instrument adapted from the literature [2-4] was used for evaluation of phases 4 and 5. The target audience of the website on Health of the Elderly was nursing students of a public university in Piauí, Brazil, enrolled in the course Adult and Elderly Health I. The objective was to build knowledge on Health of the Elderly. The content was organized in modules through Hyper Text Markup Language (HTML). Objectives were set in each module and Google was the media used. The research project was reviewed and approved by the Research Ethics Committee (CEP) at the Federal University of Piaui, Brazil.
Results and Discussion

The website Health of the Elderly was made available at https://sites.google.com/site/saudeeidoso/. At the homepage, students can browse through a brief description of the authors, schedule and other information, according to Fig. 1.

Evaluations carried out by the nursing students (n = 30) of the course Adult and Elderly Health I, from a public university in the state of Piauí, Brazil, were mostly positive.

In the ergonomic evaluation the website on Health of the Elderly, nursing students verified the working of the navigation links, data visualization, adequacy of the integration of media and ability to print. While the pedagogical evaluation they reviewed the adequacy of educational content and objectives proposed to the target audience.

Final considerations

Google's resources enabled the construction of the website Health of the Elderly and its use in the opinion of nursing students was positive.

Acknowledgment

Construction of website and statistical analysis was supported by Professor PhD Jesusmar Ximenes Andrade (Department of Accounting and Administration, Centro de Ciências Humanas e Letras, Federal University of Piauí.
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From Buzz to Business: eHealth Innovation Toolbox

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Abstract: eHealth solutions provide promising opportunities for improving efficiency and quality in healthcare. Still many eHealth innovations never get beyond the project phase. The eHealth innovation toolbox provides eHealth innovators with a systematic approach and supporting instruments to bridge the gap between Buzz (ICT as a promise for better care) and Business (viable eHealth services and business models).

Introduction

eHealth solutions offer promising opportunities for improving the efficiency and quality of healthcare. eHealth can support treatment of patients with chronic illnesses and eHealth can be a powerful instrument for supporting self-management or integrated healthcare. However, many potentially valuable innovations never reach beyond the project or pilot stage. One of the pitfalls is that many innovative eHealth solutions are developed from a mainly technological perspective. The requirements from users and the organizational and financial arrangements are often underestimated.

Recent studies have created a shared insight into the success and fail factors during the development and implementation of eHealth solutions. But there is still little practical knowledge about how to support and accelerate the eHealth innovation process towards successful implementation in healthcare practice.

The purpose of this research is to develop a systematic approach and associated instruments to support eHealth innovation projects in achieving sustainable eHealth innovations. The methodology and tools are summarized with the term eHealth innovation toolbox (eHix).

Questions are:

• How can structural implementation be anticipated already in the early phases of the development process?
• What are the relevant dimensions in a methodology for eHealth innovation?
• What factors are important in the different stages of the development of eHealth innovations?
• How can the eHix support eHealth innovations and what instruments should the eHix provide?

Methodology

The basis of the methodology is to consider eHealth innovation as a service innovation rather than technological development. For successful implementation of an eHealth service a sound business model is required. We therefore use a business model approach to bridge the gap from eHealth project to eHealth service in practice. A business model is essentially a description or blueprint of how organizations can provide innovative services in a viable way.

The method starts with a breakdown of the innovation process in several steps, each with its own goals and approaches. We choose a model with five innovation phases [1], i.e. inventory phase, design & development phase, experimental phase, pilot phase and roll-out phase. Next we selected the STOF business model framework [2] to include the business model perspective. The STOF framework describes a business model within four interrelated domains, i.e. the Service domain, Technology domain, Organizational domain and Financial domain. The eHix methodology combines the five innovation phases with the four business model domains in a matrix structure with 20 cells, the eHealth innovation matrix.

First we determined an overview of keywords that capture the aspects and results that need to be realized within each innovation phase and business model domain. The overview was based on desk research on business models, innovation management and success and fail factors for eHealth innovation and on expert sessions and case studies on eHealth innovation projects. Subsequent analyses of existing methods for service and business design than led to the identification of supporting instruments with which the various aspects and results of the innovation can be realized.

Results

The eHealth innovation matrix in Table 1 contains the most important keywords per cell. Behind each keyword are the instruments and tools that support the aspects of innovation that the keyword covers. The eHix is accessible via a website (www.ehix.eu). The eHix offers two functionalities: the eHix scan and a tools library. Clicking on the keywords will trigger a
pop up with a short explanation of the selected keyword and a list of instruments. The instruments behind the words in the cells provide templates, checklists, approaches, examples and references with which the required steps in the innovation process can be followed as closely as possible.

Table 1: Overview of eHix keywords

<table>
<thead>
<tr>
<th>S</th>
<th>Inventory</th>
<th>Design &amp; Development</th>
<th>Experiment</th>
<th>Pilot</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- target group</td>
<td>- use cases</td>
<td>- evaluation of added value</td>
<td>- experienced value</td>
<td>- offering</td>
</tr>
<tr>
<td></td>
<td>- customer needs</td>
<td>- user requirements</td>
<td></td>
<td>- user friendliness</td>
<td>- support services</td>
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<tr>
<td></td>
<td>- added value</td>
<td>- e-readiness</td>
<td></td>
<td>- clinical effects</td>
<td>- training</td>
</tr>
<tr>
<td></td>
<td>- market scan</td>
<td></td>
<td></td>
<td></td>
<td>- customer experience</td>
</tr>
<tr>
<td>T</td>
<td>- technology scan</td>
<td>- design method</td>
<td>- prototype</td>
<td>- test scenario's</td>
<td>- quality of service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- IT architecture</td>
<td>- test scenario's</td>
<td>- reliability</td>
<td>- security &amp; privacy</td>
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<td></td>
<td></td>
<td>- standardization</td>
<td>- quality</td>
<td>- quality</td>
<td>- scalability</td>
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<td></td>
<td></td>
<td>- functional design</td>
<td>- system integration</td>
<td>- robustness</td>
<td>- technical support</td>
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<td>O</td>
<td>- competences</td>
<td>- business processes</td>
<td>- resources</td>
<td>- training facilities</td>
<td>- partner selection</td>
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<td></td>
<td>- key actors</td>
<td>- impact analysis</td>
<td></td>
<td>- pilot support</td>
<td>- roles</td>
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<td></td>
<td>- business roles</td>
<td>- environmental requirements</td>
<td></td>
<td>- adapting existing processes</td>
<td>- implementati on process</td>
</tr>
<tr>
<td></td>
<td>- project structure</td>
<td></td>
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</tr>
<tr>
<td>F</td>
<td>- stakeholder analysis</td>
<td>- cost models</td>
<td>- update stakeholder analysis</td>
<td>- evaluation method</td>
<td>- revenue model</td>
</tr>
<tr>
<td></td>
<td>- funding</td>
<td>- revenue model</td>
<td>- funding analysis</td>
<td>- business case check</td>
<td>- pricing</td>
</tr>
<tr>
<td></td>
<td>- regulations</td>
<td>- market model</td>
<td>- risk analysis</td>
<td></td>
<td>- division of costs and benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- business case</td>
<td>- business case check</td>
<td></td>
<td>- monitoring &amp; evaluation</td>
</tr>
</tbody>
</table>

The second function is the eHix scan. The scan consists of a questionnaire with which project owners can establish the status of their project. The scan’s questions are connected with the cells of the matrix. After completing the questionnaire, the results show the status of the project in the eHix with the use of colors. Red colored cells need attention. The tools
in the cells provide the project owner with some instruments or templates to improve the status of the project. Green cells indicate that the most important factors are taken into account. Templates for example exist for performing a stakeholder analysis, drafting a benefit or business case, or setting up a workshop for establishing the potential added value of the target service for users and customers.

Conclusion and Discussion

The eHix provides eHealth innovators with a systematic method to bridge the gap between Buzz (ICT as a promise for better care) and Business (viable eHealth services and business models). Linking the innovation process to business model thinking right from the start ensures that future implementations of the eHealth innovation can be anticipated in the various innovation activities. Well known success factors for viable eHealth innovations receive the attention they require by linking them to the right phase in the innovation process and the right business model domain. Thus, pitfalls and underestimation of the non-technical requirements are avoided.

The phasing in the innovation process that is applied in our methodology is often used in practice to make the process manageable and progress traceable. In practice, however, innovation is not a linear process but an iterative process of design, review, redesign, etc. The initial design, content and format of the online eHix have been reviewed and discussed proven in expert sessions. However, the choice of keywords and instruments and the value and usefulness of the online functionalities still need further analysis in practice. We foresee an iterative approach in which the eHix is applied in ongoing and new eHealth innovation projects and updated on the basis of usage reviews.

References

Help4Mood – A Flexible Solution for Supporting People with Depression in the Community across Europe


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Abstract: Major depression is one of the most common disabling depressions world-wide. The Help4Mood system is intended to support the recovery of patients with major depression in the community. To ensure that Help4Mood can be used Europe-wide, it has been designed to be highly configurable. In this paper, we describe the three main configuration levels of Help4Mood, organization, clinician, and patient level. Patients can change the look and feel of the user interface and customize session content. Organizations can configure Help4Mood to fit in with existing treatment pathways, while clinicians can add patients and enter or adjust relevant demographic data.

Introduction

Depression is one of the most common disabling conditions world wide [1]. According to the DSM-IV [2], it is characterized by two core symptoms, persistent low mood and loss of interest. Depression results in changes in physiology, behavior and cognition. It thus profoundly affects the lives of people with this disease.

Across Europe, many people with depression are supported in the community. Help4Mood is a system for supporting the treatment of people with major depression in the community under the supervision of a clinician. It consists of three main components:

1. A Personal Monitoring System that tracks activity and sleep;
2. A Virtual Agent, embodied by a 3D talking head (avatar), that interacts with the patient, administers questionnaires, collects
mood and psychomotor data, offers exercises and psychoeducation, and provides access to an on-demand crisis plan, if the user is feeling particularly low;

3. A Decision Support System that interprets incoming data, plans the Virtual Agent’s sessions with the patient, and summarizes findings for patients and clinicians.

The system will be trialed in three countries, Spain, Romania and UK. These three countries have different health care systems, different Electronic Health Record systems, different mental health care pathways, and different cultures [3], Help4Mood needs to be extensively configurable.

In this paper, we summarize the user requirements regarding system configuration.

Method

User requirements were established through literature reviews and ten focus groups, three in the UK, three in Spain, and four in Romania. One focus group per country was conducted with patients, while the others involved a variety of health professionals that were involved in providing care to people with depression in the community. We also compared the different mental health care pathways and eHealth infrastructure in the three countries and in particular at the three sites where Help4Mood will be tested, the Fundacion San Joan de Deu Hospital en El Prat de Llobregat, Spain; NHS primary care, Scotland and the Clinica Universitara de Psihologie (PsyTech), Cluj-Napoca.

The Three Levels of Configurability

We determined three main levels of configurability, corresponding to the organization that deploys Help4Mood, the clinician, and the patient who uses Help4Mood.

Organization Level

Organizations that deploy Help4Mood can vary in size, ranging from health service trusts to hospitals and individual practices. Each of these will typically have standardized processes for monitoring progress and a set of exercises and psychoeducation material used for delivering treatment. To ensure smooth adoption of Help4Mood, organizations need to be able to add this information to the system in a straightforward process that will be performed once per organization. Organizations should also adapt the crisis plans to include site-specific resources.

Integrating Help4Mood into different Electronic Health Record (EHR) frameworks is more difficult due to the sheer variety of systems and
interfaces on the market. Therefore, as lowest common denominator, Help4Mood will produce a PDF report that can be easily added to many systems or emailed to the clinicians. In addition, we will support HL7 CDA-based information exchange [4] for EHR systems that support this standard.

**Clinician Level**

As clinician time is limited, we will ensure that setting Help4Mood up for a particular patient is very straightforward. Demographic data about the patient (age, gender, family, employment status) can be entered using a few simple screens.

**Patient Level**

Patients can extensively configure the look and feel of the Virtual Agent. This includes the interaction style, the visual appearance of the application, and the appearance of the avatar. Help4Mood will offer two interaction styles, formal and informal. In order to strike a balance between animation quality and computing requirements, Help4Mood offers four talking head avatars, two male and two female, which are partly pre-generated. Each avatar will be available in two clothing styles, formal or informal, to match the desired interaction style. If the patient does not like any of the characters, the talking head can be switched off. Patients can further customize the Virtual Agent interface by choosing from a variety of calming, peaceful background pictures.

Patients can also influence individual sessions with the Virtual Agent. At the beginning of each session, they can adapt the session length to their stamina. They can choose to opt out of activities, and indicate whether they wish to receive further information about a particular topic such as sleep or nutrition.

Finally, they can customize their crisis plans, in collaboration with the clinician, by assembling a list of activities that have been effective at lifting their mood.

**Conclusion**

We expect that this extensive configurability will be essential to uptake of and adherence to Help4Mood. Organization-level configurability ensures that the system will fit seamlessly into diverse care pathways, enhancing and supporting existing care. The load on clinicians has been kept as small as possible, to ensure that Help4Mood is not seen as an additional load, but as a convenient source of clinical data. Last, but not least, patients can customize the look and feel of the Virtual Agent interface and adapt the amount and type of content presented to their own needs. They can thus
make Help4Mood their own, ensuring that it is a system with which they will enjoy interacting.

Acknowledgment

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References


Juan Martinez-Miranda received a PhD in Computer Science from the Universidad Complutense de Madrid (Spain). His research interests include the study and application of Multi-Agent and Agent-Based Systems in different fields such as social simulation, e-learning and e-health. He has participated in several EU and national funded research projects and has authored more than 20 publications in specialised journals and conferences.
Innovation Policies and Macro-Regional Development in Health Care: Impact on Telemedicine and eHealth

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Abstract: Innovation has become a critical policy tool to foster a sustainable, prosperous economy. A lot of research has been done to find out the role of innovation in economy, how to stimulate innovation, how to measure innovation and how to create a supportive climate to foster innovation. The OECD (Organization for Economic Cooperation and Development, \url{www.oecd.org}) has undertaken intensive work in measuring innovation and has published a manual about measuring innovation, the Oslo Manual. In the EU strategy Europe 2020 innovation has been put at the center and the Innovation Union is one of seven flagship initiatives for a smart, sustainable and inclusive economy. Many countries are trying to apply innovation policies also in respect to the health economy and likewise to keep the balance between cost effectiveness and high quality in health care delivery services. In the domain of telemedicine and eHealth we may ask ourselves what we can learn from the experience in innovation research from other domains and from innovation in health care in particular. The objective of this paper is to give an overview of research and policy development in the area of innovation strategy development in health care and health economy. We will then relate this work to the area of telemedicine and eHealth and discuss the possible role of innovation strategies and innovation dissemination in this domain.

Introduction

Innovation has become a critical capability for a sustainable, prosperous health economy and likewise to keep the balance between cost effectiveness and high quality in health care delivery services. Small and Medium Enterprises (SMEs) are considered to be highly effective in product, service and process innovation. However, due to lack of the specific skills needed for innovation in health care, lack of financing and the significant barriers due to public procurement procedures the impact of SMEs is far from fully exploited to date. Besides a focus on Innovation policies the EU focuses on macro regional development to foster sustainable growth and tackle the
challenges of demographic change and health care [1]. One of these regions is the Baltic Sea Region (BSR) [2]. BSR plays an important role in modern Europe, as it comprises nine European Union member states plus Norway, Iceland and Russia. In addition collaboration with neighboring regions like Northern Netherlands is crucial. The BSR macro regional network for Health and Life Sciences, ScanBalt, has together with the project leaders BioCon Valley and Lithuanian Biotech Association successfully set up the EU-flagship ScanBalt Health Region (SBHR) [3]. The ultimate goals of the Flagship are to promote a globally competitive BSR Health Economy by assisting in solving the grand societal challenges of Health within the BSR, and to play a leading role promoting global health. Basic tools and models have previously been suggested by the projects Bridge-BSR (EU FP 7) and ScanBalt CompetenceRegion (EU FP6) and more than 10 years experience from macro-regional collaboration in Scanbalt BioRegion is at hand. This has led to an established modus operandi where SBHR serves as an umbrella for a multitude of coordinated activities applying to shared visions and values for the development of the region and utilizing a common communication and coordination structure. Otherwise the individual activities act independently. This is a bottom-up approach combined with a top-down advisory structure which ensures specific themes to be dealt with in depths by a multitude of teams and groups, while still referring to an overall strategy and using existing structures.

Shortly after the emergence of the concept of “eHealth” many countries and regions have developed an “eHealth strategy”. However, telemedicine has often not been addressed particularly but summarized under the broad concept of eHealth. Moreover, most of the eHealth strategies have not been embedded within the general innovation system or aligned with strategies for innovation in health care, life sciences or biotechnology. The authors of this paper suggest to integrate telemedicine into the broader policy development for health care and to link these policies to the regional or macro-regional innovation ecosystems via concrete trans-national and trans-sectorial project activities.

Macro-Regional Development and Smart Specialization

From an engineering point of view Telemedicine has entered the stage of maturity. There are many applications and systems available that provide high quality of service and security. However, the rate of adoption is still very low [4]. Main barriers are certainly legal and regulatory issues but also missing right business models and reimbursement opportunities [5-6]. Further to these barriers there is the problem of a fragmented market. Many systems are specialized to only one disease. Most systems are not integrated
into the ICT in health landscape, i.e. they come with own web platforms for patient and data management and lack seamless interfaces to hospital information systems.

Smart specialization and macro-regional development are two concepts that could be applied to overcome market fragmentation and work towards getting a critical mass for products and services [7]. A macro-region, e.g. the Baltic Sea Region, provides an environment where based on traditional relationships partners cooperate on all levels e.g. in research, policy making, economy and services like health care. The above mentioned ScanBalt Health Region could serve as a role model where factors hampering the successful implementation of telemedicine systems are addressed in a coordinated approach. The EU-Project BSHR HealthPort [8] aims at bridging the existing cross-sectoral gaps by involving the regional key actors in the value chain of health care innovations. Specifically BSHR HealthPort addresses following key bottlenecks:

1. Insufficient commercial exploitation of ideas proposed by health care researchers and practitioners;
2. Procurement practices limiting access of innovative SMEs to the health care market;
3. Insufficient innovation competencies of and cultural differences between the target groups.

The project aims to tackle these challenges at the macro-regional level.

Key objectives of the project are:

1. Set up a cross-sectoral innovation market (“HealthPort”) involving all health care related sectors;
2. Promote SME business development and facilitate their access to the health care market by identifying cross-sectoral pilot cases and increasing SME access to financing;
3. Enhance innovation competencies of the involved actors with tailor-made cross-sectoral programmes;
4. Develop regional innovation agendas and align them towards a BSR wide “health economy strategy” to improve healthcare by reducing costs and enhancing regional economic development.

BSHR HealthPort partners and associated organizations cover all health care related sectors and comprise expertise from triple helix organizations, public authorities, health care providers, industries, universities, financing institutions, as well as owners of health care providers.

Telemedicine falls within the scope of “health care innovation” and most of the telemedicine companies are SMEs working on the regional level. The BSHR HealthPort project provides tools that can be used by SMEs as well as institutions or regions to educate all stakeholders in respect to
entrepreneurship and innovation management, knowledge in public procurement practices at regional and EU level as well as providing a platform for matchmaking between health care providers and SMEs.

Conclusions

Telemedicine spans all forms of innovation from product innovation over process innovation to organizational innovation. Thus being a complex system that requires change management and adaptation at all levels for a successful and sustainable implementation. If this is not addressed by involving all stakeholders in this complex supply chain, chances of success will be very low. Telemedicine could take advantage of mechanisms and policies being implemented for innovation and macro-regional development and thus support the implementation of telemedicine on a broader scope. The concept of smart specialisation can be used to promote “champions” that have successfully implemented a service on a regional basis and transfer this service to other regions. For the Baltic Sea Region, it is both a challenge and an opportunity to demonstrate how these intentions can be put into practice at the macro-regional level serving as a heaver for BSR and for the Northern Dimension Policies or even entire EU policies.

Acknowledgment

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Dr. Wolfgang Blank, CEO of BCV GmbH and chairman of ScanBalt graduated in microbiology at the University of Tubingen. After gaining 8 years of experience in project management in the chemical industry (Henkel) including 2 years of postdoc research at the University of Kyoto in Japan, Dr. Blank spent 6 years as the Managing Director of BioTechnikum Greifswald before taking on the role as the managing director of BCV in 2001.

Dipl.-Ing. Thomas Karopka, project manager of BCV, has a background in medical and bioinformatics. Thomas Karopka is a member of ISfTeH and actively engaged in the ISfTeH Open Source working group. He is currently council member of the European Federation for Medical Informatics (EFMI) and chair of the International Medical Informatics Association Open Source Working Group (IMIA OS WG). He also serves as the European Liaison Officer for the ACM Special Interest Group on Health Informatics (ACM SIGHIT).

Peter Frank has a business background in accounting combined with a scientific background as Ph.D. in biotechnology. His experiences are from both academia, industry and cluster management including being a post doc scientist at Biocenter Oulu (FI), heading the secretariat of Danish Biotech association for SMEs, heading the Danish Industries (DI) regional association, being DI representative in Brussels in FoU plus working as a lobbyist for the cluster organization Medicon Valley Alliance. Before that he worked as an auditor and also ran his own company providing services for SMEs. He has been involved with SB from its beginning in 2001 and has participated in several EU co-funded projects as partner or coordinator.
Measurement of Blood-Glucose via Near Field Communication (NFC)

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Abstract: A newly designed blood-glucose measurement device wirelessly transfers the measurement data to a NFC enabled smart phone and, at the same time, uses the 13.56 MHz magnetic field provided by a NFC-interface to gain the required electric energy for supplying all electronic components of the device. With this concept the size of the device can be reduced, e.g., to the size of a credit card, because no battery, display and data storage is needed in the device. For measurement the new device is simply placed over the NFC-interface of a smart phone. The NFC interface powers the device and all relevant data about the device status and finally the result of the measurement is transferred to the smart phone. The measurement result and all other relevant information are shown on the display of the smart phone. The values of the blood glucose measurements are saved on the smart phone and can be further processed there if required, or can be transferred to any other place via internet.

Introduction

Near Field Communication (NFC) is an emerging standard in wireless radio communication. It is a simple data transfer standard applicable over a distance of some centimeters. In some medical devices, NFC is already used for transferring of various patient or measurement data.

The main goal of the development of a new NFC-blood-glucose-meter is the application of NFC for transferring the measurement data and the energy for the measurement by the NFC-interface. With this configuration, the size of the glucose-meter can be reduced radically. There is no display, no battery and no storage for the measurement data needed anymore, the size of the glucose-meter can be reduced to the size of a credit card.

Prototyping

At the beginning of the development of the NFC-glucose-meter it had to be made sure, that the NFC-interface can provide enough power for supplying the measurement. For this purpose a conventional glucose-meter
was purchased for measuring the power consumption during the measurement. Most of the glucose-meters are supplied by a conventional 3V-coin-cell. The measurement of the electric current by application of a measurement resistor showed a current of 1,8 mA during the measurement. When the data of previous measurements was read out of the storage, the current was lower than 0.01 mA. So a power of 5.4 mW has to be gained from the NFC-interface.

The voltage of the 3V-coin-cell is not constant over the whole lifetime. So there is a useable range of supply voltage for the glucose-meter. Measurements showed that the investigated glucose-meter can perform the measurement in a range of 2.3 V – 3.8 V. The power supply by the NFC-interface needs to prepare a voltage in this range while a current of 1,8 mA is flowing. For investigations of the power supply, the glucose-meter was simulated by a resistor of 1500 Ohm (= 2 mA at 3 V) and the voltage on the resistor was measured.

Figure 1. Block diagram of the concept of the NFC-blood-glucose-meter
To realize this concept the transfer of data and energy has to occur parallel at the same time over the same NFC-interface. The coil of the glucose-meter receives the 13.56 MHz NFC-signal and transforms it to a direct current voltage for powering the measurement. Parallel to the coil the NFC-chip is placed, which receives the measurement result by an analog input and is read out by the NFC-interface.

In Figure 1, the block diagram of the concept of the NFC-blood-glucose-meter is shown. If it is required, the direct current gained from the NFC-interface can load an energy-storage device (e.g. capacitor). A LED is applied for signaling the operability of the glucose-meter and limiting the DC-voltage. The measurement data is transferred to the NFC-chip, which is read out by the NFC-interface on the smartphone. The measured data can be stored on the smartphone or in any other accessible data storage.

In Figure 2, the actual prototype of the NFC-glucose-meter is shown. In Figure 2 the glowing of the blue LEDs and the display illustrate, that the system is ready to measure the blood-glucose level.

Further Development

At the actual development stage of the prototype, no single NFC-chip is available, which can transfer the measurement results to the smart-phone by the NFC-interface. Therefore, for the prototype a simple Mifare-NFC-chip is applied, where data only can be written in and read out by the NFC-interface. Semiconductor manufacturers provided the information, that an adequate NFC-chip with analog inputs for transferring the measurement result will be available in the near future.

Summary

The implementation of the NFC-blood-glucose-meter instead of conventional devices causes the following advantages:

- The size of the glucose-meter can be reduced radically to the size of a credit card and a thickness of some millimeters, storing in the wallet or integration in a smartphone-cover is possible;
• Measurement data can be saved on a smartphone or in any other accessible data storage;
• By using the display of the smartphone better display of measurement values, graphs or instructions is given;
• No battery needed for the measurement, therefore this is closer to green technology;
• Compatibility to many different NFC-smart-phones,


Stefan Cecil, born 1976 in Eisenstadt, received his M.S. degree in electrical engineering from the Vienna University of Technology in 2003. Since 2004 he is scientist in the Seibersdorf Laboratories in the business field EMC&Optics. There he is working in several projects on problems of electromagnetic compatibility and dosimetry. His research is in the area of numerical simulations of electromagnetic fields with different simulation tools and development of various NFC applying devices.
Requirements for a Software-Intensive Ecosystem for Telemedicine

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Abstract: Worldwide, public authorities are trying to improve uptake, efficiency and interoperability of ICT support for (telemedical) healthcare services through adoption and enforcement of standards and guidelines, such as IHE XDS and HL7. Furthermore, security concerns are often enforced by requiring services to run inside healthcare VPNs. Finally access control is tailored for authorized healthcare professionals, not citizens. However, closed network solutions along with big and hard to comprehend standards slow down uptake of solutions and access control regimes hold back interaction between initiatives in public and private sectors. With these major challenges in mind, we take inspiration from existing business and software ecosystem approaches and theories and formulate the question: how can we form a dynamic ecosystem of healthcare technology and services in order to allow easier and more flexible development, integration and application of new services, as well as accelerate the adoption of standards and further public/private engagement? Based on a commonality analysis of existing telemedicine solutions and standards in ICT for healthcare, we present functional and quality requirements that should be met for software-intensive ecosystem for telemedicine to be effective. In particular, we argue that i) emphasis on standards must be complemented by reference implementations, ii) an open source service and component approach must be complemented by quality control regime, iii) specifications and architectures must be complemented by provisioning and maintenance support by an ecosystem keystone player, and iv) access control mechanisms must support general access by authorized healthcare professionals as well as personal access by citizens.

Introduction

Telemedical systems in a patient’s home promise increased quality of life and less national spending. In Denmark many projects have experimented with video conferencing between clinicians and the patient in his/her home,
measurements and upload of data for chronically ill persons, browsing of medicine intake schemas, etc. However, these experiments have all suffered from having “silo” software architectures: a computer with a special purpose application is installed at the clinician, has its own data repository, and directly connects to a set of computers in the patients’ homes. Thus, no or little interaction happens with public systems, e.g. Electronic Health Records (EHR), and it scales poorly for patients with several diagnoses, as they need several different systems.

In the Net4Care project [2], we research software architectures that will enable small and medium businesses (SMB) to enter the marketplace for telemedical applications. We have surveyed existing products and projects and studied national and international healthcare standards and reference architectures. Internationally, there are standards that promise to ease interoperability like IHE profiles, notably XDS, and HL7 and thus seem like viable platforms on which to implement telemedical solutions. However our analyses show that they pose severe obstacles for SMBs. First, public documentation, if available, is reference documentation for the initiated and overwhelmingly bulky. For example, to our knowledge, it was only in 2010 and 2011 that more general books on CDA and HL7 became available [3,4]. Secondly, reference implementations are generally expensive proprietary systems that inhibit experimentation by SMBs.

An Ecosystem Approach

In Net4Care we propose to mitigate the learning curve as well as support SMBs’ application development for telemedicine by providing an application-centric ecosystem for telemedicine and an open-source reference implementation of the core platform. Bosch [1] outlines a set of success factors for application-centric ecosystems: a) large set of customers b) simplified contribution by third party developers c) ability to extend data models and workflows and d) a viable channel of exposure to customers. We hypothesize that few SMBs will enter a marketplace for telemedical applications as existing standards does not fulfill the simplified contribution requirement and those who do are unable to interoperate with existing public healthcare solutions, such as EHR systems.

Our ecosystem proposal focuses on the simplified contribution and extensible data/workflow model requirements as they are prerequisites for viable market channel and, ultimately, large set of customers. We have been inspired by the success of open source projects like Apache Software Foundation, Eclipse, and Android that have achieved global impact on all scales of software development right from student projects to international business. A major success factor is their learning resources, that is,
tutorials, examples, and overview documentation that provide a gentle learning curve, as well as freely available reference implementations. Thus in a couple of hours an independent developer can move from initial exposure to the first executing prototype. The goal of Net4Care is to achieve the same transparency and support for the SMB developer in developing telemedical applications.

Figure 1 shows the areas in which the Net4Care ecosystem is planned to provide value for a SMB. They are classified in three main categories: information, modules, and processes.

The modules category embodies the platform itself. To the SMB developer, this will be in the form of a framework in a mainstream programming language as well as a test environment of (simulated) servers for initial experimentation. A minimum of clinical vocabulary is assumed (like coding systems for clinical measurements) while the framework handles translations to/from HL7 (personal health monitoring records) and storage in XDS. The information category is essential as it is the learning resources that the developers of SMBs will use to quickly initiate application development using the ecosystem. Reference documentation is important but the focus will be more be on tutorials and “getting started” guides. Finally, the process category embodies certifications of companies...
and potentially software services before they are permitted to access and run on the Net4Care servers.

Utilizing the Danish National Service Platform (NSP) Net4Care servers will provide secure interoperability with relevant national and regional healthcare systems such as a national XDS Affinity Domain, National Patient Index, and regional EHRs, while exposing a simplified and coherent interface to SMBs.

As the national healthcare system is missing a security policy for integrated telemedical applications, we propose a policy that supports decentralized citizen-based access control to confidential telemedical data [5]. The proposed telemedicine policy aligns the security requirements to the national levels of security including non-repudiation by users/systems as in [6]. In order to fasten the certification procedures we further propose a semi-automated approach for system certification performed by the trusted ecosystem authorities.

Summary

The Net4Care project aims at designing an application-centric ecosystem for telemedical healthcare. We have argued why current standards fall short in supporting SMBs and their attempts to enter a promising market place. We argue that simplifying contribution is vital and have outlined how Net4Care will try to support this requirement by providing learning resources as well as an open source platform. An initial implementation of the platform is available [7].

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Semiotics and Semantic: Tools For an Effective Appropriation of Information, Communication and Health Technologies

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Abstract: As Cultural Objects, ICTs belong to the human sphere. This surround is driven by polysemiotics performances (involving many signs systems) which praxeological semantics permits to interpret. The term of Praxeology (or theory of human action) is used so far as it concerns to link principally technical objects to social practices in which they appears. The meaning of these objects is then studied in relation with the actions to which they are associated. In the case of the ICTs, their proposed “coupling” approaches (in particular for the HMIs) lead to a better use and simplify the appropriation process. The study of users’ discourses is very interesting from this point of view, and should lead to formulate recommendations for a more efficient appropriation of the ICTs. In parallel, according to a new idea of design related to electronic objects semiotics often takes place in a plan that relates different disciplines. It offers a common language to all partners and gives tools for a clear depiction of the objects and subjects involved in the interaction and tell how they interact. Example of vocal interfaces is described.

The common sense define semiotics as a theory of signification. Despite the fact that its main analysis models come from linguistics, it devotes itself to all sorts of languages. Semiotics is also an interdisciplinary discipline that deals with anthropology, sociology or philosophy, for example, but its curiosity also challenged it to deal with electronic objects. Today, according to a new idea of design, it often takes place in a plan that relates different disciplines and partners. A new situation occurs because the relationship does not necessary connect a theory to another theory but a theory to a practice. Semiotics is approached for a social application and to give a set of practical rules. Very roughly, one can make out various levels of relation: the first concerns the interaction with the electronic object (corpus level), the second the relation with the partners of the projects (dialogue level) and the third, the relation which is planned as a purpose (project level). Involved at each stage, semiotics gives tools for description, dialogue and planning.
The Object - Subject Interaction

Focus the subject more precisely at the interaction object - subject, and the way that the user (subject) established a junction with the technological object (the relationship is called a “con-junction”). As Cultural Objects, Information and Communications Technologies belong to the human sphere (concept of Umwelt formulated by Jakob von Uexküll). This surround is composed of polysemiotics performances (involving many signs systems) which praxeological semantics permits to interpret. The term of Praxeology (or theory of human action) is used so far as it concerns to link principally technical objects to social practical in which they are involved.

Referring to the three levels stake in social practices (presentational, semiotic, physical [1]), the object could become a mediator between the user and its environment. The term of “Semiotic mediation” is thusly used.

![Fig. 1: Practical levels and semiotic mediation](image)

Meaning of objects is so studied closely to the associated action, and more precisely, in case of contemporary communicant objects, with their proposed “coupling” approaches (in particular for the HMIs) to enable their use and simplify the appropriation process.

Making Easier the Appropriation of Communicant Objects

In terms of the semiotics of anthropic zones [2], the appropriation designates the way to go through the distal zone to the practical proximal zone. Rastier distinguishes three different zones: that of coincidence (the identity zone); that of adjacency (the proximal zone); that of strangeness (the distal zone). The main break separates the first two zones from the third. In other words, the opposition between identity zone and proximal zone is dominated by the opposition which separates the two zones taken together from the distal zone. Between the three zones, the two borders
deserve special attention: the *empirical border* is established between the identity zone and the proximal zone, and the *transcendent border* between the first two zones and the distal zone. Rastier suggests the use of the term FETISHES - without any negative connotation - for objects from the empirical border, and IDOLS those at the transcendent border [3].

The problematic is to tip the communicating objects from IDOL to FETISH status.

The object which has the FETISH status is seen as "familiar" and that make easier its acceptation and its daily use. An hypothesis is done that the Voice User Interfaces (VUI) which have recourses to spoken language, make easier the pass from IDOL to FETISH, in comparison of the Graphical User Interfaces (GUI). *The Recognition of Continuously Spoken Sentences* hold an important position in the way that it allows the user to address oneself from a natural way to the system without any preliminary specific forming learned to use the aforementioned system.

The recourse of the *natural dialogue* (unlimited) begs the vexed interrogation about the semantic interpretation, and underlines the role of the situational context. Indeed, communication is not reduced only to information transmission. Moreover, the "speech recognition" is not equals to the "interpretation" which requires a truly semantic and pragmatic treatment. A research project could be initiated by associating the linguists, semioticians and technologists: Predict functional Voice User Interfaces which take in account of attempts and the use of languages (lexicon, syntax, semantics, pragmatics, etc.

A preliminary study of the user's discourses (evaluations, enunciative positions, social doxa...) is very interesting from this point of view, and should lead to formulate recommendations for a more efficient appropriation of the ICTs, and a real implication of the persons.
These polysemiotics parameters permit to emphasize some specific technological solutions that are not widely used today and in particular all the HMIs based on the vocal and/or the gesture approaches for which the interaction modes are kept natural for the persons (for example, a vocal interface that would be transparently melt in the housing environment and following the context of the person to be assisted. Obviously, this can also be applied to health technology appropriation or to solutions based upon an important validation of acts in time and space. Tactile technologies can then be emphasised. The approach on how to consider the best parameter for the design thus directly condition the GUI design, the signage and colours of the interfaces signal and reminders, and, more importantly the modes of interactions with the end-user.

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Telemedical System for Individual Prenosological Health Assessment

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Abstract: During 2009-2011 longitude satellite studies have been conducted in the framework of “Mars-500” project. Prenosological assessment is a part of prenosological diagnostics - a new scientific and practical field studying people’s health in transition from normal to abnormal (prenosological) state. Its goal is to assess possible risks of diseases. This paper describes a telemedical system on the base of Heart Wizard instrument for individual health status assessment.

Introduction

Prenosological assessment is a part of prenosological diagnostics - a new scientific field, studying people’s health in transition from normal to abnormal (prenosological) states [1]. Prenosological states are between health and disease, and they are characterized by higher, than normal, tension of regulatory systems, which is necessary to maintain homeostasis. Prenosological control is aimed to monitor the people’s health, assess the “cost” of adaptation to environmental conditions and possible risks of diseases. Heart rate variability (HRV) analysis was first used in space medicine as a part of telemedicine system [2]. Now it is proven to be informative about health, including general health risks, cardiovascular conditions, various chronic disease conditions, aging, stress, fitness and more [3, 4]. This paper describes the results of using “Heart Wizard” instrument, which is designed for individual prenosological control and has been specially modified for satellite research project “Mars-500” [5].

Methods

Subjects

The study involved 4 male volunteers from USA (Poulsbo) and 6 male volunteers from Toronto (Canada). 5 subjects were from 45 to 52 years, and 5 – from 21 to 25 years. They conducted their tests weekly at their homes.
All subjects signed a written consent form. The results of 212 individual investigations were analyzed.

Methods

The study was conducted using Heart Wizard instrument (Biocom Technologies) modified for “Mars-500” project. Heart Wizard (also known as Health Reviser) is a tool to assess and manage personal health and fitness (Fig. 1). It includes a simple inexpensive pulse sensor and special Windows-based software with simple and intuitive user interface. The Heart Wizard provides users with valuable information about current health condition and its long-term history. The Heart Wizard concept is based on various scientifically valid methods of analysis of changes in one’s heart rhythm known as Heart Rate Variability (HRV). The Heart Wizard includes several health and fitness assessment tests. Heart Wizard utilizes cloud-based client-server technology. Client software components are installed on local user machines to perform testing using pulse sensors. Measured data is transmitted to Heart Wizard Data Center located on the remote server for analysis and storage. When prompted test results are retrieved from the server and displayed on the local machine in the forms of specific test reports and history charts.

A new methodological approach, developed in space medicine for assessing the risk of disease according to the HRV analysis, was used while assessing the results of studies. Adaptation level is measured here by the parameters of the functional reserves (FR) and the stress degree (SD) [6]. The measure of quantifying the health risks is the probability prenosological and premorbid states, which differ from normal states by significant shifts in autonomic balance.

Figure 1. A scheme of health assessment using Heart Wizard instrument
Results and Discussion

The analysis of test results confirmed the high sensitivity of HRV parameters to age-related shifts in autonomic balance. The shift of autonomic regulation toward reduced parasympathetic activity was observed in older research participants (pNN50=7,5±0,9 % vs 35±0,7 % in young participants) and increased sympathetic activity (Stress Index =167,3±12,8 c.u. vs 35,72±5,4 c.u.). The probabilistic approach has shown, that in the older age group the probability of normal functional states is decreased (61±3% vs 97±5%) and the probability of prenosological functional states is increased (37±4% vs 3%±5). We supposed that it increases the health risks when exposed to adverse factors.

This consumption is confirmed by the individual data analysis. The dynamics of functional conditions in one of the participants is shown in Fig. 2. Health Snapshot, Deep Breathing Test (DBT) and Health Questionnaire (prior physical work, quality of sleep, presence of illnesses, emotional state, stress, etc) data were compared. Functional deconditioning in this participant is mainly associated with stresses at work respiratory infections and accompanied by increased probabilities of prenosological state (pPrenosological). The probabilities of normal state (pNormal) decreased at those periods. We can observe not only the degradation of functional state due to various factors, but also the process of healing and recovery after illness. It is important, that the changes in autonomic balance appear at the very be-

![Figure 2. Individual probabilisic estimations of health status in the course of longitude satellite studies “Mars-500” (1 – emotional stress, 2 – respiratory infection)](image-url)
ginning of the disease, before the appearance of respiratory symptoms. Analysis of DBT data demonstrated that the lowering of functional reserves before and during acute respiratory disease in this individual accompanied by decreasing of normal reactions to the load (the growth of HRV during load is less), while after emotional stress the growth of HRV during DBT was sufficient. The revealed differences in reactions to emotional stress and respiratory disease may be useful for individual prenosological health monitoring, since we can try to classify the pre-disease condition of post-stress reactions. This problem will be the subject of further studying.

Conclusion

Telemedicine technologies can significantly improve the quality of medical care, enabling remote monitoring and using the advanced modern methods [7]. The individual prenosological health assessment is one of the promising directions of telemedicine. The analysis of test data supports the hypothesis about close correlation between changes in autonomic balance and effects of various factors (weather, emotions, morbidity, etc). The results demonstrated that unlike monthly examinations in other regions weekly individual prenosological assessment can detect disturbances of the autonomic balance prior to appearance of any health problems. This method may also help to monitor the effectiveness of preventive healthcare.

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Using Humanoid Robot in Ambient-Assisted Living

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Abstract: Authors showcase how the environmental data analysis can be correlated and used to influence the human activities in daily life, to recognize patterns relevant to COPD care, to trigger them proactively, and to deliver the efficient social communication using one humanoid robot. Authors describe an intelligent computerized system with artificial cognitive capabilities delivering the persuasive feedback to the assisted COPD patient using social humanoid robot.

Introduction

Accordingly to the World Health Organization, the Chronic Obstructive Pulmonary Disease (COPD) will become the third major cause of death in 2030. Because of the increased life expectancy and the decreased support ratio, the sustainability of care calls for the alternative Ambient Assisted Living (AAL) care solutions prolonging the stay of the elderly persons at their homes independently. It is known that presence of in-home caregivers positively affects adherence to COPD management [1].

The present study starts from the hypothesis that the independent living of COPD patients at home might be accompanied by one humanoid robot able to proactively interact and improve the conditions of those living alone. Traditionally, AAL systems deliver any feedback to the patient and/or caregiver through Personal Computer (PC). Recently an increasing number of different technological artifacts entered into our daily lives [2], ranging from graphical to tangible interfaces, from desktop computer to ambient intelligent applications [3], and specifically the use of special robots. Although those are developed in different contexts, robots are used also in social and cultural spaces [4], mainly because of their capability of taking decisions autonomously; they are able to “live” in an environment sharing presence and resources with humans or other devices and to implement communication in a social context [5].

KSERA Project

KSERA project [6] makes an attempt to deploy the humanoid robot to the homes where the COPD patients are living. It takes the tele-monitoring,
tele-alarm and assistive technology progressing in COPD care one step further thanks to the inclusion of the humanoid social robot. The proposed artificial cognitive system with social robotics combines the Ubiquitous Monitoring sub-system responsible for the data acquisition, gathering of the disease-related information, the rules and their application, the triggering system, and the socially assistive robot (NAO model from Aldebaran Robotics).

One research topic is about the most appropriate timing to deliver the information to the patient suiting his/her health management. The key difference between the state-of-the-art AAL solutions and KSERA is the way to deliver the feedback to the patient. In the traditional Human-Machine Interaction (HMI) approach, any system reaction occurred nearby the personal computer suits certain concrete Use Cases, but it might be insufficient in several real-life situations.

Patients already familiar with the robots feel the interaction in a different way compared to those experienced with artifacts like computers. This happens because the pc-based interaction relies on limited input/output devices, such as keyboards and touch-screens [3]. A mobile robot brings some additional sensors nearby a COPD patient. It complements the wearable sensing by non-invasive, multi-sensorial options. Using the social robots, it becomes possible to approach the person at the place of need, moving the humanoid robot nearby the patient instead of asking the patient to move in the front of the PC. The proposed approach eliminates the main limit of the AAL applications requiring the physical presence of the assisted person in the fixed place where the computer was installed. It offers a more powerful bi-directional communication mean because of the speech recognition and synthesis embedded in the mobile robot.

User Tests

Patients with COPD have an overall gradual decline in functions accompanied by the acute periods of exacerbation. For this reason they become vulnerable to the unfavorable environmental conditions. KSERA proposes one humanoid robot proactively delivering some social interaction to accompany COPD patients living alone, making an attempt to improve their conditions. The high fidelity instance of the KSERA prototype was installed in a room of the ISMB eHealth laboratory. User studies aimed at testing user experience was designed, set up and carried out in summer 2011 to compare the efficiency of KSERA and the interaction approach. The general goals were to investigate the human-robot interaction in an AAL context from the user perspective and to determine the best modalities to implement and to assess the acceptance of robotic intelligent systems in a
home environment for assisted living. The observed variables were referred to the HRI aspects, attention catching strategies, quality of the dialogue and persuasiveness, robot mobility, adaptation to different users groups, appropriateness of different levels of user control/system proactivity, and wider aspects, the acceptability of the robot interface, cost/benefit evaluation from user perspective, and the user requirements in terms of privacy and ethics. The user test methodology has been set up according to the ISO13407 [7] that requires the users involvement through task scenarios focused on real-life context in realistic settings. The collected feedback was used by the KSERA team as hint for setting up of the project user tests.

Results

The study involved 6 Italian people, 2 male and 4 female, aged from 56 to 93 (70 years old in average), with medium-high education level and medium level of confidence with ICT, assessed according with the TAM [8]. The tests showed that a humanoid robotic system is acceptable for the target: the first impression was very positive, relaxing and not threatening at all. Regarding the dialogue with the robot, the test highlights that there are different communication styles expected by users from the robot:

- When going to alert the user, the robot should use an assertive tone;
- When going to provide information (e.g. temperature), a less direct and more polite form is required;
- When attempting any kind of healthcare communication, e.g. a feedback about blood oxygenation, the robot needs to interact in a trustable style, communicating the data and also a qualitative judgment on it.

The robot thinking aloud is a particular modality of interaction that the sample consider necessary to know the goal of the actions that the robot is going to perform, especially when these actions are addressed to the environmental control. During the tests, the sample evaluated the process where the KSERA system monitors the environmental conditions, communicates the temperature to the user and therefore activates the fan, according to pre-set rules. In general, the possibility to receive information about the outdoor and indoor environment is judged as interesting and the KSERA capability to control domotic actuators modifying and managing the home environment is considered very important. Although people consider positively the automatism and the proactivity of the system, the sample express the preference about being involved in a brief interaction with the robot, and being informed about the parameters and possible actions to undertake.
Conclusions

After having tried different possible ways of interaction with NAO doing different tasks, people feel a positive attitude toward the robot. The robot is perceived by them as a reliable source of information and suggestions about their behavior or habits. People dislike any unauthorized change operated by the robot in their home environment or their personal behavior without being preventively allowed by them to do so. The observation shows that people think that it is easy and natural giving attention to the robot. The sample considers that the robotic system could be useful in several tasks, such as controlling home appliances (incl. air condition, lights), setting and receiving alerts about things to do, receiving information from the external world, in order to obtain a real energy- and consumption saving- lifestyle. In the view of the above, sample perceives the improved interaction through an autonomous robot because it draws and encourages humans in their wellbeing keeping.

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International Telemedicine and eHealth Initiatives and Developments
Bridging the Patient Empowerment Gap of National Healthcare Services with QR Codes

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Abstract: ICT-support plays an important role in the strategies for patient empowerment of most developed countries. However, due to a basic set-up with closed VPN-like healthcare networks and security mechanisms tailored to healthcare professionals, it is often difficult to provide patient controlled ICT-support. We present a case on medication support in a Danish context and propose a simple solution with general applicability.

The medication support case: in order to support taking medication a patient may want notifications from personal medicine management system e.g., an electronic calendar. Information can be obtained from the medicine package or from the national service, called Shared Medicine Card (SMC). Once the information is found it must be entered into the electronic calendar by the patient. The functionality of reminding on medicine intake could bring more value to more patients, if it was “automatically” available in the patients environment e.g., through applications (apps) in phones and PCs, which interacted with the SMC. However, current design of the national services does not support the integration scenarios for patient oriented systems, due to centralized access control. Thus for small or medium size app developer businesses (SMB) such security and authorization procedures create harsh conditions and long calendar time for developing affordable personalized and integrated telemedical applications.

To bridge the gap, we propose, a semi-automated integration approach, based on quick response (QR) codes, where medicine prescriptions on medicine packages, and/or the national portal, are also encoded as QR codes, which can be scanned into e.g., a smart phone and automatically converted to e.g., calendar notifications.

Introduction

According to World Health Organization (WHO) only about 50% of patients of developed countries, take their medicines as prescribed [1] and poor medication adherence result in costly hospitalizations. The annual expanses are estimated to more than $100 billion in the U.S alone [2].

Danish health authorities are aware of the importance of compliance and other medicine treatment challenges. To better support medical treatment of patients, by health professionals, a national healthcare service, called Shared
Medicine Card (SMC), was created. SMC is exposed as a web service for integration with systems used by health professionals, e.g. electronic patient records (EPR). Citizens may access its data through a web page, e.g. the “sundhed.dk” healthcare portal [3].

Although many adherence apps already exist for personal use on the Internet, they require manual typing of often complex data based on medicine prescriptions, which may be a challenge for some patients.

The SMC service has been suggested as a service endpoint, to support medicine reminder and compliance functionalities for citizens [4-5]. However, security, political and other concerns make it difficult and costly for SMBs or open source communities to integrate personalized medicine management systems (PMMS), with SMC [5].

Reports on compliance, argue that a single approach for improving medicine adherence will not be effective for all patients, because of the diverse influencing factors: economical, patients specific preferences, etc [1, 2, 6]. Hence, in order to improve the compliance situation, it should become possible, for SMBs or open source communities to build affordable, personalized PMMS for patients, satisfying data security, at the same time.

One way to support this aim, as proposed in [5], is by redesigning national web services with centralized access control (AC) to support decentralized patients based access control to health data.

In this paper, we propose a different strategy, for achieving the aim, based on QR codes, which does not require SMC web service redesign. The idea arises, as we noted that:

- Medicine packages of Danish drugstores have prescription labels attached, as in fig. 1, left.
- The information on the labels can be encoded as a QR code, in a standard format, which fits a medicine adherence scenario, as in fig.1, right.
- The medicine data exposed in iCalendar format, as in fig. 2 can be tuned to exclude the sensitive confidential information, or become partially encrypted, per user request at the drug store. This
proposal is a target for usability and human factor analysis, described in section 1 below.

- Such QR codes could, also be shown next to the medicine prescription in the protected part of the sundhed.dk healthcare portal.

Method

Research recommendations on telehealth [7], distinguish and guide through the following key areas within telehealth:

**Technical:** It is suggested to investigate the means to integrate the various infrastructure components in a secure and seamless manner and development of new or incorporation of existing technical and tele-communications standards into telehealth, see section “Technical” below.

**Human factors and usability:** The usability analysis, will be conducted using Participatory Design approach [4, 9], see section “Experimental Design” below.

**Clinical:** It is suggested to use randomized controlled trial, cf. section 2.

**Economic analysis:** If the usability and clinical studies show sufficient evidence on improved medicine compliance, we plan to do a long-term economical analysis, in collaboration with drug stores and health authorities.

Technical: Infrastructure and Security

The preliminary choice for the QR code format is iCalendar, described in the RFC 2445 [10]. iCalendar is supported by several calendar systems including Apple iCal and Microsoft Outlook. We will analyze the degree to which iCalendar and QR code is suited for medicine adherence enhancement scenarios and conduct experiments to validate the technical and organizational requirements. An example of iCalendar is shown in fig. 2.

We believe that this type of integration is a sufficient starting point, for bridging the gap of integration possibilities of NHS with patient empowering systems, in an affordable and secure way, because

**Security:** The third party, QR code based PMMS, or calendar of a patient, can access the patients’ data without gaining access to other citizens’ medicine data. PMMS, or a calendar can keep the data locally on a device without sharing it with external servers. Parts of a QR code, e.g. DESCRIPTION can be encrypted, at drug stores, on user request.

**Architecture for mobile devices:** The integration from medicine packages, does not require network connectivity, which is a security and availability advantage and reduces costs.

```
DTSTART:20110714T000000Z //start date
RRULE:FREQ=DAILY;INTERVAL=1;BYHOUR=8,18 //frequency of medication
SUMMARY: Digoxin // title of the calendar event
DESCRIPTION: Oral use, for chaotic heart rhythm 1 tbl. morning and evening
```

Figure 2. An Example of iCalendar format (target for QR Code encoding)
Architecture for PCs: If medicine prescriptions in the healthcare portal are also made available in iCalendar format, then the medicine reminder application on a PC may become independent of the use of a camera device.

Experimental Design

We plan to conduct four experiments to cover the above. The first compliance and usability experiment will use qualitative methods such as hands-on workshops [9], to validate the conceptual design. The second will test for technical soundness. The third will be a one-month “real life” experiment to test how the design fits the daily rhythms of a small group of patients. Following a redesign, the fourth experiment will be conducted over a period of 3-6 month on patients with complex medications suffering long-term illness. We hope to be able to conduct the fourth experiment in collaboration with “Danish Patients”, an umbrella organization for Danish patient associations, as well as drug stores, clinicians, health authorities and the sundhed.dk web portal.

Acknowledgment

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E-Health Dilemma in the Next Ten Years

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Abstract: The aim of this paper is to observe and discuss the application of based on image analysis computerized diagnosis systems for the next 5-10 years. The work is based on the experience and results of design and implementation of hospital information systems, systems for telemedicine and diagnosis services. Main focus is computer-assisted diagnosis vs. computer-aided diagnosis and possibilities to use such services in HIS and in remote consultancy.

Introduction

In today's society the need for fast medical consultancy is rapidly increasing. The shortage of consultants in many medical areas is a fact today. The dispersion of the population is another important factor in medical consultations. The need for remote consultancy and effective use of the available medical resources is world-wide and acute.

The health care and all supporting industries are changing the way they support patients. The high-end medical technologies need personnel with high-end qualifications, whose availability are limited. Top-quality specialists are rare and inaccessible in general.

The solution for this problem is to switch to remote consultancies and to computer-based diagnostes: to optimize both the experts’ time use and quality of health care and medical services. But computer-based methods and technologies in many cases are fast changeable. The assessment of growing-up potential and applicability of everything new has been based on assessment of change in four main areas: business, research, technology, policy. Solutions and technologies oriented to medical implementations have many limitations but one of major is the fact that neither RTD institutions nor technology-implementing companies are the end-users of the scientific and technological products: the end users are medical organizations, hospitals and sole doctors.

The paper is oriented to discuss and to explain some problems of the future of computer-based diagnosis tools and applications as a part of new generation of hospital information systems, systems for telemedicine and diagnosis services.
The Role of Computer in Medicine: The Device or the Colleague

Today more than 80% of industries are based and/or supported by computers. The same can be said about our life: more and more it is oriented to computers’ support – we have the so-called ubiquitous computing. We don’t talk about desktop computers but about mobile and embedded computer in cars, washing machines, phones, TV, different types of smart or intelligent devices.

The medicine isn’t an isolated island and for the last 40 years many computer-based tools and applications become a part of hospitals’ equipment and clinicians’ practice. At the beginning computers were only parts of information systems and special devices. Then computers started to be used to increase sensing of clinicians and this was be the birth day of the computer-assisted diagnosis. Today computers are used as a second opinion in many cases of diagnosis and this is known as computer-aided diagnosis. The direction is automated computer diagnosis. But when, where and why this will happen is an interesting question not only to SF books.

We think that for all these years and in the future the speed of this process is dependent on the need to keep solutions safe because they are related to human’s health. This basic characteristic and its interpretation reflect on clinicians’ attitude to results of computers’ diagnosis: clinicians accept computers as useful tool but not as a much narrowed colleague. This is the basic problem for the all computer era and not only for medical applications. We think that the healthy conservatism in the medical community will not allow for next 10 years to computers to change their positions from tools and devices to colleagues. And this will be notwithstanding the push from the business, companies and some social trends. This will reduce the growth of computer-aided and automated computer diagnosis.

Computer-supported methods and computer-assisted methods and technologies for medical purposes have a big advantage because they only increase clinicians’ sensing systems and enable to do high precision tasks. But this is a normal point of view for clinicians about new equipment: everybody needs new and better stethoscope. It determines smaller resistance to the adoption and better use of its functionality.

Some Business, Research, Technology and Policy Remarks about Future of Computer-Based Medical Systems

For the last year many times was discussed business aspect of future trends of computer-assisted and computer-aided methods and technologies. The Frost & Sullivan investigation [1] of computed-aided diagnosis market was mention: “From the inception of the market in 1998 up to 2008,
revenues from the North American Computer Aided Diagnosis market continued to grow rapidly year after year. It surpassed the $100 million mark for the first time in 2007. However, this upward trend was reversed in 2009 due to several factors affecting global healthcare.” In combination with some other studies can be extracted some interesting trends:

- Standalone types of computer-aided diagnosis applications and tools are no interesting in last 2-3 years: business interest is oriented to tools/applications that can be integrated with hospitals’ information systems. This trend is well known for other computer-based business and the result is plug-in technology. But computer-assisted methods are more suitable for this than computer-aided and computer-automated methods.

- Decreasing of changing a computer-aided market is based on reimbursement a costs for this research. Now the hospitals include this to patients’ cost but patients do not want to pay for this. The result is the companies; push to research groups for creating an interesting to integration functions to companies’ hospitals systems. This is another well known scheme and the result is increasing a government regulation rules. The example is new U.S. Food and Drug Administration (FDA) draft guidance documents for CAD technology issued in October 2009.

The technology trends are closely connected to the future of the computer as a device [2-6]. Today’s research and development of new methods and technologies are oriented to desktop types of computers. And this is true not only for the full list of medical devices and applications. But the future will be too different: we will have central service-based servers and many consoles/ terminals (maybe portable) connected to it. The speed of communication and the local power of console/terminal will be dominant for the new era of medical applications. This will change the point of view to current Data Mining and AI applications in medicine because will change boundaries between thin and fat clients from computer point of view. As example this will change in many aspects the computer-aided diagnosis application oriented to chronic diseases.

The other computer hardware problems are visual devices (monitors are a part of this group). The major task of computer applications is to transfer one type data (input data) to another type (output data) because the output data is more suitable and understandable for the user. But users receive this information from the computer via computer’s output devices. We think that devices like artificial skin will not be suitable for medical purposes but visual devices will be the major output subsystem for humans. The future is 3D visual systems but the lesson from movie “Avatar” is: “The sensing
system of current humans is not educated to get so many and so different information. We need a special education oriented to this type of receiving information from computers”.

Conclusion

We think that for next 10 years applications and devices oriented to computer-assisted diagnosis and computer-aided detection will enable more efficient use of doctors’ time which will result to more efficient use of consultant’s time. This will enable earlier and more focused patient consultations and increased health status. But the time of automated computer systems with mandatory ability for human control is coming. And this future will be based on computer-assisted and computer-aided experiences of medical community.

References


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Electronic Indoor Morbidity Mortality Report: A Realistic Approach to Discharge Data Collection and Analysis

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Abstract: Indoor Morbidity and Mortality Record (IMMR) forms the backbone of data in the evaluation of the health status of a nation. In Sri Lanka it is also an integral part of the health information system which supports management of health care, monitoring of disease patterns and evaluation of treatment and prevention. Although the paper based system of IMMR has served this purpose over the years to a level of satisfaction, it has increasingly become obsolete with practical and logistical barriers. This has rendered it almost a daunting task to keep up with the expected levels of timeliness, accuracy and relevance, as required of such. It has become ever more evident in the recently with the volatility of disease patterns on the rise and the role of disease surveillance becoming a “life-saver” in current epidemics. In the quest for solutions, health care digitization and a web-based IMMR, proved to be a promising tool. This system will pave the way for “enter once-use many times” concept with unimaginable ways of analysis and presentations. With almost real-time information at hand the digital health care information system would inevitably become the “crystal ball” for prediction of the future health needs and disease patterns.

Introduction

Health statistics is an important part of health management. Two main aspects of health information are preventive health sector data and curative health sector data. The curative sector statistics can be further divided in to outpatient statistics and inpatient statistics. There are several aspects for the inpatient statistics, but discharge diagnosis data or indoor morbidity mortality data plays a very vital role in identifying the disease status of a county and help the health administrators in numerous ways. Primarily, such information assist in the decisions of resource allocation including infrastructure, pharmaceuticals, equipment and personnel and predict disease trends to be equipped to face the such situations.
Various countries have adopted various methods to collect discharge diagnosis data. Even among developed nations, the method of collecting data differs from country to country.

According to World Health Organization, the Sri Lankan cause of death registration process is classified as “Incomplete [1]”, and there is room for improvement to achieve the level of “Reasonably Complete cause of death Collection” which has already been achieved by majority of the developed countries.

Current Data Collection System in Sri Lanka

In Sri Lanka, in case of a death, discharge or transfer of a patient, the diagnosis of the patient is entered into the Bed Head Ticket (BHT) by the medical officer of the ward. This is the initiation of IMMR reporting. At present ICD-10 clinical coding system is utilized for categorization of diseases. The reports are generated quarterly to include this discharge data and sent to the Medical Statistics Unit for analysis. The main outcome is presented as The Annual Health Bulletin of Sri Lanka.

The current manual system possesses numerous drawbacks inherent to paper-based systems. One of the major issues faced is the inability to incorporate ICD codes in totality into the limited space allocated in paper based forms. Therefore at the central level it is impossible to find the patient aggregates according to any given ICD code and sometimes separate studies have to be carried out to find the individual diseases [2]. The same implication is applicable to age groups thus data of non-routine age groups are not available at the central level. Repeated data entry at several places significantly hinders the data accumulation/collection process. Further, this has made the data less reliable.

Owing to quarterly generation of reports, possibility of obtaining real time and up-to-date information is not foreseeable in the present context. No provision has been made for the collection of private sector data which accounts for 5% of hospital admissions [3].

All the above causes contribute to delayed publication of the data end product: The Annual Health Bulletin, thereby making it incomplete, inaccurate and insufficient. The data is therefore inevitably quite obsolete by the time of the publication [4]. Owing to this, data users and decision makers have drifted from the culture of evidenced based decision making for day to day and long term management.

In order to overcome these drawbacks it is imperative that the health care sector of Sri Lanka adopts a cost effective, efficient, reliable and user-friendly way of collecting storing, processing and disseminating discharge
data. The proposed eIMMR (electronic Indoor Morbidity and Mortality Record) system was developed with such a vision in mind.

Methodology

The present system was studied by procedural observations and stakeholder interviews. The stakeholders of a possible eIMMR system were also identified using the same methods.

Regular stakeholder meetings were held with the identified stakeholders to identify the user requirements of the new system. The identified advantages of the current system were also directly incorporated into the system with the stakeholder consent.

“Agile” method of software development [5] was used throughout the development process of this software. Suitable programming language and Data Base Management System were selected after a relevant literature review.

The implementation method used was piloting. In the evaluation phase summative and formative evaluation methods were utilized to assess the system and input necessary amendments as per the changing user requirements.

Discussion

The system was developed using PHP with MySQL as the database both of which are free and open source software. The identified six user levels were given different interfaces depicting their requirements. The total ICD 10 [6] classification was introduced to the system. Being a web based system, the total functionality and usage of the program can be monitored centrally in real time, and any malfunction can be addressed at once. The initial piloting was started in seven large hospitals, and the system already covers more than 5% of the total discharges in the country.

The resource usage of any health system mainly depends on the length of stay of patients in a healthcare institution. In a paper based system, there is no way to calculate this and all resource allocations are done according to the admission episodes. The salient feature of the system is the introduction of patient days per disease for the Sri Lankan Health System.

Regular evaluation of the system has shown encouraging results. The report completion time from the hospitals has been reduced from 6 months to mere 2 months. Further, Indoor Morbidity and Mortality Return Preparation time was reduced from 3 weeks to just a few minutes.

For the first time, the central institutions are being able to analyze data according to the ICD codes and patient days.
Future Plans

It is planned to introduce this system to the hospitals throughout the country. With new analysis tools currently in development, this system would provide the ultimate solution to satisfy the dearth of discharge data information in the country. When fully implemented, the eIMMR would be the showcase of how Computing and Information Technology can be incorporated in to the Health Care system at a minimum cost. It would give the administrators valuable and up-to-date information for planning, resource allocation and disease surveillance and in general act as the tool for healthcare management in the country.

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**E-Ophthalmology – One Solution for Innovative Health Management**

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*Abstract:* Modern information systems are not only technological, but also have organizational and human dimensions. They are an integral part of the business organization and a product, consisting of three main components: organization, people and technology. Medical information systems are designed to automate the activities, associated with diagnosis, treatment and personal health management of patients in hospitals and medical centers. In Bulgaria there are over 520 medical centers. At the same time, software market for medical health solutions is still gaining experience, although there are companies with approximately 5 years experience. And despite the potential to grow, it happens at a slower place noticeable. This paper presents a functional software development, specialized for ophthalmic practice in Bulgarian medical environment. The record design is subordinated to the Bulgarian and international medical laws for storing personal and medical information. It allows storing any processing medical data, needed for full eye examination – medical history, visual status, hematological, biochemical and urine examination, attaching ophthalmoscope and etc. images, option to set medical diagnostic term and patient observation data. On the other hand, in the current dynamic interweaving technological and web situation, patients are expected to participate proactively, regularly coordinating their care among multiple providers, interacting with health information outside the medical center or clinic, and sharing health information with others in their personal and professional lives. This central role means patients must store, maintain, and retrieve many kinds of personal health information, ranging from medication schedules to information researched online about their conditions, to referrals, to contact information for individual clinicians. This EHR with telemedical functions is unique for Bulgarian ophthalmic medical practice, because it’s the only specialized information system in the area, unlike the other combined software solutions.

*Introduction*

Taking an active role in personal health improves the quality of self-care; helps ensure appropriate care when patient interacts with the health care
system and increases confidence in dealing with family’s illness and injuries. It can also decrease expenses and minimize increases in deductibles, co-payments and premiums. Patients who take part in decisions about their health care typically have better outcomes. This model of behavior can be achieved only with the help of Electronic Health Records, generated by Medical Information Systems (MIS). Health management, both personal and at the hospital, is impossible without digital data. Independently what type of medical expert must patient visit, it is obligate to assure completeness of his personal health status. In this way, better care and better diagnoses is guaranteed. Only MIS can ensure the following parameters:

- **Accuracy:** Data are the correct values and are valid;
- **Accessibility:** Data items are easily obtainable and legal to collect;
- **Comprehensiveness:** All required data items are included. Ensure that the entire scope of the data is collected and document intentional limitations;
- **Consistency:** The value of the data is reliable and the same across applications.

This article is focused on development and specifying restrictions of a specialized medical information system. In the process of constructing the method of system analysis was used, in other words - decomposition of complex problems into parts in order to solve the task through analyzing their interactions and reconciliation.

The main goal of any MIS in clinical departments is predominantly automatic processing of information in the preliminary work in determining the diagnosis and developing treatment tactics. Major data sources are documentaries (technology, graphics and data recorder, specifications, price lists), data from medical apparatus, occurring in the workflow expert correspondence and acquired during a conference (telemedicine work model) etc.

**Methods**

The presented medical information system with telemedical functions is specialized for the needs of ophthalmic offices and considering that, it differs from the already developed information systems as a unique software product in Bulgaria.

Entrance in system is secured by 5 component's protection: username, password, public key, PIN and private key.

The form is a digital representation of regulated paper documents, used in Bulgaria. It is purposefully created to imitate the paper version, in order to ensure the fast and easy adaptation to the software product by the experts.
One of the most important conditions for the introduction of new medical information system is the user friendly interface, which hopefully stimulates and attracts the effective use by medical staff.

In any clinic, there is large number of workplaces, or two or more clinics using one system, so Client-Server technology is obligatory because it allows storing data from multiple locations at one place. There are plenty more benefits from using such technology:

- Easier administration – the collected data is at one physical location;
- Centralization – access, resources and data security are controlled by the server;
- Flexibility – any new technology can be easily integrated into the system;
- Scalability – any element can be upgraded when needed;
- Safer backup – everyday easy backup;
- Higher security – complete security and encryption support for databases.

After patient data exists in the server database, the patient case-record can be created. It contains 8 forms:

- Patient data – the system automatically extracts personal data from Patient’s register, and doctor begins to enter medical data – where is the patient sent from, is the patient an emergency or planed case, how many days has he spent into the clinic, outcome from hospitalization, etc.
- Condition at admission – contains data about the patient medical condition and any treatment, made through the hospitalization.
- Anamnesis - detailed and consistent means of obtained information from patient or relatives, for the nature of disease. The data consists of present complaints, past medical studies, past medical treatments, family medical history, medical study plan and medical treatment plan.
- Visual status 1 – data about eye orbit, eyelids, tear glands and lachrymal pathways, eyeballs, conjunctiva, and cornea for both eyes. There are fields for every symptom, where the ophthalmology specialist can enter data and personal notes.
- Visual status 2 – continues the data about specialized ophthalmology status - anterior chamber of eyeballs, irises, pupils, crystalline lenses, vitreous bodies, ophthalmoscope test and visual acuity again for both eyes.
- Further examinations – it contains data about further, if necessary, examinations – blood hematological and biochemical, and urine tests.
There can be attached multiply tests for one patient case-record, in special form, by clicking “Add new examination” button for additional type of the test. If necessary, edit is also available; but with digital signature required.

- Patient monitoring - the next form of ophthalmic disease history contains chronologically entered information about the patient's condition after treatment.
- Diagnosis - the last window that is filled from the history of ophthalmic disease includes the final diagnosis, additional data for eye status and any patient's ophthalmologic images.

The system allows large number of statistics – patient’s and medical data. The most important is generating of Medical conclusion from the case-record and extract it to Microsoft Word by simple click. Every statistic form has buttons for extraction to XLS, DOC or PDF format.

The patient also can access his personal record from a distance, by entering username and password in a specially designed web platform. He can initiate a conversation through a specialized messaging board, whenever there are complaints or questions. This simple telemedicine function secures the patient that he is always in connection with his doctor and his condition is constantly traced.

Conclusion

The presented software solution is about to be popularized to the medical information systems market in Bulgaria. Its uniqueness, completeness and security are the benefits which are likely to find a place in clinics and medical centers. But on the other hand, still immature market in the country of such technologies and the refusal of doctors to develop their computer skills are obstacles we have to face.

References

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New Fact of the Early Telemedicine History

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In worldwide prospect the telemedicine history can be counted from 1905. On March 22nd 1905 Wilhelm Einthoven, professor of physiology of Leiden university, Holland, Nobel winner, inventor of the electrocardiography, made translation of the normal electrocardiogram (ECG) via telephone cable from the laboratory in his own house to the university clinic at a distance of 1.5 km. W. Einthoven for the first time in the world used a Latin prefix "tele-" for a designation of the distant medical care. He called his own system «telecardiogramme». In 1906 in magazine «Archives Internationales Physiologie» prof. Einthoven published an article devoted to the first-ever telemedical technology [5, 23].

Nowadays tele-ECG is actively used in many countries in the world as a part of emergency medicine, in-hospital treatment and home care [2, 6, 17, 22-24].

Telemedicine history in Ukraine traditionally is counted from the moment of introduction of the first analog tele-ECG systems and others biotelemetry devices. This happened in 1969 [23]. However, this study has allowed "shifting" with almost 30 years the start up Ukrainian telemedicine.

In the autumn of 2011, while working with archival documents the following information was found: In edition “Polish Medical Newspaper” (Polska Gazeta Lekarska, N27 from 1937, p. 515) in the description of the L’viv general hospital told: «last two years in Department of infectious diseases were regularly spent teleelectrocardiography researches. Patients remained in department, and results of examinations of the hearts were transferred on 500 meters in Pathology Institute. These researches are organized by prof. Franke» [16]. Discovering this specific information we have undertaken research in order to find details and reveal the exact circumstances of the first application of the telemedicine in Ukraine. As a result of the analysis of variety of sources [1, 3-4, 7-14, 18-21, 25-27] the authors managed to discover that in 1935 in L’viv professor Marian Franke (fig.1 [25]) organized a telemedicine (tele-ECG) system. The sending
device was placed in the Department of infectious diseases of the L’viv general hospital, while the receiver was situated in the Chair of the general and experimental pathology of the L’viv University Medical faculty. The head and co-author of the tele-ECG system was prof. Witold Lipinski (fiq.1 [26]). This fact was confirmed by two additional independent publications – one from 1937 and another from 1965 [19, 27]. ECG transferring was lead via «special wires» at a distance of «about 500 meters» [7-8]. A lamp ECG machine "Elkagraph" manufactured by F. Hellige & Sons (Freiburg, Germany) was used. According to M. Frank «Keeping the patient at his/her place [due to tele-ECG – the note of authors] allowed avoiding the collateral reactions connected with his/her transportation» [7-8]. In 1936 M. Franke published article about changes of ECG records of patients with infectious diseases (in particular – with a scarlet fever (90) and a diphtheria (19). The article «Zmiany elektrokardiograficzne w chorobach zakaźnych» (“ECG changes during infectious diseases”) in two parts was published in the Polska Gazeta Lekarska (“Polish Medical Newspaper”) [7-8] (Fig. 2).

As the basic tool for tele-research Prof. Franke specifies “teleelectrocardiography”. Groups of 109 patients (including several children about 14 years, and few patients at artificial ventilation or at terminal stage) had been examined from a distance. Professor Franke revealed and carefully described variety of ECG changes especially caused by infections such as delays of conductivity, miocarditis, rhythm disorders, changes of an electric axis of heart, etc. No doubt, for the first time in Ukraine the telemedicine (telecardiological) system was used in 1935 in L’viv by doctors and scientists under the leadership and supervision.

Fig. 1. a) Professor Marian Franke (21 March 1877 L’viv – 12 September 1944 L’viv) - head of Chair of the general and experimental pathology of the L’viv University Medical Faculty, first time in Ukraine introduced telemedicine in 1930s. b) Professor Witold Lipinski (30 November 1886, Krakow – 27 September 1955, Lodz) - head of Department of infectious diseases of the L’viv General Hospital, co-author and co-worker of Prof. Franke during implementation of the telemedicine in Ukraine in 1930s.
on of Professor Marian Franke.

There are some examples of a tele-electrocardiogram of patients with the infectious diseases, transferred and interpreted by distance via tele-ECG system of Prof. M. Franke (fig. 3). Several tele-ECG sessions were lead for the patients at terminal (agony) stages, even for the patients at artificial lung ventilation; so, we can summarize that Prof. Franke for the first time in the world shown possibilities of the telemedicine in intensive care (fig. 3).

**Conclusion**

1. For the first time in Ukraine the telemedicine has been used in 1935 in L’viv by group of doctors and scientists under the direction of Professor Marian Franke and Professor Witold Lipinski.

2. The first Ukrainian telemedicine system was a tele-ECG system based on the lamp electrocardiograph and wire data transmission. Probably for the first time in the world the tele-ECG system was used in area of infectious diseases and intensive therapy.

3. Practical use and scientific studies of the tele-ECG results (n=109) have brought a considerable contribution into the further development of the electrocardiography as an objective method of examination of the cardiovascular system. The significance of the telemedicine for the solving
of organizational, epidemiological and clinical problems was also demonstrated.

4. Tele-ECG is one of the most powerful tools of the modern telecardiology. Telemedicine activity of Prof. M. Franke and Prof. W. Lipinski have excellent confirmed and realized Wilhelm Einthoven’s thesis [5] that: «Only there, where there is a connection between laboratory and hospital, a cooperation between the physiologist and the clinical physician, where everyone remains head in the own territory, only in this case a fruitful use of electric methods of diagnostics is possible».

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Roadmap towards Sustainable Pan-European Certification of EHR System

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Abstract: This paper addresses status and possible roads towards a sustainable and comparable quality labelling and certification (QL&C) across Europe. It provides several ways to document functional and interoperability quality of an application. It lists benefits that can accelerate the adoption of QL&C.

Introduction

Realising health added and economic value of eHealth and Health IT applications requires a permanent focus on “quality”, both at functional as well as on “interoperability” level. That quality should be objectivated in a comparable and trustworthy way. This paper introduces first the potential and the pitfall for Electronic Health Record (EHR) system quality management. It indicates then possible roads towards a sustainable and comparable Quality Labelling and Certification (QL&C) across Europe with market or authority driven approach and illustrated them by some examples.

Realising the potential of the EHR

Recent reviews of the literature found a set of high quality studies showing that EHR system improves the quality of care by increasing adherence to guidelines, enhancing disease surveillance, and decreasing medication errors [1]. Balfour [2] observed most absolute increases in improvements in quality of care in the range of 12% to 20%. Coordination of care is one of the main benefits proposed by EHR, particularly for individuals with chronic conditions or with multiple co-morbidities. Chaudhry [3] found enhancement of primary and secondary preventive health care delivery (influenza vaccination 12 to 18%, pneumococcal vaccinations 20 to 33%, etc.). Another positive value is a decrease in rates of health services utilisation, specifically radiology tests and laboratory measurements [2].

However, the benefits listed are average figures for EHR applications in general. The performance of an individual EHR system may be much more disappointing than expected. EHR systems have to fulfill the expectations
of the users, payers, patients and health authorities, but also to respect some quality requirements in order to provide the full potential of the EHR and to prevent some avoidable risks. In the past, health-related software has been mainly used for administration and billing purposes: the potential to harm the patient was so very low. Nowadays, EHR systems deal with critical function such as prescribing. Such systems may have a catastrophic impact on the health of the patient, e.g., Nanji [4] noticed that a computerised prescribing system, without comprehensive functionality and processes in place, does not decrease medication errors. Alerting for allergies, contraindications or dosage errors are important functions to be integrated in such systems in order to impact upon rates of medication errors. More and more adverse events resulting from the use of bad information systems or from misusing EHR systems are observed, e.g., Myers [5] made a review of the reported Clinical Information System Adverse Events in US Food and Drug Administration Databases. The collected information shows that these adverse events are mainly manifested by missing or incorrect data, data displayed for the wrong patient, chaos during system downtime and when systems are unavailable for use. At the initiative of the EFMI, a website [6] makes also a compilation of the reported incidents in healthcare where medical information system was the cause or a significant factor.

**EHR Certification in Europe**

Some countries in Europe considered the potential of EHR system big enough to harm a patient seriously and set up some QL&C to support the software function shift. The study of the European project EHR-QTN shows that nine European countries have already set up a national EHR QL&C process at least one functional domain: Austria, Belgium, Denmark, France, Ireland, Netherlands, Norway, Portugal and Serbia. Others countries declare also their willingness to establish an EHR QL&C within 1 or 2 years: Slovakia, Czech Republic and Italy.

The impact of the QL&C has been studied in this project and countries have noticed, after the launching of a QL&C, an ongoing effect on the quality of the functions covered by the certification through the suppliers’ adoption of a minimum clear functional requirements where possible based on standards. Software solutions quality is uniform and better. Data exchange and functional modules are easier to compare and subsequently to buy. Interoperability is facilitated in the selected areas on national level. The impact of the certification is increased when supported by a legal framework like in Serbia with the IT Rulebook [7] or by financial incentives and the promotion of the certified products to end-user customers like in Belgium.
**EHR Certification strategy**

QL&C covers different services, approaches and results, depending on who is the “initiator” of the process. A “Certificate” is always granted by an authority, enforced by legal or regulatory mean. Other quality labels are either a “Quality Label” (third party assessment), or a “Quality Mark” (self-assessment with an external audit) or a “Declaration of Quality” (self-assessment without an external audit). For EHR system, the most suitable QL&C are “Certificate” and “Quality labels”. Both EuroRec Seal and IHE Integration Statement are “Quality labels” granted by private service providers and should be considered as “market” driven. The same applies for the “Continua Certificate” which should not be called a “certificate”. Certificates, at least regarding EHR systems, are granted in Belgium and Serbia and regarding some functions of the EHR in Portugal, France. Authority can grant power to a certification body to make effective testing. The certificate is granted either by the authorities or by the certification body. The quality labelling service provider grants the label. The effective testing is done by a third (affiliated) party in case of EuroRec or by the service provider himself in case of IHE and the Continua Alliance. EuroRec is addressing the EHR system as application, focusing mainly on functional aspects (data exchange and sharing of health related data, reliability, trustworthiness, privacy management, authentication, semantic aspects).

IHE focuses mainly on the exchangeability of health data between different health information systems and addresses also security and privacy. Continua Alliance addresses the portability of device related information from device to the different connected information systems. Neither IHE nor Continua address the quality and the reliability of the content exchanged by validating the correct working of the issuing software or the device.

**EHR Certification Roadmap**

This section address step by step what needs to be done in order to reach generalised quality labelling and certification at Member State level, covering at least one area of certification (functional, ‘interoperability’, use) for one intended user group (general practitioners, hospital nursing, pharmacists,…). The process and the time scale for nationwide quality labelling and certification are basically the same for most of the countries. They do not depend on the set of functional criteria to be tested or on the kind of profile to be validated. Time scale seems to depend, at least partially, on the human resources available and on the willingness to make use of available expertise or to reinvent again the wheel, country by country. These steps towards a nationwide certification of EHR systems are
regrouped in 4 main phases. 1) Setting the framework will take between 1 and 3 years. Most of the tasks within this phase are reusable for next QL&C sessions or when expanding scope and content to include other user groups and domains. 2) The pre-assessment phase will take between 6 and 9 months, depending on the possibility or willingness to make use of existing documentation and tools (EuroRec / IHE). 3) The definition part of the assessment phase may take between 3 and 6 months while the assessment phase as such partially depends on the number of applications to be quality labelled or certified. 4) The granting and maintenance of the Label / Certificate should take another 3 months.

Conclusion

This paper raises the awareness of the need of QL&C of EHR systems and shows briefly how to implement such process at national level. The deliverable “Roadmap Towards Sustainable Pan-European Certification of EHR Systems” [8] of the EHR-QTN project describes this process, on national and cross-border level, more in detail and provides some recommendations on legal and regulatory framework, involvement of stakeholders, the technical framework and the quality labelling and certification process as such. Third party assessment offers most guarantees to the “clients” and regarding cross-border trans-European aspects. As mentioned in the Belgrade Declaration [9], we confirm the importance of QL&C and the need of a common definition of a minimum set of quality criteria applicable to advanced EHR system in Europe.

References

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Secure Data Exchange Based on Signature PKI

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Abstract: In a national exchange platform for medical data, several security considerations have to be addressed. Main solutions are based on cryptographic functions: digital signatures are used to ensure the authenticity of users and the integrity of data, while digital encryption will be used to ensure the confidentiality of data. In our approach, we show that trustful public/private-key cryptography can base on an existing signature PKI for secure communication of electronic data: Communication partners will generate temporary public/private key pairs which are used during the communication session to ensure an end-to-end encryption. With each information request a temporary public key certificate is transmitted, asking the sender to encrypt the requested information with this key. In effect this approach will save expensive maintenance costs. The necessary preconditions for this approach are already given within the context of a national eHealth platform: multiple receivers, even mostly unknown at the time of information providing, trustful centralized server components, and a data-pulling workflow on receivers’ side.

Introduction

The idea presented in this paper is an improvement to reduce the costs for operating the eHealth platform described in [2]. A pragmatic usage of signature cards avoids the costly maintenance of a public key infrastructure (PKI) for encryption and decryption. This idea is described in the context of the eHealth platform in [1] and it is applicable for other contexts as well. Encryption is an appropriate method to avoid non-authorized readings of information during the transmission from a sender to a receiver. Digital electronic signatures are used to ensure that the content of the message is not changed during the transmission of the message. Both applications, encryption and signatures, make use of so-called public-private key pairs. A key pair for encryption is used in the way that a message is encrypted with the public key and it can only be decrypted with the corresponding private key. A key pair for signature is used in the way that a message is hashed, the hash is encrypted with the private key and attached to the message. A receiver may use the public key to decrypt the hash-value and compare the
result with the self calculated hash-value of the received message. If both
hashes are identical, the signature is correct.

A Public Key Infrastructure (PKI) can be seen as a public available
directory where public key certificates are stored. Additional for encryption,
private keys have backups. In case the private key gets lost, and the owner
still receives encrypted messages, he needs the backup to decrypt those
messages. On the other side, for signature keys a backup infrastructure is
forbidden as it contradicts the non-repudiation of signatures. Otherwise the
user could argue that someone else may have signed with the stolen backup
key. If the signature key is lost, it can be replaced by a new one, while the
old signature key is added to a certificate revocation list.

Regarding the provided infrastructure behind, signature keys should never
be used for cryptography because of the missing backups and cryptography
keys must never be used for signature because of the existing backups.

Three Kinds of Information Exchange

The eHealth platform is designed for information exchange. Depending
on the type of information, there are different kinds of communication:

**P2R, Provider P to (known) Receiver R:** The data provider knows the
data receiver. For example a laboratory sends a report directly to the
prescriber. In this case the laboratory result is signed by the biologist,
encrypted and then sent. The report can only be decrypted by the prescriber.

**P2UR, Provider P to Unknown Receiver UR:** The data provider does not
know which receiver finally will receive the information. Because of the
free choice of the patient, the data provider is not allowed, to address
information directly to another health professional. For example: The family
doctor should not send the prescription directly to a selected pharmacist.
Instead, the family doctor encrypts the data for “the eHealth platform.” As
soon as the patient-selected pharmacist pulls down the information, the
eHealth platform re-encrypts the information for that pharmacist.

**P2MUR, Provider P to Multiple Unknown Receivers MUR:** This is the
classical use case for shared electronic records. One data provider produces
information for an undetermined number of unknown receivers.

Encryption Based on Signature PKI

As already mentioned, cryptography PKI needs a backup service for the
private keys while a signature PKI must not have a backup service.

The eHealth platform is presented on Fig. 1. A hospital may send a
discharge letter to a dedicated practitioner (P2R) or provides the document
for an unknown pharmacist that will be selected later by the patient (P2UR).
Or the hospital provides the document in the patient's health record for
future usage (P2MUR). Therefore the hospital asks the eHealth platform for a temporary public key by sending a signed request. The platform will provide a message containing a generated public key signed with the signature of the PKI. Then the hospital will use the received public key to encrypt the message before sending it to the eHealth platform.

For retrieval, an information requester generates a key pair for encryption, signs the public key part with his signature from the PKI, and attaches this part to his data request. The platform checks whether the requester has the rights to get this information on base of the PKI signature, then re-encrypts the requested document with the received temporary public key, and delivers the signed and re-encrypted message to the requester. The encryption/decryption now bases on an existing signature PKI. A costly cryptography PKI is not necessary. A quite similar structure of providing and pulling information can be applied resp. added to common mail servers, restricted to the P2R communication.

Solving the Re-Encryption Leak

The remaining problem is the re-encryption, where the server has to decrypt the information first and then encrypt it again for the receiver, which means the message or mail is disclosed temporarily. This has to be avoided by the use of a trusted third party (TTP), separated from the other servers of the infrastructure. Fig. 2 shows the principle: The sender generates a symmetric encryption key (sym-key) and encrypts the mail herewith. Then the sender announces his request for sending and asks the TTP for a public key (pub-TTP) to encrypt the symmetric key. It attaches the encrypted symmetric key to the encrypted mail and delivers both to the mail server. If the receiver pulls his mails he sends his signed public key (pub-RCV) to the mail server. The mail server then sends the encrypted
symmetric key to the TTP for re-encryption with the pub-RCV. Note, that the TTP is not aware of the encrypted mail. The TTP re-encrypts the symmetric key with the temporary public key of the receiver and hands it back to the mail server. Finally the mail server delivers the encrypted message together with the encrypted symmetric key of that message to the receiver. The receiver decrypts the symmetric key with his temporary private key (priv-RCV), and then decrypts the message with the symmetric key.

References


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Telemedical Ecology: Preliminary Results of Longitudine Medical Environmental Research Project “MARS-500”

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Introduction

Telemedicine technologies are increasingly used for transmitting of necessary for the diagnosis data, remote contacts with patients, collection of statistics. Thus the main object of telemedicine is usually ill person, who needs in diagnosis and treatment.

Telemedical approach has long been used to assess the health status in space medicine. Today we have an effective system of medical health monitoring of space crews. The experience of medical care during space flights shows that the functional state of the organism is directly dependent on environmental conditions. Many of space technologies are successfully applied in Earth medicine, including technologies for assessing the health status in people working under adverse conditions. This publication is devoted to the one of the main aspects of space telemedicine – the studying of interactions between the environment and the human body, i.e. the processes of human adaptation to the effects of stressors, and to prognostic evaluation of the risk of disease in healthy people.

The human body should be viewed as a dynamic system that provides continuous adaptation to the environment. Adjustment or adaptation to new conditions is achieved by the expenditure of the functional resources, which constantly are used and must be restored. Health is considered as the body's ability to adapt to environmental conditions. Functional states, at which adaptation is achieved with considerable tension of regulatory systems, called prenosological [1], because they precede the appearance of pathological states in the form of various nosological forms of diseases.

New scientific and practical field - prenosological diagnosis, which appeared in space medicine, is studying and evaluating the functional states on the verge of the norm and pathology. Under the influence of various environmental factors (climatic, industrial, psycho-social) prenosological states occur at first, and then, premorbid and pathological conditions appear.

The use of telemedicine approach to assess the health of people, affected by various environmental factors, provides a basis for the selection of a new
scientific field - telemedicine ecology [2, 3]. This publication presents the experience of prenosological approach in relation to environmental issues. The Institute for Biomedical Problems of Russian Academy of Sciences has completed a long-term 520-day experiment in the model of the spaceship, which simulated the work of the crew during the flight to Mars [4].

**Methods**

**Subjects**

The study involved 130 male volunteers (12 groups). Six subjects were in the model of interplanetary spacecraft (“Mars-500” crew) and the other (satellite) groups (6-15 people) were located in 11 cities around the world under usual conditions (Tab. 1). All subjects signed a written consent form. The study protocol was approved by the institutional ethical commission.

**Methods**

To carry out this studies in the experiment "Mars-500" the hard-software complex "Ecosan-2007", specially developed by "Medical Computer Systems" (Russia) for this project, has been used [4]. It includes the electrocardiograph (ECG) "Cardi-2", which allows to record ECG in three standard and three unipolar leads, and poligraf "Pneumocard", which is the analog of the device, which is currently used aboard the International Space Station [5]. In addition to the traditional electrocardiogram "Cardi-2" analyzes the low amplitude oscillations of heart potentials (the dispersion mapping of electrocardiogram) and displays the results as a "heart portrait". The integral parameter of this analysis is "myocard" index, normally not exceeding 14% [6]. Research Protocol provides for two types of research studies: A) monthly ECG recordings (5 minutes at rest position, 15 minutes at functional respiratory tests), completing a questionnaire about lifestyle, stress and possible complaints in the past month with the measurement of blood pressure, height and weight. B) The quarterly recordings of cardio-respiratory parameters when running functional tests with physical, mental and orthostatic stress.
Heart rate variability (HRV) data was obtained from ECG recordings (sample rate 1000 Hz) to evaluate the autonomic regulation of circulation according to the standards [7, 8]. HRV analysis allows us to evaluate not only the result of the functional tests, but their "cost" - the regulatory systems tension, which is necessary to perform loads (the "adaptation price").

Preliminary individual conclusions about health status were done for every individual and files with the results of studies were transferred to a database in analytical center via Internet connections. A special website was created for informational and technical support of research [9]. A new methodological approach, developed in space medicine for assessing the risk of disease according to the HRV analysis, was used while assessing the results of studies. Adaptation level is measured here by the parameters of the functional reserves (FR) and the stress degree (SD) [5].

Results and Discussion

Table 2. The main parameters of cardiovascular homeostasis and autonomic balance in test groups from few Russian regions

<table>
<thead>
<tr>
<th></th>
<th>Minsk</th>
<th>Magadan</th>
<th>Ekaterinburg</th>
<th>Syktyvkar</th>
<th>Moscow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (bpm)</td>
<td>79.3±1.1</td>
<td>72.7±0.7</td>
<td>70.4±0.6</td>
<td>73.9±0.5</td>
<td>74.0±0.8</td>
</tr>
<tr>
<td>Systolic arterial pressure (mm Hg)</td>
<td>123.0±0.9</td>
<td>129.3±0.6</td>
<td>118.5±0.7</td>
<td>121.0±0.6</td>
<td>124.4±0.6</td>
</tr>
<tr>
<td>Diastolic arterial pressure (mm Hg)</td>
<td>79.1±0.65</td>
<td>80.6±0.57</td>
<td>76.4±0.57</td>
<td>75.9±0.42</td>
<td>75.8±0.68</td>
</tr>
<tr>
<td>Stress Index (c.u.)</td>
<td>135.6±11.6</td>
<td>135.0±5.7</td>
<td>82.6±5.1</td>
<td>127.0±4.3</td>
<td>125.3±8.6</td>
</tr>
<tr>
<td>pNN50 (%)</td>
<td>13.8±1.3</td>
<td>8.7±0.7</td>
<td>20.9±1.4</td>
<td>11.4±0.8</td>
<td>10.7±0.9</td>
</tr>
</tbody>
</table>

Fig. 1 demonstrates the distribution of satellite groups from few regions of Russia and Belarus on age and body mass index (BMI). A slight but significant (p <0.001) differences in age (from 28.9 years to 35.1 years old Minsk, Moscow) and BMI (from 23.6 to 26.4 in Minsk, Moscow) are de-
ected. When comparing the results of researches these differences are necessary to be considered.

Table 2 shows the mean group values of some indicators for operational assessment of functional status. As can be seen of these data, distinct upward trends in heart rate (HR) are marked in Minsk, Moscow and Syktyvkar groups. The highest level of arterial blood pressure (systolic and diastolic) was observed in Magadan and Moscow groups. The lowest values of HR and blood pressure are observed in Yekaterinburg. When comparing the data on the cardiovascular system functional status with age and BMI, it can be assumed that the observed differences in variables of cardiovascular homeostasis are associated not only with age and constitutional features. This hypothesis is confirmed by comparing the autonomic regulation characteristics in examined groups.

Stress index (SI) reflects the level of sympathetic regulation and the degree of tension, and pNN50 - the parasympathetic regulation. The most favorable functional state of regulatory mechanisms observed in the group from Ekaterinburg (the average of all groups by age and BMI), and the worst - in the group from Magadan, which is the second by age and BMI. The group from Minsk has the highest values of stress index, but the sufficient activity of parasympathetic level of regulation (pNN50).

Assessment of risk of disease in studied groups confirmed that the worst distribution of subjects by risk categories (Fig. 2) was observed in Magadan and Syktyvkar. These cities are located in Russian North and are the regions with the most unfavorable climatic conditions of all investigated. If in Ekaterinburg over 50% of subjects belong to the first category of risk, in Magadan and Syktyvkar more than 70% of subjects belong to the second category of risk with a predominance of prenosological states and high probability of more adverse - premorbid states.

Conclusion

Thus, by applying the principles of prenosological diagnosis for telemedicine studying in groups of practically healthy people the important data about changes in functional health status under different environmental conditions can be obtained. Telemedicine technology in conjunction with using the principles of prenosological diagnostics allows detecting the adaptive response of the organism due to the influence of environmental factors in different climatic and geographical zones. It gives us the possibility to predict the risk of disease and to "manage" the health, which is especially important for the healthy contingents of people, working under stressful conditions, particularly in inaccessible areas.
Figure 2. Distribution of people in satellite groups in Mars-500 project at different categories of risk.

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Telemental Health in Biomedicine and Āyurveda: An Analysis of Online Health Forums in Slovenia and India

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Abstract: Despite little or no legal regulation, millions of people worldwide are participating in online health forums, searching for health-related information and advice as well as social support through networking with both health professionals and other patients suffering from similar conditions. Increasing participation in such forums shows that there is a great need for such provision of health care, yet little research has been conducted on the topic in order to describe these practices and evaluate their impact on health-seeking behavior. This contribution compares and contrasts the presentations of depression on two online health forums, the Slovenian biomedical MedOverNet portal and the Indian Āyurvedic forum Divya Yoga Mandir Trust. The data indicate that geography, culture, language, and medical epistemologies are significant in the articulation of internal affective states and depression.

Introduction

To date, the majority of researchers in the area of health-related online communication have focused on the online delivery of biomedical products and services with little research on how other branches of medicine conduct their services online. In this paper, we compare how illnesses, depression in particular, are discussed in two online forums diversified by geography, culture (Slovenia and India), language (Slovenian and English respectively), and two medical epistemologies (biomedicine and Āyurveda). We seek to understand if and how expressions of illness change by the use of technology.

The Internet and the Transformation of Patient-Provider Relationship

In biomedicine, the traditional patient-provider relationship put the health providers into a position of higher authority due to their expert knowledge and their capacity to diagnose and treat, while the patient was seen as passive and vulnerable, to be acted on and not consulted with [1]. In Slovenia, as in other Western settings, this relationship was traditionally
paternalistic and the doctor was not supposed to discuss the treatment with the patient but rather decide on this by him or herself [2]. In India, the patient-provider follows the same trend, but it is also influenced by different medical epistemologies such as traditional and transcendental medicines as well as by rural-urban and public-private divides [3]. Because doctor-shopping and health-seeking from numerous sources is common in India, providers are both authoritarian and consumer-oriented in their approach [4].

Such relations between patients and health providers are changing because of the increasing use of the online websites, dedicated to health and treatment. Among the benefits of online health forums are the possibility of providing free health information, increasing health systems efficiency, and greater patient empowerment through the democratization of medical knowledge [5]. Today, online-savvy "expert patients" have knowledge and confidence to play an active role in the management of their illness and treatment.

However there are also risks to using the Internet for health purposes. The material and information offered online may be questionable, contradictory and sometimes simply wrong and providers may give advice without assuming any legal and ethical responsibilities for their "e-patients" [6]. Also, patients with chronic or terminal illness may not only be looking for information, but also for hope and a way to cope with degeneration and eventual loss and in their online search may pursue and eventually undergo costly, unsafe, unproven treatments [7].

Methods

Data were collected from 1st March 2010 to 30th April 2011 from two publicly accessible online health forums – Med.over.net (MON) in Slovenia and the Divya Yoga Mandir Trust (DYMT) in India. MON is the first and largest Slovenian medical, social, and pedagogical website [8]. One of their forums is dedicated to health and about 180 physicians, mostly biomedical, deliver free and quick advice in the Slovenian language. The DYMT is an online pharmacy, medical consultancy, and a physical organization headquartered in north India. The Trust specializes in traditional Āyurvedic medicines and yoga treatments offering a wide range of remedies. The Trust’s website is in English and offers online consultations with its vāidyā (term for Āyurvedic doctor). These services are free; however its online pharmacy sells a range of Āyurvedic drug packages.

Using "depression" as key search term yielded 35 entries for MON and 90 entries for DYMT. Two entries from each site were subsequently discarded because of lack of relevance. The final sample included 33 entries from
MON and 88 from DYMT. A discourse analysis was performed on these entries. Content was analyzed for language and the latent meaning in the text which reflect current socio-political contexts. Data were coded thematically and imported in NVivo for further coding. Ethics approval was not obtained since the data are publicly available. However to ensure anonymity the nicknames used on both forums have been omitted.

Findings

In MON there were more women (28) than men (5) whereas in DYMT there were 43 men and only 25 women. Encounters on both sites tended to be single exchanges regarding particular health issues though there were some individuals who wrote more than once.

Most MON participants wrote in reference to themselves whereas in the Indian forum a significant number (n=17) sought advice on behalf of others, usually elderly parents, spouses, and friends. There was no difference in medical information provided by individuals who described themselves compared to those who described the medical status of others. Participants tended to be highly knowledgeable about their or their family member’s medical histories and used specialized biomedical language to describe various procedures and treatments. Providers, in contrast, tended to use non-technical language.

In both forums participants viewed their depression as related to other mental disorders, existing chronic and infectious health conditions, and wider social and economic maladies. Participant’s descriptions of their affective states also partially reflected a response to the distinctive institutional cultures of the forums. On DYMT, the participants related their expression of depression to morality and their social world, claiming that they always led a “simple life” but nevertheless “lost heart,” became “lost souls” and ultimately sick. MON participants predominantly linked depression to physical symptoms and rarely to feelings of sadness or socio-economic difficulties.

Health problems were largely discussed through the prism of biomedicine on both sites. Individuals on the DYMT forum were prepared to use multiple drug combinations and few expressed reservations about the side-effects of antidepressants and other drugs. In contrast, on the MON website eight participants specifically worried about the side effects of drugs, especially antidepressants and contraceptive pills and an additional eight discussed their experiences with antidepressants.

Discussion and Conclusions

The translation of the provider-patient relationship from the clinic to an
online forum did not automatically disassociate it from its cultural and political mores. Rather these relationships tended to be transferred from one platform to another. This was seen not only in the provider-patient interactions, but also in the overall interpretation of the culture of these forums by participants. The participants on these forums did not create a distinctively new online identity, but rather extended their actual moral and social realities into the online world, often to the extent that they did not even use the possibility of securing their anonymity.

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References


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The Issue on eHealth Integration into Routine Statistics

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Abstract: The small-scale survey among hospital statisticians and insurance assistant has shown that H-info 2.0 software, processing routine data and registration of patient medical records is used at all hospitals levels in the healthcare sector. 68.2\% of the total participants unanimously advocated for “the further improvement of currently used software”. 27.3\% of them expressed the opinion to “create and develop new software” for routine data processing due to interact with e-health (CR=2.5 and PD=40.9\%). Thus, the desired e-health software (with existing H-info software) is thoroughly introduced to health care organizations at all level.

Background

The e-health strategy is embarked in the health sector of Mongolia since 2009. With the passage and implementation of the strategy there was the need to identify how interacts the desired e-health with existed medical software applications, particularly routine data processing.

Methods

We conducted a small-scale survey among hospital statisticians and insurance assistant and physicians. Into the small scale survey 130 statistic and insurance assistant and physicians were involved. Data were generated using a combination of questionnaires and in-depth interview of users.

Results

The survey revealed that H-info 2.0 software, processing routine data and registration of patient medical records, is used at all hospital levels in the health sector. 68.2\% of the total participants unanimously advocated for “the further improvement of currently used software”. In addition, 27.3\% of them have opinion to “create and develop new software” for routine data processing due to the interaction with e-health (CR=2.5 and PD=40.9\%). 52.0\% of the primary hospital statisticians and health insurance staff, 30.7\%
of the general hospital physicians and 17.3% of the specialized hospital physicians expressed their opinion for “the further improvement of currently used H-info 2.0 software”, because it is more convenient to use in their work and familiar for health staff. Even though 53.3% of the total health information officer got sufficiently involved into the trainings and gained suitable professional competence for performing their duties, 40.0% of them are insufficiently competent (CR=1.3 and PD=12.5%). The proportion of insufficiently at the primary level of health care constitute 48.1%, at the second level as general hospital - 40.7% and at the third specialized level - 11.2% respectively.

Therefore presently it is more appropriate to arrange trainings on e-health applications dedicated to involve the health care providers of all hospital levels. 80.8% of responders agreed with performance of health care service improved by using the computer software, 18.5% did not agree on that and 0.7% have completely opposite opinion. 80.6% of responders expressed their satisfaction concerning to their using computer software and 9.3% stated that they are unsatisfied with used software. 41.7% of the participants who gave negative answer to this question were statistic and insurance assistant and physicians at the primary level health care service, 41.7% at the secondary level and 16.6% at the third level respectively. Reasons of user’s unsatisfied states are shown as below Fig 1.

In addition 59.4% of the responders had responsibilities for carrying out additional job duties such as assistant physician, nurse, file and archive clerk, social worker, medical first aid call physician, researcher, mass
media and information officer. 80.6% of total responders usually work overtime out of them 41.7% were work at primary level, 39.8% at the secondary level and 18.5% at upper level respectively. The main reason of this overtime work among them at the primary and second levels was related with the additional held job positions at the same time.

Conclusion

In terms of interacting of desired e-health with existed H-info software there is necessity thoroughly to upgrade and introduce e-health concerned software applications and build capacity in health care organizations at all levels.

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Mobile Health Solutions
A Customizable Mobile Tool to Promote Health and Prevent Non-Communicable Diseases

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Abstract: The accessibility and usability of technological applications to promote health is a topic of ongoing research by application developers to find tools adapted to specific needs of each user. In this situation, developing countries like Brazil, Colombia, Argentina, among others where applications have been developed, aimed to check patients using mobile platforms, including cell phones, but the social use level is low because in several cases its use is complex and pricey. The paper presents a monitoring system of 4 physiological variables, 3 environmental variables and 4 related to personal characteristics, using mobile phone applications. In order to increase its use, the sensors are inexpensive. The developed applications are unencrypted and provide free access installation. The processes of evaluation and clinical validation of the overall system were carried out in Sao Paulo, Brazil. The applications are available to stimulate the involvement and social participation, health promotion and implementation of health policies, as state policies. The successful level of devotion and social acceptance of the system, is part of the personal adaptability to the needs of patients, because the system provides increases of the achievements, user-friendly and easy to use interfaces, important information for health control and supports an oriented structure for health services. Currently the system is used in physical motor rehabilitation, control of energy balance and control of arrhythmias, among others.

Introduction

At the congress of Med-e-Tel 2010, we have presented the study called "Monitoring System of Assessment of Energy Expenditure to Human in Free-living Condition by Mean of Information and Communication Technologies" which showed a monitoring solution of energy expenditure in a free environment based on measures of acceleration, heart rate and temperature, which were collected in a wristwatch and then transmitted to estimate energy expenditure of various physical activities. With this study we support in rehabilitation process from the patient's familiar environment,
but the system was not made available to the rest of the society due to the high cost of the devices, its complicated usage, the need of a qualified person to operate the system, and local coverage. Currently, a new version of the system, which does not use a cell phone, was implemented to monitor the primary care of the health care centers, achieving greater accessibility of the population.

Requirements

**User**
Friendly-user interfaces to ensure accessibility for users of all ages. The system must be adaptable to the monitoring requirements of each user, allowing the development of new applications, e.g. control body falls for seniors and elderly people. The sensor network should be wireless and comfortable in order to allow free movement of the user, and low cost for the final customer.

**Monitoring System**
The sensor network shall be self-configuring and auto-detected by the data acquisition device. The monitoring system should allow to store and process data in a mobile equipment and also to transmit to a central server. Remote access coverage (national) is also planned.

![Figure 1. Architecture Service-Oriented](image)

**Service-Oriented**
To design a structure that transforms user requirements (telemedicine network) and client (patient) in products set up in any logical platform (open source); To ensure the accessibility, confidentiality, integrity and
availability of the information from mobile and interoperable with other communications platforms.

Customizable Mobile Tool

The Brazilian State and National health system policies have been driven policies of social inclusion in medical services supported by mobile technologies adaptable to the many needs of the population.

Data mining

To perform decision analysis results by combining cross-variables (from sensors, data logging and calculations) implemented models of trees and influence diagrams, validating each of the reported results. The creation or sub-tree pruning is done according to the needs of monitoring, control or prevention of non-communicable diseases.

Software Development

For the system five app (Android) were developed, database and web application are based on open source. Some apps are:

- Motion Tracker - measures triaxial acceleration using a sensor embedded in a cell phone. Applied in the estimating level and intensity of the physical activity and measurement of the energy expenditure.
- Food manager - allows recording the user's food intake and converts in calories. Applied to calculate the energy balance (burned calories vs. calories consumption).
- Heart rate - acquires registers and processes the heart rate and variability from a sensor installed in the chest monitor. Applied to estimate the level of physical activity and monitoring of arrhythmias.
- Tracks - place monitor connected to a global positioning system satellite. Applied in the displacement control and measurement of some environmental factors useful in the measurement calculation of the energy expenditure and physical activity level.
- User Health Data - allows to record personal and anthropometric data of the user. Applied to the measurement of energy expenditure, physical activity, body mass index, and so on.
- Health File Sender - classifies into a single compressed file the information to be sent to the data center. Applied in the data transmission.

Applications

Promoting health

Through mass campaigns released by the government, e.g. "Better at Home" launched in November 2011 and inspired by internment homecare
program, which promotes the use of home monitoring system. Encourage self-control through physical activity campaigns and healthy eating habits.

**Prevention of non-communicable diseases**

The system was tested for monitoring physiological variables that help prevent some risk factors of obesity and cardiovascular disease, and the control of motor rehabilitation processes in an open environment. This is a helpful tool that supports the study as a key setting for interventions aimed at preventing non-communicable diseases.

**Beneficiaries**

Currently the system was validated with adults and elderly patients of both sexes, with excellent results under medical staff supervision during the implementation of individualized treatment.

**Conclusions**

The system presented in this study was validated and it provides the adaptability necessary, broad social adhesion, low cost, easy to use, ergonomics, programming flexibility and comfort.

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Achieving Behaviour Change among Pregnant Mothers Using Mobile Phones

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Abstract: Mobile technologies offer great potential in overcoming health challenges in developing countries by supporting acquisition, transfer, storage, processing, and securing data to deliver meaningful results. AKDN eHealth Resource Centre (eHRC) supports the use of mobile technologies for behaviour change communication among expectant mothers to enhance the use of health facilities for antenatal care and deliveries. The project was implemented in Mardan district in Khyber Pakhtoonkhwa province of Pakistan. Lady Health Workers (LHWs) were provided JAVA-enabled Cell phones, and trained in using cell-phones for data entry using a simple template in the local languages. LHWs registered all pregnant mothers in the intervention area. The sample size in the intervention area reached 433; while the sample size in control group was 375 mothers. Data was transferred to the server using ‘FrontlineSMS’ software. The same software was used to generate health promotion and personalized health messages to the mothers. The data was integrated with an Electronic Medical Record solution, ‘OpenMRS’ to create a medical record for each registered mother. The study showed moderate increase in contact between the pregnant mothers and the LHWs. The intervention also significantly increased the number of mothers having four or more antenatal visits at the health facility during pregnancy from 43% to 65%. The focus group discussions with LHWs, doctors, pregnant women, and their husbands in the communities for their experience of using mHealth solution for safe motherhood revealed that all these groups praised the experience and wanted to continue this intervention. This mHealth initiative demonstrates a scalable and replicable low cost solution, which can be used for applications other than safe motherhood. The integration of SMS-solution with the community-based medical record system shows an innovation with huge impact on improving health behaviour of individuals and the community.

Introduction
There were an estimated 5.3 billion mobile subscriptions worldwide in 2010, with more subscriptions than people in developed countries and rates of 68% in developing countries [1]. The same report indicates that the total number of text messages sent globally increased threefold from 2007 to 2010, up to a current level of 6.1 trillion messages per year, or 200,000 messages per second. Mobile technologies offer a great potential in overcoming health challenges in developing countries supporting acquisition, transfer, storage, processing, and securing the raw and processed data to deliver meaningful results [2].

Main objective of this initiative was to use low-cost mobile Health (mHealth) solutions for behavior change communication among pregnant women to improve their utilization of health facilities for antenatal care and deliveries. The project was implemented in Mardan district of Khyber Pakhtoonkhwa province of Pakistan having a population of 1.9 million [3]. The project started from Jan 1st, 2010 and ended in March 31st, 2011.

Activities

The project used community-based quasi-experimental design, starting with situational analysis, discussions with community, formatting and customization of the software, trainings of the selected health staff, i.e. lady health workers (LHWs) and field surveys. This was followed by creating short messages covering major aspects of maternal health such as antenatal visits, vaccination, pregnancy care, for health promotion and translating into the local language (Pushto). The messages were sent regularly to expectant mothers and the frontline health workers using an interactive SMS solution called ‘FrontlineSMS’

Community-based, open-source software called OpenMRS was used for maintaining medical records of the patients. OpenMRS is an enterprise electronic medical record system platform to support the delivery of healthcare in developing countries and is also accessible via mobile phones making it appropriate for data retrieval even with limited internet connectivity. Save motherhood project (SMP) is integrated with patient medical record for data management. Registration forms were installed in mobile phones given to each LHWs with proper training to register and enter the data of a pregnant community woman and submitting these registrations forms to the OpenMRS server.

Results

In one year nearly 347 mothers were registered in this project, out of which 97.7% received awareness messages on regular basis. The messages content was focused on baby development, pregnancy problem and
associated risk with delivery. The study showed that this project reduced ratio of delivery and pregnancy related misconceptions in the community. The project helped increase the rate of deliveries at health facilities from 35% to 55%.

- **Increase in community contact with health providers**

  Pregnant women were shown to have more contacts with the healthcare providers in each trimester, compared to the baseline and the control group. The average number of contacts with LHWS in the case group increased from 4.1 per trimester to 4.7, whereas the same number increased from 4.1 to 4.2 in the control group (p=0.07). Similarly, the average number of contacts with the doctors in the case group increased from 1.2 per trimester to 2.2, whereas the same number increased from 1.3 to 1.4 in the control group (p<0.001).

- **Increase in antenatal visits**

  The frequency of antenatal visits to health facilities was significantly increased in the intervention group compared to the control group. Percentage of mothers making four or more antenatal visits went up from 43% to 66%, compared to control group where antenatal visits went down from 66% to 57% (p<0.05).

- **Qualitative Data**

  The project team also conducted focus group discussions with LHWS, doctor at the facility, pregnant women, and their husbands in the communities about their experience of using mHealth solution for safe motherhood. All these groups praised the experience and want to continue this intervention. LHWS thought of eHealth as a tool to comfort their work load.

  “By using this mHealth solution, my work became easier than before. I can now consult to doctors when I find myself in problem. Now I don’t need to go the health facility to submit the data of a month, I can send data of pregnant women on daily basis. It has saved my time a lot. I make lesser mistakes now.”

  Doctors also considered this initiative as a means to decrease communication barrier among health care providers. According to one Doctor: “Communication between all LHWS and health facility is easier now. It has helped in educating the community women and LHWS as well. By getting the daily based data, the data is managed very well in health facility.”

  The pregnant mothers included in the study found it beneficial for their maternal health. One mother explained regarding her experience as “Safe Motherhood Program has made us aware about our own health especially during pregnancy. Through these messages now we are facing less health
problems. It is really good to get advices on what to do and what not to during pregnancy. We often forget about our pregnancy but this system reminds us daily. It has educated us on birth spacing. Now we think before our delivery where to go and what to do.”

Not only mothers, but also their husbands appreciated this initiative. As one man praised: “This program has removed our misconceptions about woman’s health during pregnancy. We can now understand that antenatal care and postnatal care is very important for the life of a woman and her child as well. Now we can make proper arrangements before delivery of our wives.”

Conclusion

The mHealth initiative discussed above demonstrates a scalable and replicable low-cost solution, which can be used for improving maternal and child health, and other similar applications. The integration of SMS-solution with the community-based medical record system shows an innovation with huge impact on improving health behavior of individuals and the community.

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References


Shariq Khoja is a physician, with PhD in eHealth from Global eHealth Research and Training Program, University of Calgary. Dr. Khoja has extensive background and interest in using eHealth technologies to facilitate healthcare services and education. His research interests focus on creating evidence and policies to guide the implementation of eHealth in developing countries. Dr. Khoja is leading the ‘PAN Asian Collaboration for evidence-based e-Health Adoption and Application (PANACeA)’, which supports researchers in 17 Asian countries to create evidence for e-health implementation. Dr. Khoja has contributed extensively to literature, especially through the development and validation of eHealth Readiness assessment tools for healthcare institutions. Dr. Khoja holds Adjunct faculty position at the University of Calgary.
An Effective Mobile Monitoring for Patients at Risk of Fainting

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Abstract: In this paper we present a mobile monitoring system able to collect information about the patient’s health condition during his stay in the so-called hot waiting room for a nuclear medicine department. The proposed system automatically monitors some vital parameters such as Heart Rate and Oxygen saturation and also information about posture and movements. The collected data is processed through a rule-based Decision Support System (DSS), implemented on a mobile device, and capable of automatically generating alarms if a dangerous situation occurs. The tests have demonstrated that the system was extremely successful.

Introduction

Recent advances in wireless sensor networking have revealed new opportunities in a variety of applications including healthcare systems. In fact, the healthcare market is among the fastest growing markets for Wireless Sensor Technologies [1]. One such example wherein medical systems can benefit the most from wireless networks is continuous monitoring of patient’s vital signs and context-aware patient’s information within the hospital premises. Many medical ailments can be monitored quite conveniently with the use of these networks within a hospital environment and the monitored data can be analyzed in real time. A wireless system does not require patients to be confined in a specific place, rather it allows them to move around freely in the rooms. This is very important in an application as the monitoring of infected patients in a department of nuclear medicine of a city hospital that need to be moved within the rooms, for example from the hot waiting room to the diagnostic room.

In this paper we present a new mobile monitoring system able to collect information about the patient’s health condition during his stay in a nuclear medicine department. The monitored information is analyzed through a rule-based Decision Support System (DSS) implemented on a mobile device. Additionally, the proposed system, in order to reduce the number of false alerts and, as a result, situations in which nursing staff mostly ignore
alarms from the monitors, combines the collected real-time vital signs with patient’s context information, like postures, movements or falls.

The Rule-Based DSS Design

Decision Support Systems (DSSs) provide a practical and user-friendly approach for aiding people to make decisions and solve unstructured problems in a wide set of different application domains [2]. In particular, they are being recently designed as knowledge-based, i.e., they heavily rely on the knowledge elicited from experts with the goal of supporting users in their decision activities by reproducing the process followed by experts that are entrusted with such decisions because of their experience or expertise.

With the goal of providing a highly expressive and understandable approach to encode the experts' know-how about a specific domain [3], the developed DSS has been designed in order to support the combination of ontology with production rules (i.e. if-then rules) for providing inference procedures able to generate actions and suggestions for supporting users.

The overall inference process lies on a triple-based rule engine which implements a forward chaining scheme, i.e. a data driven method that can be described logically as a repeated application of the generalized modus ponens. In other words, available data are supplied as facts and used to evaluate eligible rules and draw all possible new inferred facts. The terminological knowledge, i.e. the specific domain expressed in terms of concepts, attributes and relationships, is arranged and stored into the system as a collection of facts encoded in form of RDF (Resource Description Framework) triples [4]. Then, the data acquired are dynamically inserted into the system as new facts by both instancing a new set of individuals and associating to this individual the proper attributes values according to the patient’s data coming from sensing devices.

The core of the developed rule engine is a lazy pattern matching algorithm specifically designed and implemented as a light-weight solution suitable for resource-limited mobile devices [5]. The lazy pattern matcher is responsible of determining which rules are satisfied and which facts satisfy them, with the goal of executing eligible rules as soon as they are identified, based on the observation that only one of them is fired anyway [5].

Firing an eligible rule can alter the set of facts stored into the system, by producing either the assertion of new facts or the discharge of existing ones. The inference process will be repeated until new eligible rules are found.

System Details

The architecture of the proposed mobile monitoring system is based on that presented in [6]. This system is designed for hospital patient monitoring
and will be used in a department of nuclear medicine. In this department many cardiac patients are examined under stress by using a small amount of a particular radioactive substance in order to undergo specific examinations. Once injected, patients have to stay in a specific room to wait for the examination to be performed. The amount of time patients have to wait depends on the kind of examination that has to be performed and on the time the substance takes to propagate -within the body- and to decay to the right level. After the examination, patients return to the waiting room until the level of radiation becomes lower than a specific threshold and, so, harmless. When the patient is injected his Heart Rate and his body temperature can increase dramatically resulting in low oxygen saturation and frequent fainting. To perform an accurate and effective patient monitoring the proposed system uses an ECG monitor with an embedded 3-axis accelerometer and an oximeter monitor that continuously monitor the patient’s health conditions and his/her movements. The following table describes all parameters that the system takes into account.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate</td>
<td>Patient’s Heart Rate measurement acquired in real time</td>
</tr>
<tr>
<td>Resting Heart Rate (RHR)</td>
<td>Patient’s heart rate when he is at rest</td>
</tr>
<tr>
<td>Maximum Heart Rate</td>
<td>Maximum patient’s heart rate calculated by using Karvonen formula</td>
</tr>
<tr>
<td>SDANN</td>
<td>Standard Deviation of Sequential Five-Minute R-R Interval Means</td>
</tr>
<tr>
<td>SpO2</td>
<td>Measurement of the amount of oxygen attached to the haemoglobin cells in the circulatory system</td>
</tr>
<tr>
<td>Time Interval</td>
<td>Time window elapsed between two potential abnormal situations detected</td>
</tr>
<tr>
<td>Walking / Running</td>
<td>Boolean datatype property indicating if the patient is walking / running or not</td>
</tr>
<tr>
<td>Standing Up / Lying</td>
<td>Boolean datatype property indicating if the patient is standing up / lying or not</td>
</tr>
</tbody>
</table>

The fall detection is based on a threshold-based algorithm [7], which attempts to identify movements that are potentially harmful or indicative of immediate danger to a patient. This information is used by the DSS to contextualize the patient’s health condition. In this way the system minimizes the false positive alarms compared with a classic decision-making system that is devoid of awareness of context. In the Fig.1 some of implemented rules are presented.
Conclusion

The tests have demonstrated that the system was extremely successful. Even when attempting to trigger false positives with normal but exaggerated movements, in the great majority of the cases the system generates no alarms. On the other hand, to test an emergency situation, for example a patient’s fainting, several testers were asked to wear the device and emulate seizure-like shaking to the best of their knowledge and ability.

The system was always able to correctly detect each person’s suspicious movements with no need for individual calibrations; therefore no false positive situations were generated. Finally the system was able to detect some possible risk situations that were not detected by a classic decision-making system that was devoid of awareness of context.

References


Figure 1. Implemented Rules

- if [ (SpO2 < 80) AND (elapsedTimeInterval > timeThreshold) ] then
  alertType = Alarm;
- if [ (HR > HRmax) AND (lying = true) AND (elapsedTimeInterval > timeThreshold)]
  then
  alertType = Warning;
- if [ (SDANN < 50) ]
  then
  alertType = Alarm;
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Feasibility of Mobile Health for Rehabilitation – Pilot Study in Finland

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Abstract: This paper presents a user-centered research and development process of the mobile application for rehabilitation of knee osteoarthritis (OA). The definition of needs, and possibilities to utilize technology for promoting health behavior and rehabilitation were explored. The mobile application was developed and the feasibility was evaluated by end-users. In the field-trial, twenty-three women (mean age: 60 SD 4.5) with mild knee OA participated in a 8 week home strength training intervention, where they were randomly assigned into 1) a mobile group instructed by mobile device (n=13) or 2) a control group (n=10). The feasibility of the mobile application was examined by a 5 graded Likert-scale questionnaire and System Usability Scale (SUS). Also qualitative data were collected. In addition, leg extensor power by Nottingham Power rig and dynamic balance tests by figure-8-running test were measured. The user experiences were positive, and the usability of the application was ranked high. There was no significant improvement or difference between the groups in the physical performance. Based on the results, the mobile application turned out to be feasible in the home-based rehabilitation.

Introduction

Osteoarthritis (OA) is the most common joint disease in the world. Risk of OA increases with age; almost 90 % of people over age 65 years have radiological OA related changes in one’s joints [1]. Knee and hip OA causes long-lasting physical activity limitations more than any other disease. Symptoms of OA lead often to avoidance of physical activity and this can cause disability, diseases and decreased quality of life [1]. According to international guidelines, the treatment is based on conservative methods, and the goal of the treatment is to maintain and improve the pain management and functional capacity [2]. In addition, previous studies have shown that aerobic exercise, muscle strengthening, and mobility exercises aim to promote quality of life [3-4].
In the field of physiotherapy, a video guidance with help of computer or television is a typical eHealth method. It has been shown that video based exercise guidance increases adherence to intervention [3-4], and is related better result of the treatment [5-6]. In general, home monitoring and advising the patient with technology is an effective intervention in disease treatment [7]. Mobile technology has been used e.g. to track physical activity, to provide healthy diet counseling, to send patients reminders about upcoming appointments, and to support patients also in other health problems [8]. The aim of the study was to examine the feasibility of a user-centered mobile application in the rehabilitation of mild knee OA.

Methods

User-centered designing

User-centered designing of the mobile application was initialized with the research members of sport and health sciences, and information technology. The needs for supporting health were charted, and variety of suitable ideas of involving mobile technology for promoting health came up, concerning the fields of physiotherapy, rehabilitation and supporting physical activity. One idea was to develop a mobile application for home-based exercise for rehabilitation, and a web user-interface for physiotherapists to enable monitoring of progress of the patient. User requirements were defined based on the needs of physiotherapists and patients. The prototype of the mobile application was developed with Adobe Flash Lite 3.1 for a touch-screen mobile phone with Symbian S60 operating system. The application was designed to take advantage of media rich content. The exercises were advised by video, text and spoken instructions, and an individual performance of the guided program was evaluated after each training session; the pain, the amount of performed exercise, the strain and the psychological vitality were assessed via inquiries included the application.

The exercise programs were designed based on physiotherapy guidelines of OA in knee [2], and it changed progressively in every two weeks. The program was similar in both groups, three times a week. In addition to the exercise program, duration, strain and exercise type of other physical activity were also tracked by subjects. The subjects set their own goal for physical activity, and the progress was shown in graphical form.

Participants

Twenty-three voluntary post menopausal women (mean age: 60 (SD 4.5) years, height: 162 (SD 5) cm, weight: 69 (SD 10) kg) with early knee OA were randomly assigned into 1) a mobile group instructed by mobile device (n=13) or 2) a control group (n=10) instructed by printouts. Women with
Kellgren-Lawrence radiographic grading of knee OA 1-2 were included into the study. In both groups, the knee rehabilitation was an 8-week home-based resistance exercise intervention.

The feasibility of performing the intervention was examined by a 5 graded Likert-scale questionnaire and the usability of the application by the System Usability Scale (SUS) [9]. The qualitative data were collected and analyzed with data-driven content analysis. Muscle power was measured with a Nottingham power rig-dynamometer [10]. Dynamic balance and agility were evaluated with a timed figure of 8 running test [11]. The informed consent was obtained from all participants prior the study.

Results

At the baseline, both the mobile application and the phone were described to be easy to use and reliable. Operational difficulties were related to technical characteristics. Main experiences about usability were that the application was interesting and motivating.

After intervention, functionality, usability and innovativeness were the main categories describing the application. The most commonly described qualities were functionality, easiness to use, and enhanced motivating features. Usability of the mobile application was ranked 87.3 (SD 7.9) out of 100 SUS-points. Adherence to intervention was 91% in the mobile group and 98% in the control group. The mobile group ranked the feasibility of intervention higher in 5 graded Likert-scale (mean 4.46; 95% CI 4.20 to 4.72) compared with the control group (4.14; 3.67 to 4.61) (p<.001). There was no significant improvement or difference between the groups in leg extensor power or dynamic balance.

Discussion

In this pilot study, the application was easy to use, and feasible in the use of home-based rehabilitation among women with mild knee OA. Since the intervention was relatively short-term, and the contents of the exercise programs between the mobile and control groups were similar, it was not expected to find any significant differences within or between the groups in the results of the physical performance. The adherence in both groups was high, and it is important when developing mHealth, that the application is encouraging for adherence to have better results with rehabilitation [4]. Effectiveness of telemedicine has been studied with promising results [7], but in the future, bigger randomized controlled studies is needed to explore the effectiveness of mHealth in rehabilitation.

Modifiability of the application should be taken into account, because the technology gets more sophisticated all the time. User interfaces should be
easily modified for different operating systems and variety of mobile devices (e.g. Android, iOS and Win phone 7) to ensure the widest reachability of the patients. The usability of the applications is important, and by taking into account the requirements of the end-users, mobile technology can be used as an aid to monitor the progress of intervention and to support the activities of daily living in different patient groups. In summary, the results of this study are promising, and the rehabilitation process could be a natural part of daily living of the individual with help of mobile technology.

Acknowledgment

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References

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mHealth Confidentiality- Understanding Cell-phone use in KwaZulu-Natal, South Africa

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Abstract: Introduction: Mobile phones have the potential to facilitate Telemedicine in Africa. The use of cellular phones and computers has potential legal and ethical issues that have not yet been explored in the African setting. Methods: A questionnaire was developed. This was administered to patients in urban and rural areas. Convenience sampling was used. Results: 263 patients have completed the questionnaire. 83 (31.6%), 137 (52.1%) and 43 (26.4%) were from rural, urban and both settings respectively. 13.3% of rural users share SIM cards. While 21.7% from urban and 22.5% from rural settings of both groups place their SIM cards in other phones. 44.6% of rural and 13.2% urban dwellers state that the hospitals use their number to contact other patients. 34.1% urban and 48% of rural patients have been without air-time for more than one week. In the rural areas, Connectivity was not an issue. Conclusions: Mobile health (mHealth) and more particularly cellular telephony is seen as a potential facilitator of telemedicine and eHealth in sub-Saharan Africa. Healthcare regulators need to consider mHealth when developing regulations to ensure they are adequate and enabling.

Introduction

The use of mobile phones for the delivery of health care is emerging as part of strategic plans of the United Nations and the World Health Organization [1]. Studies using mHealth technologies in the developing world have shown potential in the areas of drug adherence [2], disease surveillance [3], medical education [4] and disaster management [5].

Cell phone penetration in Africa has been rising rapidly, albeit off a very low base and is now approaching 50%. More importantly, there is cell phone coverage to 70% of rural areas in Africa [6]. Cell phone penetration in South Africa is approaching 100% [7]. Recent data from South Africa suggests that Internet penetration, both urban and rural, is rising rapidly through access via cellular phones [8].

For mHealth, and more especially cell phone based mHealth, to facilitate telemedicine, there are many questions that need to be addressed on the African context, especially those around confidentiality and privacy. Are
patients willing to use cell phones to receive health information or actively seek advice or services? In communities where cell phone penetration is not universal, what levels of confidentiality and privacy can be expected. Are cell phones and or SIM cards shared and do people with cell phones serve as message takers for those without? What is current practice among doctors and nurses regarding cell phone use? Have healthcare regulators considered mHealth and if not are current regulations adequate?

The purpose of this study was to determine the habits and practices of how patients in KwaZulu-Natal, South Africa use their cell phones in order to identify potential legal and ethical issues.

**Method**

A questionnaire was developed which addressed issues such as sharing of phones, subscriber identity module (SIM) cards, taking messages for other people, connectivity and the ability to contact health facilities or doctors via their cell phone. The questionnaire was administered in two settings: patients waiting to be seen by private practitioners in a large city and patients in outpatient clinics of public hospitals in rural areas. The study was approved by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal and consent was obtained from all participants. Fishers exact test was used for statistical analysis with alpha set at 5%.

**Results**

Two-hundred and seventy-six people completed the questionnaire, 13 of whom did not own a mobile phone. They were excluded from further analysis. It had been expected that there would be two groups of respondents, rural and urban, but a third group emerged, those who work in urban areas but who live most of the time in rural areas. The key findings for the three groups are shown in tables one and two.

**Discussion**

Relating to confidentiality and privacy of patient information, over a third of respondents are not the only users of their phone, 50% of people in KwaZulu-Natal take health related messages for others and twenty percent are phoned by hospitals trying to contact other patients.

Table 1: The domains on cell phone use, privacy and confidentiality expressed as the number of respondents and percentage in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Urban n=137(%)</th>
<th>Rural n=83(%)</th>
<th>Both n=43(%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am the only user of</td>
<td>88 (67.2)</td>
<td>53 (70.7)</td>
<td>26 (63.4)</td>
<td>0.71</td>
</tr>
</tbody>
</table>
I lend my phone to other people & 26 (19.7) & 23 (30.7) & 11 (26.8) & 0.19 \\
I share SIM cards with other people & 5 (3.8) & 10 (13.3) & 3 (7.3) & 0.04 \\
Other people put their SIM card in my phone & 24 (19.2) & 18 (25.4) & 7 (18.4) & 0.55 \\
I put my SIM card in other people’s phones & 28 (21.7) & 16 (22.5) & 10 (24.4) & 0.93 \\
The hospital contacts other people through my cell phone & 14 (11.1) & 33 (44.6) & 5 (13.2) & <0.0001 \\
I take messages on my phone for other people & 54 (41.5) & 58 (78.4) & 19 (47.5) & <0.0001 \\
I have had a cell phone stolen & 31 (23.7) & 14 (18.7) & 13 (30.2) & 0.36 \\

| Table 2. The domains on airtime, connectivity and type of cellular phone |
|-------------------------------------------------|--------|--------|--------|-----|
|                                                   | Urban n=137(%) | Rural n=83(%) | Both n=43(%) | p-value |
| I buy airtime on contract                        | 37 (27.8)    | 3 (4.0)  | 7 (16.3)  | <0.0001 |
| I have been without airtime for more than a week in the last year | 44 (34.1)    | 36 (48.0) | 15 (36.6) | 0.14   |
| My number has changed in the past year           | 28 (21.4)    | 22 (29.3) | 12 (29.3) | 0.35   |
| I am able to keep the battery charged            | 129 (98.5)   | 66 (78.0) | 40 (93.0) | 0.004  |
| I get a good phone signal at home                | 120 (94.5)   | 60 (81.1) | 38 (90.5) | 0.01   |
| My phone has a camera                            | 119 (90.8)   | 43 (57.3) | 38 (88.7) | <0.0001 |

Cell phone theft is high (22%) as are number changes. Whether sharing of mobile phones, SIM cards, and taking health related messages for others is a cultural practice or a simple matter of expediency is not explained. What is concerning is that these practices allow for breaches of patient confidentiality if the mobile phone is to be used as a health tool.
The majority (82%) use their mobile phone on a “pay as you go” basis with very few people having a mobile phone contract and this was more apparent among rural patients attending public hospitals. Connectivity does not appear to be a problem in the rural areas surveyed.

This survey has revealed a number of issues that could affect patient privacy and confidentiality and need to be considered when developing mHealth services, especially services relating to disease such as HIV and tuberculosis. Whether taking health messages for others is a cultural phenomenon needs further investigation.

References

Mobile DSMS: A Mobile Health System to Increase the Availability of Peer-Support among Persons Living with Chronic-Non Communicable Diseases

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Abstract: Chronic non-communicable diseases (CNCDs) are one of the leading health threats in the developing regions. They require constant monitoring and attention to ensure that complications are minimized or prevented. Disease self-management support (DSMS) is an essential element of care for all persons living with CNCDs and is necessary in order to improve patient outcomes. One form of DSMS is peer-support, where a group of patients come together with a common purpose of sharing each other’s experiences and accessing help. This paper presents the design of a mobile application called Mobile DSMS that is used to enable patients to virtually connect using their cell phones and provide the necessary support required to improve their self-care behaviours. Mobile DSMS offers patients the necessary tools to log their self-care practices, review their past behaviours and share health outcomes in a virtual support group comprising of 5 patients. The objective of the system is to increase access to peer-support, so that patients who would not normally participate in or have access to a regular ‘physical’ support group session can still benefit from the advantages of one. A focus group comprising of 21 patients and caregivers was used to assess the usability of the application and the initial perceptions of this type of remote support. The findings show that the majority of participants found the system to be very helpful and they indicated that they would use it. Feedback was also obtained on how the patient mobile interface can be improved.

Introduction

There is a growing body of evidence which demonstrates that mobile communications has the potential to radically improve healthcare services—even in some of the most remote and resource-poor environments [1]. Mobile health refers to the provision of health-related services via mobile communications. To date, several important mobile health applications have been developed for areas such as education and awareness, remote data collection, remote monitoring, communication and training for healthcare
workers, and diagnostic and treatment support. As interest in mobile health continues to grow, social networking software continues to gain widespread popularity among Internet users. However, no research has been conducted to investigate if mobile health applications based on principles of social networking can have a positive effect on health outcomes.

This paper reports on research that integrates features from mobile health applications and social networking software. This research has resulted in the development of a mobile health application called Mobile DSMS. Mobile DSMS provides features which allow a person suffering with a chronic non-communicable disease (CNCD) to form a support group with up to five other persons having the same or a related CNCD. Using their smart phones, persons in a peer support group can record their self-care practices, review their past behaviours, and share health outcomes with other members in their support group.

In the next section of the paper, we describe the motivation behind our research with Mobile DSMS. We show how the idea grew out of mobile health applications used for remote monitoring and education and awareness as well as the growing popularity of social networking software. We then give an overview of Mobile DSMS and describe some of its features which enable peer-support using mobile communications. Next, we describe a focus group study which was carried out with persons in the target population to gather their perceptions of the mobile application. Finally, we conclude by discussing how the results of the focus group study are being used to re-design Mobile DSMS so that it will better achieve its objectives.

Related Work

Over the last five years, there has been an emergence of mobile health care applications. The MediNet project [2] focuses on the design and development of a health care management system for the Caribbean region. Part of its architecture includes a remote monitoring and education application using mobile phones [3]. This application enables patients to share their daily readings and exercise habits remotely with their health care provider. It also offers the patient daily tips on the management of their disease based on the patient’s current health context. Ref. [4] is another mobile self-management tool that allows diabetes patients to improve their self-care behaviours using a built-in recording and coaching component.

This paper presents the use of peer-support in the self-management process. Ref. [5] uses peer-support to allow patients to connect both online and using a mobile phone to connect with other patients. This type of peer-support is open to the world; where anyone can join and the processes of
finding and joining a suitable group is left up to the patient. The Mobile DSMS is based on a framework for collaborative disease management using mobile technologies [6]. The patients are assigned to peer-groups comprising of 5 persons and the group assignments, in the first version of the application, is based on a custom algorithm. This paper describes the design and evaluation of this mobile application.

Self-Management Support Using Mobile Phones

Mobile DSMS or simply mDSMS is a mobile application that allows patients and their caregivers to connect with other people living with similar health circumstances. The first prototype was designed and developed for the HTC Touch SmartPhone running the Windows Mobile 6.5 operating system. The system is broken down logically into personal services and group services. The personal services or features allows the patient to capture data on their observations of daily living including physiological readings, diet, exercise activities and their current location where they are using the system. This part of the system also provides a Results feature that allows the patient to review past data captured. The group services or features allow the patient to contact a particular member of their peer-group or the entire group (consisting of 5 patients). The patients can also enter into a Discussion with the wider patient community by posting and reading post on different areas of the Self-Management Education (SME) syllabus. The group feature also enables the patients to view the history of their peers with the objective of harnessing and exploiting the experiences of the group. This type of sharing is intended to foster close peer ties for self-management support. The last group feature is a meeting reminder whereby if there are events relating to self-management occurring in their village, the patient/caregiver will be notified. The following section describes the user study that was conducted and the results obtained.

Methodology & Results

In January 2012, the researchers at the University of the West Indies conducted a mixture of questionnaire, individual interview and focus group, to examine the preliminary perceptions of the mDSMS application.

Twenty-Four patients visiting their medical practitioner were asked to participate in the study. Out of the 24 people surveyed, 21 volunteered their responses. The volunteers were given a questionnaire to obtain demographical information which is summarized in Table 1. The participants were then presented with a screenshot prototype. The researcher explained each screenshot and asked the participants to think aloud on what they saw in the screenshots and their initial perceptions. A screenshot
prototype was chosen because (1) this system was new to the target population so it was important that the prototype mirrored the actual system as much as possible and (2) considerable development time is required to implement all the features in the system, this type of prototype reduces this time, since some features that are not seen as being of value by the target group are discarded at an early stage. The main objective of this study is to investigate the participants’ interest in using the mDSMS application and to obtain suggestions for improving the application.

Table 1

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean)</td>
<td>36 – 66 yrs</td>
</tr>
<tr>
<td>Gender</td>
<td>Male(10) Female(11)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Afro-Trinbagonian (7) Indo-Trinbagonian (13) Mixed (1)</td>
</tr>
<tr>
<td>Role</td>
<td>Patients (16) Caregivers (5)</td>
</tr>
<tr>
<td>Number enrolled in a Support Group Programme</td>
<td>0</td>
</tr>
</tbody>
</table>

At the end of this exercise, all the participants surveyed stated that they found the system helpful. In terms of willingness to use the system, 20 said that they would use it and 1 said “Not sure”. Some of the open-ended responses included:

For me, yes, it will be helpful
Yes, definitely
It appears to be helpful
Yes, people do this now...when you discuss these things with others, it feels good
Yes, my friends already help me ....they tell me what to eat to feel better
Yes, people should start doing this
Yes, there is a support group at my clinic but I cannot attend because of personal family commitments
Not sure, not familiar with this phone

When the participants were asked what suggestions they can make to improve the system, they said/asked:

Not really, it’s good.
I need to use the system first to give suggestions on improvement
For persons who are vision impaired...how will this be handled?
Cannot remember everything explained at this moment, will need to use the system first
Is this system available for regular (‘me-too’) phones?
There should also be a caregiver network that allows caregivers to contact each other
Need to use it to identify what the system is not doing for me
Including some type of moderator
Having access to an existing diabetes library
Including more community visits
A lot of information already provide...better to keep the system simple
Why is a group size 5?
I will like to see some interpretation of the results
If people have some impairment (e.g. cannot see or hear) can they use this system?

Discussion & Conclusion

The results show that there is high interest in the mDSMS application. People were already accustomed to sharing health information with their friends and family and therefore, were already familiar with the underlying process. This is an advantage for the introduction of this new mobile initiative since the learning curve required will be mainly associated with the use of the mobile application itself versus changing the sharing habits of the target group.

The use of this type of platform was also supported in this study since none of the participants surveyed were enrolled in a support group programme and one indicated that they are not able to attend face-to-face support groups because of conflicting personal commitments. This system is intended to increase the availability of peer-support. When it comes to the suggested improvements, some people expressed the need to use the system in order to make recommendations. The next phase of this study if to use the feedback obtained from this study to refine the design of the mobile application. In April 2012, a field trial will be conducted where users will be able to use the system in their real world settings.

Other users expressed concern about the fact that many patients may have poor vision or other sensory impairments. To address the impaired vision, the system is being developed with an optional audio component that guides the patients as they use it. This feature is expected to also act as a reminder system and it is already used in other computerized systems in the country such as Banks’ ATM. To address other impairments, the system is designed in such a way that the caregiver can use the application on behalf of the patient. This way the patient still benefits from the systems intended purpose – record observations of daily living, review (and analyze) past recordings and share in each other’s experiences. The remaining suggestions will be addressed in the next version of the application.
Acknowledgment

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References


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Portable Telemedical System with an Intelligent Expert System for Doctor Decision Making Support in Emergency Situations

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Introduction

In Russia more than twenty thousand people die in road accidents annually. A significant percentage of these deaths as well as the impact of injuries are potentially avoidable with proper, timely intervention and response in the critical first hour or so after the accident. According to the golden hour rule survival chances are greatest if aid is received within the first sixty minutes after the accident. In the next hour the number of victims will increase by 30% and if no medical aid was received within the first three hours, the number of victims will increase by 60%. Russian team of engineers at T-smart LLC has found a solution that brings effective medical assistance during the first critical hour.

In this paper we are introducing the newest solution in the line of portable telemedical systems – ARNEGA™ Expert – a portable telemedical system with an in-built intelligent expert system for doctor decision-making support in emergency situations. This new solution weighs about five kilograms and yet includes an entire clinic of qualified medical specialists.

System Structure

Such structure (Fig. 1-4) allows the user/operator attending a patient to get in touch with a remote expert/consultant who has access to special medical knowledge bases (for reference information) and a smart medical
dummy (for demonstration of correct procedures that should be performed on a patient) and thus receive a qualified consultation and even visual instructions on what to do with the patient onsite.

This new portable solution allows rescue forces and medical staff to reach the farthest corners on Earth to save lives. Technically speaking this is achieved by positioning a mobile telemedical system along with satellite terminals in a safe place with access to communication channels and at the same time dispatching medical staff/rescuers equipped only with an interactive helmet and a vest into dangerous and hard to reach spots, where no vehicle can pass and where any additional equipment will be too cumbersome.

The system consists of a user wearable set of autonomous equipment with software and hardware parts and infrastructural components for organizing a remote telemedical center of expertise. It is implied that the user is a medical worker located in a remote area and is attending a patient.

Wearable equipment consists of both hardware and software components.

**Hardware includes:**
- A specialized computer with a set of interfaces for connecting medical devices and sensors;
- A set of medical devices and diagnostic sensors;
- An interactive helmet or video-glasses with inbuilt cameras and audio and video communication systems, a visualization system with augmented reality support;
- Communication module for contacting a remote medical center;
- Autonomous power supply.

**Software includes:**
- Visualization module and data processing module;
- Local reference medical knowledge base;
- Local expert module for doctor decision making support;
- Videoconferencing system;
- Augmented reality module.

**Infrastructural Components: Model of a Telemedicine Center**

**Hardware includes:**
- Supercomputers for data storage, processing and generating an expert’s report;
Software includes:

- An automated expert system of doctor decision making support that is based on:
  - The analysis of medical knowledge bases and incoming medical image processing and classification results
  - The analysis of simulated responses received from smart medical dummies when certain procedures are performed on them (mathematical models of physical processes inbuilt into smart dummies are built).
- A videoconferencing module for active interaction between an expert consultant and a remote medical worker;
- A module of automatic generation of an expert report and its further transmission to a remote medical worker (in case a live expert consultant is unavailable).

Technologies

- Newest development in the area of neural network algorithms and their application/adaptation to solve the task of processing images received from medical devices and then classifying them. This will save a doctor’s time and help make a better decision (diagnosis).
- Expert systems and knowledge base building technologies;
- Object visualization technologies that support and include augmented reality solutions using HPC and GPU-intensive computing resources;
- Application of smart dummy technologies, where a remotely located medical worker learns how to treat a particular patient from
watching a videoconference where remotely located experts perform certain procedures on a smart medical dummy.

Competitive Advantage

The project’s advantage is in the innovative solutions used that have no analogues.

In order to solve complex diagnostic tasks effective neural network algorithms will be applied in processing the data received from medical devices. This means that the data has to be carefully and correctly read from the medical devices and gathered in the form of special archives and then all data must be verified by a group of qualified medical experts. When developing neural network algorithms, development team has relied on the experience accumulated by the Russian Scientific School in the field of neural network technologies and their applications.

In the project course mathematical models of physical processes inbuilt into smart medical dummies will be built with further integration into the doctor’s decision support system.

Acknowledgment

The authors greatly acknowledge the effort and the support provided by both medical and administrative staff of the Russian Railroad and the Russian Telemedical Association involved.

References


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Russia is trying to keep pace with world's telemedicine standards. The greatest progress is seen in the area of portable telemedical systems. A portable or mobile telemedical system is a set of communication, processing and diagnostics equipment all integrated into one weather and shock-proof carry case, backpack or wearable ammunition, which allows medical and emergency staff to bring medical aid to those who need anywhere anytime.

Currently a modern network of stationary and mobile telemedical centers has been organized and is now successfully functioning in the framework of the existing the Russian Railroad OJSC healthcare infrastructure. These centers function in accordance with international videoconferencing standards, thus allowing to work with all Russian and international clinics that use telemedical technologies.

It is important to note that a telemedical network within medical establishments of the Russian Railroad makes up a common information space that is organized for the improvement of overall therapy effectiveness as well as support of managerial decision-making. The telemedical network is made up of:

- Medical information systems belonging to connected clinics with all necessary equipment for medical and statistical information exchange;
- An information analysis system for measuring the effectiveness of the medical activities conducted by the Russian Railroad medical establishments;
- A network of stationary and mobile telemedical centers;
- The railroad staff electronic health records;
- A modern telecommunications infrastructure.

The telemedical technologies existing in the Russian Railroad healthcare structure help solve the following tasks:
• Conducting remote routine and emergency video consultations (teleconsilium) with central hospitals of the Russian Railroad and other leading Russian and international medical centers;
• Interactive doctor’s teletraining (postgraduate education),
• Interactive broadcasting of diagnostic procedures, surgeries being conducted in leading Russian and international medical centers when new medical technologies and equipment are being mastered;
• Interactive broadcasting of diagnostic procedures and surgeries to leading medical centers in order to receive recommendations and second opinion when manipulating a patient (tele-mentoring);
• Conducting interactive workshops and scientific conferences;
• Organization of emergency video consultations of patients from sites of accidents or man-made catastrophes using mobile telemedical systems;
• Remote patient video monitoring at home (home telemedicine).

Today it is no longer doubted that application of telemedical technologies entails a positive economic effect represented by:

• Decreases in patient transportation costs achieved by conducting routine and emergency video consultations; the cost to conduct 1 remote video consultation for remote regions of Russia is 80-120 times less than the total costs incurred for the trip to Moscow needed to conduct a face-to-face patient consultation;
• Increase in the effectiveness of overall medical treatment conducted at home is achieved by transmitting patient data to medical centers and discussing it with qualified medical staff using a home telemedical system;
• Decrease in doctors’ training costs achieved by conducting interactive teletraining.

Just as important is the social effect achieved by telemedical technologies, which help make highly qualified medical aid accessible to the people living in remote access regions, thus fulfilling the citizen’s rights according to the Constitution.

Portable and Mobile Telemedical Systems

Portable and mobile telemedical systems are presently used as part of the Russian Railroad healthcare infrastructure. There are currently about 91 of these systems that are actively being used by the Russian Railroad to conduct routine and emergency remote video consultations from remotely located regions in Russia, from emergency and accident sites.
At the present time three different versions of a mobile telemedical system have been developed:

- A telemedical compartment that is part of a mobile (train-based) consultation and diagnostics center;
- A telemedical system that is part of an ambulance;
- A portable telemedical system (Fig. 1, 2 and 3).

All of the above mobile telemedical systems include:

- Portable videoconferencing system in a rugged (weather and shock-proof) case;
- Set of equipment for transmitting patient data during the video consultation;
- Set of portable medical devices;
- Power supply;
- Portable satellite terminals;
- Data encryption;
- Interface modules for remote and wireless audio and video data transfer, for vital signals data transfer.

Mobile Systems (Ambulance or Train-Based)

Mobile telemedical systems that make up an integral part of an ambulance or a mobile consultation and diagnostics center use portable self-guided satellite dishes that are place respectively on top of the car or coach (train). The unique construction of this mobile telemedical station allows to conduct remote video consultation while the vehicle is moving at the speed up to 70 km/h.
Ambulances equipped with these mobile telemed systems are currently used in Moscow and Saint-Petersburg.

A similar system is used as part of a mobile consultation and diagnostic center in a number of medical specialized trains - “Matvey Mudrov”, “Nikolay Pirogov” and “Fedor Uglov” named after famous Russian doctors and academicians. These trains work on the North-West, Far East and Far North of Russia.

**Portable Systems**

Some of the first portable telemedical systems developed and used by the Russian Railroad are based on videoconferencing solutions by Tandberg (e.g. Tandberg Tactical II) and use self-guided Inmarsat system portable satellite communication terminals (e.g. Inmarsat NERA World Communication Voyager).

An entire network of telemedical centers was built throughout Russia from Sakhalin to Kaliningrad using such portable systems. By 2010 at least 300 telemedical centers have been organized with the help of Russian Telemedical Association.

In 2010 a new portable telemedical system has been developed to suit the needs of the Russian Railroad health infrastructure. The system includes:

- Portable foldable satellite terminals. This enables audio and video data exchange via the Inmarsat BGAN satellite network. BGAN terminal support data exchange at speed of up to 492 kb/s, has standard Ethernet ports and also supports an additional voice communication channel;
- An interactive specialized helmet that allows for an interactive audio and video data exchange between the operator wearing the helmet and remotely located consultants and experts. All communication is conducted in a duplex mode. A special visor attached to the helmet can be lowered in order to receive video instructions on how to act in a particular case;

![Fig. 3. Remote video consultation of a child with a congenital heart defect using a portable telemedical system in the herders’ camp on the shores of the Arctic Ocean.](image)
• A special HD camera is used, it is weather-proof and detachable on an extendable cord from the helmet for an object close-up and comfortable patient examination;
• An autonomous power supply;
• Specialized cases for the notebook and medical devices that are weather and shock proof;
• Touch free interfaces for connecting additional devices (video cameras and medical devices);
• A unique telemedicine module, which enables express patient monitoring and vital data transfer into medical establishments for teleconsultations and hospital preparation for incoming patients. The module includes various medical equipment and tools that can be connected via a digital interface (USB/Bluetooth/etc) to other system’s modules. It can include an ECG, pulse oxymeter, stethoscope, blood pressure meter and other laboratory equipment;
• LED lighting;
• GLONASS/GPS and other positioning sensors for staff movements tracking and for patient condition monitoring (falls, etc) in future modifications.

About 60 such systems currently being used and there is a contract with a Russian developer to supply 200 more in the next two years.

It is important to note that the Russian Railroad telemedical network is developed in close collaboration with the Russian Telemedical Association, thus demonstrating an example of successful integration of interests of both departmental and municipal health care – all for the purpose of bringing medical aid to the people living in remote region of the country, as well as increasing overall doctor qualification based on the use of modern telecommunications technologies.

Future Developments

Russian Telemedical Association, the Russian Railroad and Russian developers are presently closely working with Cisco in order to bring portable and mobile telemedical solutions to other regions in Russia as well as to other neighboring countries.

A new project in the area of portable and mobile telemedical systems is being currently developed, which will help automate and support doctor’s decision-making. The main distinction from the previous systems is inclusion of new intelligent components (system modules), such as:
• Access to telemedical knowledge bases;
• An expert module to support doctor’s decision-making;
• Augmented reality and visualization module that will help generate visual instruction on how to manipulate a patient;
• Image segmentation and classification module for processing medical images using neural network technologies;
• Smart medical dummies and mathematical models of physical processes inbuilt into the dummies; this will help practice different treatment methods (instead of live patient we use a smart dummy for practice).

This system allows the user/operator attending a patient to get in touch with a remote expert/consultant who has access to special medical knowledge bases (for reference information) and a smart medical dummy (for demonstration of correct procedures that should be performed on a patient) and thus receive a qualified consultation and even visual instructions on what to do with the patient onsite.

Acknowledgment

The authors greatly acknowledge the effort and the support provided by both medical and administrative staff of the Russian Railroad and the Russian Telemedical Association involved.

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Security Challenges for Remote Patient Care Systems using m-Health Technologies

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Introduction

Recent years have witnessed a paradigm shift in the remote healthcare deliveries. A major driving force of this evolution is the rise of mobile devices that have significantly changed lifestyles of citizens and have provided fascinating business prospects to the service providers. According to the estimates of International Telecommunications Union (ITU), there are over 5.3 billion mobile telephone subscriptions worldwide whereas only 2 billion users have Internet connection at home [1]. These figures justify the uptake of mobile healthcare services – also known as m-Health.

It is evident that m-Health products are poised to make significant impact on the healthcare landscape; and to considerably improve the quality of life for patients and make them and their families much more confident in their capabilities to assume their social lives with a better protection level. A number of medical measurements are often required during the course of a patient's routine activities. These measurements cannot be made at home in a very quiet and controlled environment. Many risks increase when elderly people are outside in an environment that is not specifically prepared or adapted for them (such as falls, heart or breathing problems, etc.); still extension of the life duration at home cannot be seen as completely satisfactory if the home becomes a prison with limited social relationships. M-Health will therefore become a mandatory step in the assistance technologies for elderly population in the coming years. However, security concerns are the impeding factors for wide scale deployment of the m-Health solutions [2, 3]. There is a long way to go for addressing the entire bunch of m-Health security requirements. In this paper, we highlight our vision for addressing these challenges and present our proposed approach. Our work is based on our experience of working in various e-Health projects at regional, national, and European levels.

Impact of Security Issues on the m-Health Products' Market

The business model of the m-Health products is increasingly becoming attractive nowadays. The turnover of the market in the US only is predicted...
to be 1.3 billion dollars in 2011 [4]. Major app stores are currently offering 17000 m-Health applications of which 74% have paid business models [5]. These figures clearly depict the significant role of m-Health products in the coming years where the m-Health industries poised to reach out to 500 millions of a total of 1.4 billions smartphone users by 2015 where 76% of total m-Health application market revenue will be generated from related services and products [5].

However, in order to meet these targets, m-Health systems must implement specific requirements related to mobility issues. The authentication and access control to medical or private data must take into account the risks associated with the mobile devices (such as theft, misuse, connection issues, etc.), as well as the way for a patient to allow sharing of data and transmitting them to other stakeholders (such as general practitioner, nurses, family members, etc.). In the event of development of specific devices like fall-prevention device or emergency call device, it will be required to implement advanced security features at hardware and/or firmware levels to enhance authentication and access control and to prevent IP bypasses (such as service or data theft, viruses, etc.) that may seriously endanger the user. The mobility issue implies that the devices may escape – even temporarily – from the user's control, the integrity of m-Health devices must be guaranteed with highest security standards due to the potential consequences if a malicious user takes control of the device.

Adequate security measures are also needed for the compliance of these m-Health products with the standing legislations otherwise despite enormous business pushes; the vision of seamless access to health resources from mobile devices will remain an unfulfilled dream. Some guidelines in this context are emerging specifically for the HIPAA compliance [6]. However, more comprehensive certification and accreditation mechanisms need to be evolved to facilitate the adoption of m-Health services and products especially in the European landscape where data protection directives are the strictest ones.

Our Proposed Approach for Addressing the Security Requirements

We consider security of Body Area Network (BAN) [7] as frontline defense for the m-Health architectures followed by the communications security. There are several modes of communications in m-Health systems, where security gaps emerge while using hybrid communication channels. IPv6 discovers security gaps and provides better security in hybrid communication systems.

It is evident that overall m-Health infrastructure can never be protected if there is no adequate security mechanism for the back-end systems. We
propose to have a *monitoring* set-up to ensure that optimal security solutions for a back-end system are put in place. This approach will also be helpful in establishing trust on the service providers in open market for the mobile applications especially where the same smart devices are also used for the health applications.

Like in any IT system, applications security is the Achilles' heel for the m-Health systems. It cannot be overlooked in a system where personal information is gathered or processed. It is understood that applications security vulnerabilities together with the human error of the users constitute the weakest link in the m-Health security chain.

We understand that our ambitious approach for addressing m-Health security requirements has to tackle a number of real-life constraints to yield a practical solution. Scarcity of power supply is a known constraint for the miniature mobile devices. However, other limitations such as bandwidth requirements are often neglected. Moreover, in-depth security features that are deployed at various network layers not only consume a lot of resources but also take their toll on the overall performance of the device systems. We also need to take into account various functionalities blocked by the device manufacturers. For example Bluetooth for file exchange is not supported by the Apple iPhone.

A common approach for addressing multiple identifications in a composite system is the Federated Ids, so that authentication of devices, users, systems, and even organizations can seamlessly be made. However, we need to ensure the protection of data against any compromise of these identities or theft of the devices storing them. To achieve this objective, we propose that data should not be stored at all in the sensing devices; and smart devices such as PDAs should always make encrypted storage with regular synchronization with the back-end storage systems.

We propose a Security Service Broker (SSB) to efficiently manage and coordinate security services without extravagant performance overheads. The security policy of m-Health system is hosted by the SSB. It also contains the data flow sequence that enables it to coherently invoke policy enforcement and decision points. It also coordinates the authentication of various stakeholders such as services; their providers; and end-users. We plan to use a security-monitoring module for the continuous monitoring of security state. The SSB will identify if a security state is no more active or if a function is not invoked in a semi-automatic manner. The SSB is still in the conceptual phase; and we plan to perform further analytical analysis before its prototyping.
Perspectives and Future Directions

Our proposed solution for addressing security requirements of m-Health deployments is not merely meant to protect physical devices and their inter-communications; it rather aims to assure protection of individual patient's personal information without restricting their physical movements beyond their homes.

Our future directions include deployment of SSB (Security Services Broker) and testing and validation of its performance parameters. An important criterion of SSB performance evaluation will be its reliability. It has to be failsafe so as to ensure optimal security guarantees even when other components of the m-Health ecosystem are unable to operate properly. Reliability issues are non-trivial in such critical systems that require due attention of the designers as we have recently seen that even highly available infrastructures such as clouds have suffered outages [8].

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The Potential of mHealth Technology Incorporation in Brazil

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Abstract: The Telehealth Network of Minas Gerais develops activities of teleconsultation and tele-electrocardiography for primary care of 658 municipalities in Minas Gerais province, Brazil. It has already performed more than 800,000 electrocardiogram (ECG) analyses and more than 30,000 offline teleconsultations. Thinking about mobile devices potential with 3G service inland, the Telehealth Network of Minas Gerais has incorporated a mobile service in August 2010 to try to increase teleconsultation utilization rates. This is an alternative for the bad quality of internet connection by radio that is still a barrier to utilization in remote areas of Minas Gerais. Due to its greater mobility, it allows users to save time and increases service efficiency. However, the mHealth is still underused because the devices’ screens are usually small, making it difficult to type or attach a file using a small keyboard. Furthermore, the 3G technology is just available in some inland cities. In order to overcome these limitations, telecom companies are working to increase network coverage and to improve software usability. In conclusion, the service expects for 2012 an increase in utilization rates in sites by the mHealth technology base on tablets or comfortable mobile phones with 3G.

Brazil is a continental country spanning 8,514,876,599 km², 5565 municipalities, almost 200 million inhabitants [1] with a human development index (HDI) of 0,718 [2]. Minas Gerais is an important Brazilian province, with more than 10.3% of the total population and 15.3% of total municipalities of this country. The Brazilian Unified Health System (SUS), is based on primary care that refers patients to specialists in reference centers. Access to specialized care is difficult for residents of small and remote municipalities because health resources are concentrated in the largest cities.

In order to reduce these inequities in Minas Gerais, 658 of its 853 municipalities are served by the Telehealth Network of Minas Gerais. This network was formed in 2005 and started providing teleconsultations and
tele-electrocardiography for primary care in 2006. The project has already performed more than 800,000 electrocardiogram (ECG) analyses and more than 30,000 offline teleconsultations. Utilization rates in October 2011 were 93% for tele-electrocardiography and 66% for teleconsultations.

A number of investments in Brazil’s telecommunication network have occurred in the last years. The reflection of these investments can be seen now. In 2007, 65.4% of cities in Brazil had cell phone network. This proportion sharply increased to 99.9% in October 2011. At the same time, the percentage of population with access to mobile broadband increased from 58.8% to 76.8%. Furthermore, 95.8% of Brazilian population was served by fixed broadband connection in October 2011 [3].

In October 2011, the Brazilian government permitted tax exemption on tablet PC produced inside the country. This led to a 30% decrease in price and probably will lead to the popularization of these devices in 2012.

Linking these two resources, internet and mobile devices, the 3G connection increased by 90% in the first semester of 2011. Between November 2010 and November 2011, the total number of active access points, increased 99.6% in Brazil and 104.4% in Minas Gerais. Table 1 shows the percentage of increases from access by Wide-Band Code-Division Multiple Access (WCDMA) devices and by mobile data terminals [4].

Table 1: Increment of WCDMA devices and mobile data terminals in Brazil and Minas Gerais between November 2010 and November 2011

<table>
<thead>
<tr>
<th>Increases by</th>
<th>WCDMA devices</th>
<th>Mobile Data Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>90.6%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Minas Gerais</td>
<td>86.4%</td>
<td>13.6%</td>
</tr>
</tbody>
</table>

To increase teleconsultation utilization rates, and planning for future expansions of network technologies, the Telehealth Network of Minas Gerais incorporated a mobile service in August 2010. The conventional method for performing a teleconsultation of Telehealth Network of Minas Gerais is a website. The mobile service is an additional option to access all the functions of the regular website, and new information can be added by both methods in the same database. This alternative allows sending text and attached files uncoupled for each teleconsultation. With this characteristic, more than one file of up to 8MB in all usual formats, such as jpeg, doc, or gif, can be attached.
Mobile technology, therefore, has the potential to increase telehealth expansion and utilization rates. The mobile service represents an advance for the Telehealth Network of Minas Gerais, but when it became part of regular system, in August 2010, the telecom infrastructure in Brazil was expanding, but not enough to

Fig. 1. A tablet PC with 3G technology accessing to mobile service of Telehealth Network of Minas Gerais

Fig. 2. Map showing rainfall in Brazil (mm), December 2011. [5]
adequately absorb this innovation.

Two important factors that prevent a substantial increase in utilization rates of teleconsultations are:

- Internet connection quality. In inland cities of Minas Gerais, the internet connections are commonly made by radio and a storm normally causes a disruption. The option for radio connection is because in countryside it is the cheapest way to connect to the Web. Adverse weather conditions regularly occur in this province, especially in summer. For example, Figure 2 shows that in December 2011, it rained in almost the whole province of Minas Gerais, and more than 450 mm of rain was registered in the capital, Belo Horizonte.
- Uncomfortable user interaction through mobile devices. In the last years, the common mobile device for internet connection has been smartphones. These devices’ screens are usually small, making it difficult to type a teleconsultation question or answer, or to attach a file using a small keyboard.

In order to overcome these limitations, telecom companies are working to improve software usability in their development laboratories and to increase network coverage.

In conclusion, the service expects a marked improvement in 2012 due to an increase in utilization rates in sites by the mHealth technology. The Telehealth Network of Minas Gerais believes that this increase will be based on popular tablets or comfortable mobile phones with 3G technology with better software usability using inland by 3G connection.

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Regional Initiatives in Telemedicine and eHealth
Asynchronous and Synchronous Teleneonatology – Clinical Experience at National and Regional Levels

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Abstract: Achievements of the tele-neonatology in Ukraine are presented. Asynchronous teleconsultations are lead via e-mail and web-platform iPath. All recommendations have positive influence to the clinical workflow. For the first time we have used a wireless tele-ECG for intensive care in neonatology. Tele-ECG in neonatal ICU allows: verification of the clinical diagnosis in 100% of the cases and advanced and fast correction of the medication therapy in 36%. Telemedicine in neonatology is a powerful tool for support of clinical decision making, development of individual treatment program, improvement of medical workflow and care availability.

Tele-neonatology is a complex utilization of the different telemedicine technologies and applications for planning and providing of the special medical care in neonatal period (from birth till the 28 day of the life of the newborn children). During last 15 years tele-neonatology is focusing on: telemonitoring, telescreening of retinopathy at premature infants, tele-echocardiography, teleconsultations and elearning as well as on some special applications as tele-visits.

Our strategic goal is to improve quality and availability of the special care for problematic new born via tele-neonatology at a national level, i.e. to “bring” care to the patient via telemedicine and to make possible the fast and effective clinical decision making. Tele-neonatology network in Ukraine includes National Association, primary, secondary and tertiary hospitals in six regions, university clinics in 3 regions, international perineonatology project and industrial parties. At international level we have a collaboration with several university clinics and specialized hospitals in 5 countries from European Union, Switzerland, Russia, Turkey and US.

Asynchronous (Store-and-Forward) Teleconsultations
Primary and secondary hospitals (especially in rural areas) rely on this form of telemedicine more often, because asynchronous teleconsultations allows them to receive: prenatal teleconsultations from high-level centers; dynamic supervision; preventive care for the infants with low weight; access to special electronic data bases for the infants with congenital abnormalities and telediagnosis.

Indications for asynchronous teleconsultations in rural hospitals are developed. They include: problems with diagnosis or current treatment, receiving second opinion for the invasive actions, surgeries, treatment of casuistic case [1].

Main tools for the store-and-forward tele-neonatology are e-mails and web-platforms. For the e-mail teleconsultations we have used standard medical records including short text with clinical case description and relevant diagnostic data (more often – medical visualization as x-rays, CTs, photos) and, of course, easy to use but reliable approaches for data safety. Patients with orthopedic pathology (about 50%), congenital abnormalities (20%), neurological or skin pathology (10-20%) are significant part of e-mail teleconsultations. Average duration of asynchronous teleconsultation is between 12 and 48 hours. The problems that are most often discussed are primary tactics and early treatment. Every case is discussed by 1-4 experts from Ukraine, Russia, Austria, Germany and Turkey. Most often additional diagnostic tests are recommended. All recommendations have positive influence on clinical workflow [3-4].

The most impressive experience that we have is with the application of a telemedicine web-platform originally known as iPath. iPath was developed in Basel University. This is open-source application widely used in many telemedicine projects. In Ukraine the installation of the iPath server is under the supervision of Association for Ukrainian Telemedicine and eHealth Development.

iPath is a environment, every user have to pass through registration and double-staged recognizing. Such approach is necessary due to medical safety reasons. In four regions of Ukraine iPath web-platform is used as main infrastructure for the tele-neonatology regional staged network. It means that official formal telemedicne consultations between primary-secondary level hospitals and tertiary referral clinical centers are organized through iPath platform. Specialists on-duty in tertiary clinics and moderators are ready to perform teleconsultations at anytime. This is easy-to-use, clinically and cost-effective approach with normal level of safety. So, this is real rural tele-neonatology. External experts provide teleconsultations at more sophisticated level or for rare casuistic cases [1].
International teleconsultations (35.0%) made diagnosis and treatment more comprehensive, allows to increase clinical efficiency of the telemedicine in neonatal care. The teleconsultation it’s not only clinical tool, but also a way for knowledge transmission and skills improvement. Staff on rural hospitals has approaches for evidence-based practice, new information and clinical protocols via experts’ recommendations. Especially valuable it is when experts’ recommendations include additional information (we call it “evidence-based advices”, it could be similar clinical case examples, full-text articles, references etc).

Telemonitoring (Tele-ECG) in Neonatal Care

A lot of things in neonatology could be improved by telemedicine and one of them is cardiology. Tele-echography is a well-know telemedicine tool for the store-and-forward or, more often, real time transmission of the heart and vessels ultrasound images, loops for the diagnosis and treatment decision making. The randomized trials revealed excellent management and diagnostic results of this technology. ECG is an effective diagnostic method, well-known and widely applied in neonatology. It is cheap, easy-to-use and has good diagnostic efficiency. The main problem in its application is the interpretation of ECG (de jure - correct and fast analyses of the ECG signs is a routine clinical skill, but de facto – it is a problem), which exactly could be solved by telemedicine.

Trans-telephone ECG transmission, one of the earliest telemedical technology, allows fast and comprehensive diagnostic of cardiac pathology, suggestions for treatment and patients’ management tactics. In Ukraine first tele-ECG system was established in 1935 by Prof. Marjan Franke [2]. Since 2007 new wireless (mobile) digital tele-ECG system – UNET – is developed and implemented in Ukrainian health care system. After analysis of PubMed publications we are going to assert that we have used wireless tele-ECG for intensive care in neonatology for the first time in the worldwide [3-4].

Indications for the teleconsultations are: intranatal hypoxia, suspicions for congenital abnormalities, clinical signs of cardiovascular pathology (cyanosis, heart murmurs etc), monitoring of the medication therapy (dopamine) efficiency.

Wireless Tele-ECG system UNET was established in neonatal ICU and call-center in Emergency Cardiology Department of the Regional Hospital.

Tele-ECG consultations were performed for 22 newborns in age 1-27 days (premature infants - 18%, pregnancy pathology – 73%). Special neonatal electrodes were used. Duration of the tele-ECG consultations was 10-15 min. Different changes at ECG were found at 73% of the infants.
Most often the pathology discussed included right bundle branch block with sinus arrhythmia or supra ventricular paroxysmal arrhythmia.

UNET system is very suitable for the urgent situations due to in-build telemedicine unit including GSM-modem for the wireless data transmission and headphones kit for the talking with expert. Tele-ECG in neonatal ICU also allows objective verification of the clinical diagnosis in 100% of the cases; advanced and fast correction of the medication therapy – in 36%. All calls for the specialists’ visits were well back-grounded. Good clinical outcomes – about 19%.

This preliminary study of the clinical efficiency of the tele-ECG system UNET shows high level of diagnostic accuracy, positive influence on clinical strategy and outcomes.

Conclusion

Telemedicine in neonatology is a powerful tool for support of clinical decision making, development of individual treatment program, improvement of medical workflow and care availability. In Ukraine experience with tele-neonatology is very positive and quite promising. International collaboration allows organizing a telemedicine network at evidence-based principles and solves clinical and teaching problems at more sophisticated level.

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Biotelemetry Tool for Healthcare in Local Area

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Abstract: This study was conducted in Sao Paulo (Brazil), a metropolis city where there is a gradual increase in the number of elderly people who need technological applications according to their capabilities, especially in the area of monitoring their physiological signs. Therefore, the demand growth for services in primary care is a vital component of treatment. Aware of this reality, our study presents a useful tool for the local area health care based on a biotelemetry system using Bluetooth™ sensors' network and a module of acquisition, processing and data transmission to a storage data center in a local area. For the application presented in this study, the network uses three sensors: heart rate, body temperature and triaxial motion with an electronic plate developed for the acquisition, processing and data transmission. Regarding data storage, the system offers two modes: i) internal mode: an internal memory for the processing module and/or ii) external mode: connected to a server via Bluetooth™. The information is available to users via password access. The results proved the usefulness of the system, due to several technical factors and portability. With regard to technical factors, electrocardiography signal retains a correlation r=0.89 (p <0.05), triaxial acceleration signal r=0.9 (p<0.05) they are used to calculate the physical activity level. The biotelemetry system has been tested on elder people for the fall control and control of cardiovascular diseases related to arrhythmias.

Introduction

Background

The aging process of the world population is a natural and irreversible phenomenon. The data presented by Velasquez (2010) show that between 1950 and 2000 the population over 75 years old has doubled. This number will be outpaced to 300 million people (2030), doubling again, but in much less time, which shows acceleration in the rate of growth of this segment of the population. Even though there is a longer life expectancy, the living conditions and access to health services in developing countries are still precarious. According to the Brazilian Institute of Geography and Statistics in 2010 the elderly population in Brazil was 7.4% of the total population,
and the largest concentration was found in the northeastern and southeastern states.

One of the main causes of chronic degenerative diseases is literally the downfalls of these elderly people, which according to the Brazilian Society of Geriatrics (2011) at least 30% of elderly people fall every year, and consequently increases the responsibility in their functioning of their daily life activities. FLEEM® (2010) system detects falls from a cell phone, however, the usage of cell phones are very low among the elderly population.

### Biotelemetry System

**Bio-signals**

*Accelerometry:* MEMS triaxial sensor located near the center of the body mass, sensitivity 1.5 g, 800 mV, 1 kHz sampling frequency;

*Heart rate:* sensors arranged in type II Derivation and the development of electrocardiograph based on instrumentation amplifier, 1 kHz sampling frequency and signal level of 5 V;

*Body temperature:* precision temperature sensor encased type TO-92 and sensitivity of 10 mV per degree Celsius.

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**Figure 1. Biotelemetry System**

**System**

The presented system consists of a main 120 g module attached to the belt of the trousers, with three sensors: heart rate, triaxial acceleration and temperature, a Bluetooth communication protocol and a computer that stores, displays and transmits the results of data processing. The system area coverage tested in residential environments is 20 m². For the main module, an electronic card is designed to acquire the EKG signals of a type II derivation of anteroposterior displacement, mediolateral and vertical, and of temperature with sampling frequency of 1 k Hz, yet, it is implemented a card of processing, storage and transmission of signals programmed without an encryption. The power supply of the main module is based on two main
batteries of 7.2 V, 1,000 mAh (LT-AP) attesting an autonomy of 20 hours of operation. The computer is programmed to receive signals, calculate individual results or signals’ cross processing, storing in a database, to display and alert levels outside of the calibrated parameters. All data are processed using MatLab® R14. The information is secured by encryption protocols, and password access.

Validation

The results proved the usefulness of the system, due to several technical factors and portability. Regarding the technical factors, the electrocardiography signal maintains a high correlation \( r=0.89 \) (\( p<0.05 \)). The triaxial acceleration signal achieved \( r=0.92 \) (\( p<0.05 \)) during control fall tests. The considered delay time is 10 ms and it is set on the data processing programs.

Healthcare Applications

Fall Control Systems

During daily activities, the elderly are at high risk of falling, causing dysfunction of motor skills, brain damage, unconsciousness, among others. The biotelemetry presented system calculates the fall of an individual based on measuring the vertical acceleration vector, which varies significantly in value in these cases. Once the fall is detected, the system checks the final position of the sensor’s three axes and compares their values for a minute and defines whether it is a fall or just a rough change in the body position without falling. Once the fall has occurred, the system activates two types of alarms: a vibration-noise to wake up the patient and if the patient is all right, he could shut it off, and the second transmits a signal to the data center, which will activate an emergency call in the server. The ECG signal is transmitted every minute and stored on the server for remote queries.

Beneficiaries

These are elder people who live alone and are prone to this kind of accidents as well as family members and doctors who are monitoring the activities of daily life of the elderly.
Conclusions

The presented system is practical, noninvasive, versatile and inexpensive. Accepted by the volunteers put through the tests due to its comfort and does not interfere with the movement of the body. It is currently used for the monitoring of elderly patients, achieving optimal control of falls and prevention of cardiovascular risks. We offer a reliable tool that can help health professionals in making decisions for improving quality of life for the older people.

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Abstract: In a national exchange platform for medical data, several security considerations have to be addressed. They mainly focus on data privacy and the protection of medical data against unauthorized access and misuse. Encryption of medical data ensures the confidentiality of the data, but this is only a part of the entire solution. To allow the search of medical data of patients, the platform additionally needs to store unencrypted metadata that describes the type of medical data and which gives some hints about the expectable content. Metadata of medical data are a real risk to disclose sensitive personal related data of patients. As long as such information is only stored inside a hospital or doctor’s office, the risk of disclosure might be acceptable. But in a context of a national exchange platform for medical data this risk must not be underestimated. This paper presents a de-identification concept that minimizes the risk to disclose sensitive medical data.

Introduction

Metadata of medical documents are needed to allow the search of encrypted documents. Metadata might describe the document container (e.g. document type, circumstances of creation) but also be an extract of medical information of the document itself. The more medical information is extracted as metadata; search queries for documents can be more fine-grained. On the other hand, the more information is extracted from the medical data, the risks to disclose sensitive information about the medical state of a patient increases rapidly. Therefore, the protection of extracted medical metadata is an essential demand beside the protection of the medical data itself.

Encryption of metadata will not be an option, as the information is necessary for the search of documents. One strategy to overcome this problem is the processing of the metadata in a way that it becomes worthless for possible attackers. The processing of the metadata to achieve privacy properties, like k-anonymity [3] or t-closeness [4] cannot be
performed, as this would alter the real data and not only a copy for statistical purposes. The proposed solution for the national eHealth platform of Luxembourg foresees the de-identification of metadata by the replacement of the demographic data by a pseudonym. A trusted third party provides the de-identification process, which is organizational independent of the data providers and the platform maintainers.

De-identification is a state-of-the-art concept that allows the protection of personal data already by design [2]. It is a minimal demand to achieve privacy, as statistical analyses of the metadata and linkage to external sources still might allow the disclosure of sensitive information or in worst case the identity of the patient.

For the eHealth platform this concept is used to store metadata of the medical data inside the document registry only pseudonymized. This concept is extended by a sophisticated communication protocol that prevents at any time data providers from knowledge of the pseudonym, the storage repository of the platform from knowledge of any demographic data, and the trusted third party from knowledge of medical data. It includes role-based access of the de-identification services and mechanisms to resolve problems that might arise from faulty determinations of pseudonyms.

Methods

In principal there are several possibilities to de-identify data. In case of anonymisation, any demographic data is entirely removed from the metadata without substitution of the demographic data. As the metadata is used to enable sophisticated searches of documents, anonymisation is not an option. The association of the documents to the same persons must be given. In case of pseudonymisation, the link between metadata of the same person is kept by the use of pseudonyms. The pseudonym replaces all removed demographic data. Two data sets with the same pseudonym belong to the same person, hiding the identity of the person.

For the creation of a pseudonym, the person needs to be clearly identified first. This step is crucial part in the process as it tries to normalize all variations of demographic data (e.g. typographic errors, address change) of a person to one identity. By chance, this identification decision might be false or undecidable and requires manual intervention. After having successfully identified a person, the pseudonym will be created out of this identity either by using random numbers that are managed in mapping tables, or by hashing or encrypting of a unique identification number of the person.
In a national context of an exchange platform for medical data, the setup can be described as shown in figure 1 [1]. Main actors are Data Sources, which produce the data that is registered with all relevant metadata in the Data Registry and stored encrypted in the Data Repository. Data consumers will query the platform for medical data or overviews of existing medical documents. The Data Repository and Data Registry should never deal with demographic data of the patients and only use pseudonyms of the patients. In this setup, data consumers are only primary users, meaning that they know the demographics of the patients and having a transparent access to the medical data. The setup does not foresee the existence of secondary users, which only would use de-identified data, e.g. for creating statistics.

Results

The separation of demographic data, which are known at the data source / data consumer, from the pseudonym is done via the introduction of a trusted third party. A handshaking protocol on base of pick-up-ticket guarantees that the data source and data consumers never get in contact with the pseudonym, and the data repository and the data registry never get in contact with the demographics of the patient (figure 2). This is additionally enforced by the use of a Security Token Service and role based access to the services of the Trusted Third Party. In the national eHealth context, pseudonyms of one person are only identical, if the pseudonym was created at the same institution. For
queries of medical data, the Trusted Third Party returns a list of all pseudonyms, which belong to the same person. It is assumed, that an identity at source side never changes, but identification decisions at the Trusted Third Party might be wrong. If this decision is corrected at one time, only the list of pseudonyms of the same person might change, but the pseudonyms do not have to be changed for each medical data at the registry or the repository.

References


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eHealth: Case Studies in the Czech Republic

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Abstract: The paper focuses on brief description of several approaches to eHealth applications in the Czech Republic. We present several case studies of developed solutions showing the principal differences between EHR based systems and “electronic health notebook”.

Introduction

The first summary on e-health applications in the Czech Republic can be found in the study E-Health in Central and East European countries focused on the Czech Republic, Hungary, Poland and Slovenia, and supported by the European Commission, DG Information Society, eHealth Unit \cite{1}. We focus on the attempts to develop methods and applications for eHealth in the Czech Republic and present several case studies of developed solutions. We analyze eHealth applications running in the Czech Republic collecting and sharing patients’ medical data and two research tracks on EHR based on I4C-TripleC and K4Care European projects. The advantages of the structured EHR in dentistry are mentioned. The IZIP project supported by the greatest health insurance company VZP is compared with projects mVITAKARTA and Kartazivota of smaller health insurance companies. Finally we discuss the issues that are vitally important for successful implementation of eHealth systems.

Case Studies of eHealth Applications

EuroMISE Center was the partner in the European project I4C-TripleC, where results of the European project I4C (Integration and communication for the continuity of cardiac care) \cite{2} were implemented and validated in the project TripleC in two Czech hospitals. The knowledge received from the project TripleC was further enhanced. The priority was to propose and develop appropriate techniques of structured data entry, representation and processing aimed at minimizing the effort of users (physicians, nurses) of the system and maximizing the clinical outcome of the collected data. The
proposed solution was implemented in a pilot application ’Multimedia distributed electronic health record’ (MUDR) [3-4]. The prevalent application area for the research was the domain of cardiology and dentistry. A voice-controlled DentCross component for EHR in dental medicine was developed and semantic interoperability in the cardiology domain was studied. The synergy of the voice-control and the graphical representation of data made hand-busy activities in the dental practice easier, quicker and more comfortable. Dental EHR with the interactive voice-controlled DentCross component is running in dental care at the University Hospital in Prague - Motol [5].

European cooperation with Czech participation in research on EHR was also running in frame of K4CARE (Knowledge-Based HomeCare eServices for an Ageing Europe) project [6]. The K4CARE platform is accessible using different ICTs. It is a web-based platform, and the services provided, are accessible by web browsers and wireless devices, such as mobile telephones or PDAs. With this integrated platform, the flow of information about the updated state of the patient among the different professionals can become time-space independent. Nowadays, when the patient in home care moves to a different place, the professionals who assume his/her care have serious difficulties to obtain the clinical history of this patient. Since most of the services are performed either by nurses or social workers who usually do not have laptops for their work we developed an application for PDAs that provides these care givers with all necessary data and information they need at the patient’s home and allows them to enter new data about the patient’s health state. The EHR for home care integrates data from multiple sources, captures data at the point of care, and supports caregiver decision-making. Its structure is described in [7].

IZIP project [8] originated as an Internet health book providing communication between patient and physicians, where its existence and content was a sole decision of the patient. IZIP was not and even today is not an electronic health record (EHR), although it is often mistakenly or deliberately interpreted in this way. Recently the issues, concerning IZIP funding by the General Health Insurance Company (VZP), have destroyed the trust of Czech citizens in the use of the EHR in Czech healthcare. Due to the continuing financial support, especially from VZP, the project IZIP has not been exposed to competitive pressures. IZIP has been developed without following the international standards, "best-practices" and outcomes achieved in other international and European projects on EHRs. IZIP has not implemented the international standards such as ISO/HL7 10781:2009, ISO/EN 13606 and other standards of Health Level 7 Inc., integration profiles IHE (Integrating the Healthcare Enterprise) or recommendations
expressed by the EuroRec Institute in terms of quality guaranteed by Seal 1 and Seal 2. Therefore it is inconsistent with international efforts to interoperability and quality of EHR. IZIP does not create EHR that would fully replace the existing paper documentation and to allow its effective use in healthcare. Nowadays it is presented as an “electronic health notebook”, which is much closer to its content and functionalities. It contains basic health state information, emergency dataset (e.g. blood group, last tetanus vaccination, risk factors, allergies and medication) and personal patient insurance account. It offers possibility to schedule preventive examinations, vaccination schedule, etc.

Other smaller health insurance companies have launched similar projects as IZIP, e.g. (m)VITAKARTA [9] and Kartazivota [10]. However, their authors present them only as a health notebook or basic data for emergency purpose, not EHR. Kartazivota is a project of the Health Insurance Company of the Ministry of the Interior. It offers three basic electronic services: personal insurance account (detailed list of expenses for the patient’s health care in last 3 years); correct and safe care (important patient data / contact information, patient and family history, chronic diseases, allergies, surgeries, injuries, medication, etc.); emergency (important information extracted from the previous list). It is accessible via smart phone. VITAKARTA and mVITAKARTA represent a project of the Sectoral Health Insurance Company. VITAKARTA is a desktop application and mVITAKARTA is an application for smart phones, having versions for iPhone and Android based phones. In addition to the basic functionalities available in IZIP and Kartazivota, it offers more interactive functions, e.g. adding more items, concerning current health state, personal diary. Further extension of functionalities is planned. There are dozens of systems similar to IZIP in the world, free and paid, which can be traced on the internet.

Conclusions

During practical design and development of several above mentioned applications and deeper analysis of the others we have learned many important lessons we would like to mention in the conclusions. eHealth applications that healthcare needs must be based on the latest technological platforms allowing future flexible development. During their design and implementation it is essential that primary data and other information are stored mainly in a structured form and not in the form of free text. Transferring information between health care providers must always be based on a responsible approach of both parties in the relevant legal and human relation to the data subject, i.e. a patient. Use of international classifications and standards, use of ontologies and systems designed to
allow integration with clinical practice guidelines, or other systems supporting medical decision-making must be of good quality and economic efficiency. Data storage and data transfer must be properly secured and at the same time they should allow the highest possible degree of interoperability. Legislation must clearly and unambiguously define relationship to the issued data from the perspective of individual stakeholders, i.e. health care providers, patients, health insurers and providers of information and communication technologies.

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References


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Abstract: Across Europe, economic and demographic developments pose new challenges in health related issues: a general tendency to prioritize on health and safety, the strong increase in welfare related diseases and the increased need for (home) care for the ageing population are causing health care costs to increase rapidly. Innovative solutions are necessary to meet these challenges and to avoid health care becoming unaffordable. These challenges are also an opportunity: because of the scope of the public health issue, and the increasing need of products and services in this area, it is an attractive target area for developing innovative new technologies and applications.

In the Interreg IVC project Innovation 4 Welfare (I4W), six European partner regions exchange best practices, develop new innovation projects and influence regional policies by stimulating innovation in the field of health and safety (‘welfare’). Fifty-one stakeholders such as policymakers, knowledge providers, economic and social intermediaries and health institutions collaborate in eight innovation projects in the field of teleservice, safety and security, benchmarking and food. By means of interregional cooperation, Innovation 4 Welfare builds new coalitions of economic and social actors. In that way I4W is intending to become a European generator for new technological solutions promoting health and welfare.

A practical example of a collaborative project is ‘Fitrehab’. Within this project a virtual reality based rehabilitation and training platform is developed. This platform allows patients and medical discharged people to perform physical exercise at home. The results are monitored by experts so they can customize the program for each patient. Fitrehab will be implemented within existing infrastructure of hospitals and assesses the benefits in terms of costs and performance.

Another project is called ‘Mnemosyne’. In this project an online-based platform for elderly patients with dementia syndrome, Alzheimer and their families is developed.

‘Robo MD’ is another example. This project is about the further development of a homecare robot that monitors and detects critical situations.

Innovation 4 Welfare is co-funded by the Interreg IVC Programme. The INTERREG IVC Programme is part of the European Territorial Cooperation Objective. It is an EU programme that helps regions of Europe work together to share their knowledge and experience. Launched in 2007, the programme will run until 2013.
Introduction

Across Europe, economic and demographic developments pose new challenges in health related issues: a general tendency to prioritize on health and safety, the strong increase in welfare related diseases and the increased need for (home) care for the ageing population are causing health care costs to increase rapidly. Innovative solutions are necessary to meet these challenges and to avoid health care becoming unaffordable. These challenges are also an opportunity: because of the scope of the public health issue, and the increasing need of products and services in this area, it is an attractive target area for developing innovative new technologies and applications.

In the Interreg IVC project Innovation 4 Welfare (I4W), six European partner regions exchange good practices, develop new innovation projects and influence regional policies by stimulating innovation in the field of health and safety (‘welfare’). In this way the project addresses EU policy objectives in two areas. First it increases competitiveness through innovation and transition to a knowledge-based economy. Second it stimulates the creation of new solutions in the field of health related issues.

Innovation 4 Welfare is co-funded by the Interreg IVC Programme. The INTERREG IVC Programme is part of the European Territorial Cooperation Objective. It is an EU programme that helps regions of Europe work together to share their knowledge and experience. Launched in 2007, the programme will run until 2013.

Cooperation and Exchanging Experiences

Innovation 4 Welfare brings together 51 policymakers, knowledge providers, economic and social intermediaries and health institutions, implementing projects and policies across six regions. These stakeholders share, exchange, transfer and implement good practices and renew the regional policy agenda’s. By means of interregional cooperation, Innovation 4 Welfare builds new coalitions of economic and social actors. In that way I4W becomes a European generator for new solutions promoting health and welfare.

The regions that work together in the Innovation 4 Welfare project are Catalonia (Spain), Lombardy (Italy), Noord-Brabant (Netherlands), South West Bohemia (Czech Republic), Upper Austria (Austria) and Tartu (Estonia).

Although the six regions have different experiences they also have a lot in common or at least have the challenge to work on issues in the following application fields:
• Services and products for special target groups (like elderly people);
• Accessibility, mobility and smart homes;
• Medical and home care systems;
• Safety and security.

In these application fields technical solutions within ICT, food- and biotechnology, advanced materials and design are being applied.

Methodology

Innovation 4 Welfare has developed a methodology to ensure a proper way of sharing, exchanging, transferring and implementation of good practices. This methodology is characterized by two stages. In the first stage project partners have defined a framework for good practice identification, implementation and transfer. It has been defined with help of regional seminars and site visits, involving regional key actors in innovation, health and safety policy. This stage has resulted in a practical guide for regional policy actions. The second stage is centered on exchanging good practices in eight collaborative subprojects. The second stage results in overall policy recommendations and an evaluation report.

Collaborative Subprojects

Innovation 4 Welfare is a mini-programme which focuses on eight interregional innovation subprojects dealing with the application fields and technology areas in teleservice, safety and security, benchmarking and food. The subprojects include new innovative ideas and/or the interregional implementation of regional best practices. Each project includes at least three organizations from at least 3 Innovation 4 Welfare partner regions.

Fifty-one stakeholders such as policymakers, knowledge providers, economic and social intermediaries and health institutions collaborate in the subprojects. Participants are technology centers, universities, polytechnics, development agencies, hospitals, local authorities, etc. Since one of the objectives of Innovation 4 Welfare is stimulating business development in the participating regions, the subprojects cooperate with regional Small and Medium sized Enterprises (SMEs), who also benefit from the project results.

Fitrehab

A practical example of a collaborative project is ‘Fitrehab’. Within this project a virtual reality based rehabilitation and training platform is developed. This platform allows patients and medical discharged people to perform physical exercise at home. The results are monitored by experts so
they can customize the program for each patient. Fitrehab will be implemented within existing infrastructure of hospitals and assesses the benefits in terms of costs and performance.

*Mnemosyne*

In this project an online-based platform for elderly patients with dementia syndrome, Alzheimer and their family is developed. The online-based platform provides innovative means of emotional and informational support for relatives and carers of Alzheimer and dementia patients. It also provides tools for the remote assistance and monitoring of the patients and educational appliances for cognitive stimulation. By conducting a pilot test, the validity of teleassistance home care services for remote therapeutic treatment of dementia and Alzheimer have been researched. The outcome gives partners the opportunity to draw a picture of the state-of-the-art of the sector and to identify the most pressing needs to be addressed.

*Fobos*

Fobos aims to address the improvement of the quality of life by developing and implementing a good practice for food borne pathogen early detection. Due to food-borne diseases people can develop life threatening diseases, especially infants and elderly people. Therefore a balanced team of three university research groups and five private companies blend to analyze, implement and transfer a DNA-based protocol. At first the protocol is customized to food-born detection and to several kinds of food matrices, including milk, cheese and meat. In the second phase, the procedure is implemented in an industrial context. After validation of the protocol, it is transferred to the agro-food and meal distribution companies, as well as to other relevant and interested stakeholders. They can implement it in their Hazard Analyses and Critical Control Points (HACCP) and other food-chain critical points.

*HaS Passport*

HaS Passport aims to stimulate innovation in regional health and social services, especially in rural areas. For regional services a ‘passport’ is created in order to organize exchange of experience and to create a good practice book.

*MRH*

Mechatronics based Rehabilitation at Home develops a ‘white book’ on the different aspects of rehabilitation at home based on mechatronics. The input for this white book is obtained by consultation and by own research, and will be made available for regional policymakers, companies and authorities providing health and social care. The project focuses on present
developments in rehabilitation, success factors of a MRH application, business opportunities, design and developments and steps to be taken to make MRH applications a success. Five pilot applications have been developed to demonstrate the results of the studies.

*Pickfiber*

Pickfiber is an international platform of experts on the development, testing and data managing of novel food components based on ecological/organic fibers with specific properties to fight obesity and associated conditions. The project has produced a reference scientific handbook for the scientific advisors of the European Safety Food Authority and innovative agro-food companies.

*Robo MD*

This project is about the further development of a homecare robot that monitors and detects critical situations. The robot is to be used by elderly people or people with cardiovascular diseases. The main objectives of the project are to increase patients’ services via wireless ICT technology, to offer a service tool to beneficiaries and to help to decrease the cost of regional home care systems.

*Tiam*

The Tiam project develops a toolkit to prevent work-related musculoskeletal disorders. The toolkit contains guidelines, information on processes, checklists and templates for the purpose of hazard identification and risk assessment of work-related musculoskeletal disorders and injuries. Combined with the toolkit guidelines, the use of templates will ensure that a procedure is complete and that key activities in the process are completed correctly.

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National Strategy on Telehealth for Slovenia – One Year Progress in Preparation of the Foundations

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Abstract: Endeavours for preparation of a foundation document for a national strategy on telehealth in Slovenia are presented. An initiative to prepare it was taken by the Slovenian Medical Informatics Association. The process of its preparation is slow due to the complexity of the task and several interactions among experts in related fields. The document is to be completed in mid-2012 and should complement the national “eHealth 2015” strategy that is to be prepared by the Slovenian government. In this paper, steps towards the completion of the task are presented and open dilemmas discussed.

Introduction

Slovenia has been implementing its “eHealth 2010” strategy through projects targeting mainly business-to-business services in healthcare. Within that strategy some telemedicine pilot projects were planned but there was no systematic support for a steered development and implementation of telehealth services. For this reason a national strategy on telehealth (telemedicine) that would be a part of the national eHealth strategy is needed. To facilitate the process of telehealth strategy preparation, the Slovenian Medical Informatics Association - SIMIA (a member of ISfTeH) mandated a group of experts (the authors of this paper) to prepare a document that should serve as a foundation document.

There is limited literature that covers national strategies relating to telehealth. So preparation of the foundation document represents a challenge to the authors. However, the American Telemedicine Association keeps an on-line living document on home telehealth policy [1]. Elsewhere, there are regional strategies available [2-3] that have been valuable at the initial stage of our document preparation. Many strategies are parts of broader eHealth strategies; consequently telehealth issues are only briefly elaborated. Some countries have developed their “telemedicine” strategies e.g. Malaysia [4]. And although the scope of telemedicine, according to our understandings, is much narrower than the scope of telehealth (see Fig.1) [5], the Malaysian strategy presents telemedicine in a broader view, so the document represents, in fact, a telehealth strategy. A “telemedicine rocket”, an organisational model proposed in that document (see Fig. 2), enabled us
to design our own framework. Policies, legislation and standards are driving engines for the system. The services organisation, processes within them, people and finances are the fuel - pushing forward services, applications, tools and technologies that are linked by networks. The goals fit within a clearly expressed vision.

Fig. 2 presents a model of home telehealth services based on the B2P (business to patient) relationship. Within different telehealth services same information and communication tasks are performed: data, text or audio/video contents are transmitted or more complex tasks performed (e.g. remote control of medical device). Therefore such services have similar technological requirements and could use the same communication platform.

To run the services, their environment has to be well organised and functioning. As well as having adequate strategies, the political climate should be favourable. Potential service providers should be ready, sufficiently resourced and have appropriate governance frameworks.
Their perspectives must be ethically sound and demonstrate an understanding of and be responsive to service user (patient) perspectives. To support strategy implementation, there must also be educational and training support together with a commitment to promote and share the knowledge and experience gained.

Structure of the Telehealth Strategy Foundation Document

After an intensive literature review and discussion among the members of the preparation group, the foundation document was structured as follows:

1. Description of the approach to the strategy
2. Slovenia and its health policies:
   - Objectives of the Slovenian health policy, characteristics, trends and challenges;
   - New demands and challenges for health, especially those in favour of introducing telehealth services.
3. Telehealth services basics and concepts:
   - Scope, definition;
   - Service models;
   - Stakeholders in telehealth services;
   - Technological concepts and solutions.
4. State of the art in telehealth in Slovenia and other European countries:
   - Existing telehealth services, solutions and initiatives;
   - Existing reimbursement practices (USA, Europe);
   - Obstacles to the development of telehealth services;

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   - Existing telehealth services, solutions and initiatives;
   - Existing reimbursement practices (USA, Europe);
   - Obstacles to the development of telehealth services;
5. Analysis of the existing national strategic documents on healthcare and eHealth in relation to potential telehealth services.

6. Adaptation of the healthcare system:
   • New models of services and redesign of processes in healthcare;
   • People (culture, education, competence, promotion, skills);
   • Financing;
   • The European and the national legislation in eHealth, telemedicine and telehealth;
   • Management of the ethical issues in telehealth services;
   • Standards.

7. Telehealth deployment strategy:
   • Deployment model (management functions and structure, change management, success factors);
   • Processes in dynamic planning of services (concept of pilot applications, implementation techniques);
   • Barriers and accelerators to the development;
   • Dissemination of experiences gained from pilots;
   • Sustainable reimbursement models for the Slovenian healthcare system.

7. Re-design of the healthcare system with telehealth services incorporated.

An initial outcome of work for the foundation document is in the definitions adopted for the key terms: telehealth, telemedicine and telecare. These definitions were agreed and submitted to the Ministry of Health of Slovenia to be added to a national dictionary of health informatics.

Plans for Further Actions

The draft of the foundation document for the strategy is to be ready for a professional debate on a national level by mid-2012. The document will then be passed to the Ministry of Health of Slovenia for further elaboration. The strategy should complement the national “eHealth 2015” strategy that is to be prepared by the Slovenian government.

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References

Drugo Rudel has 20 years of experiences bringing innovative solutions to people with disabilities particularly elderly people living at home His activities include aspects such as establishing telecare networks to provide telecare services, system integration and implementation of new technological solutions. Dr, Rudel is The Slovenian Medical Informatics Association (SIMIA) board member since 2000.
Telemedicine Network Used For Team Building
Contributes To Improve Case Management in the
Remote Areas of Mongolia

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Abstract: Huge distances, poor infrastructure, harsh climate, and a
technology and skill gap between central and provincial levels imposed
telemedicine to develop health services in Mongolia.
The Dornod province being 656 km away from the capital city was a
prime candidate to join the telemedicine network.
During the project, besides the installation of the telemedicine network,
considerable efforts in training and constant stimulation of the staff
were made to keep a team spirit alive.
These efforts contributed to the improvement of the medical services at
the periphery and to the stability of the staffs in the periphery of the
telemedicine network.

Introduction

Mongolia is a landlocked country located between Russia and China.
Distances are considerable (total area 1.56 million km²) with an average
population density as low as 1.76/km² for a total population of ~2.7 million.
As more than a third of the total population leaves in or around the capital
city Ulaanbaatar (UB), the distant areas are often below this average. The
provincial hospitals therefore serve a large territory with sparse population.
Poor infrastructure, harsh climate with temperature ranging from +40°C
during a short summer down to -40°C during a long winter make
communications difficult. A gap in technology and skills of the medical
services between the central and the provincial levels further increase the
feeling of isolation among the physicians of the most remote areas.
In this context, they have to deal with a considerable number of cases of
cardiovascular diseases, which constitute a major public health concern in
Mongolia with a prevalence of 23.6 per 10,000 and which are the first cause
of mortality.
The Center for Cardiovascular Diseases project supported by the Grand Duchy of Luxembourg, among several possibilities, was designed as a “virtual” centre made of a network with a head node in a teaching hospital in the capital city. Initiated in 2001, it was the first telemedicine project in the country. It connected together 6, and eventually 8, of the 21 provinces, including the two far most ones, plus the capital city, thus covering nearly 75% of the population.

Dornod is the most distant province eastward, 656 km away from the Capital city; it can be reached from UB in 12 hours overland. The prevalence of cardiovascular diseases in this province was 18.97 per 10,000 population in 2010.

The Dornod province joined the project in 2002. The province hospital at that time neither had specialized cardiologists, nor was there any experience in cardiac ultrasonography, and the connection to the Internet was very limited. These conditions designated this province as a potential prime beneficiary of breaking isolation by connection to a network.

Activities

The leading principles of the project were to meet the expressed needs of the distant physicians, not to make them comply with central requirements; to listen to the periphery, not to talk from the centre; to give the means to learn, not to teach. All efforts were geared at favouring appropriation and to build a team among professionals working thousands of kilometres apart. Being designed with them and for them, the project was left in their hands and managed by one of their peer.

The operation mode was built on a dedicated website allowing exchange of data/images for advice between provinces and center, and between provinces as skill improved. In other sections of the website, the physicians can find algorithms on the case management of the most common cardiovascular diseases. At each of the key decision points, explanation can be found from attached self-learning material. The acquisition of knowledge is checked on a voluntary basis through the website on specific sessions, the incentive being the acquisition of credits necessary to renew the doctors’ licenses.

A web-based simple medical record was developed. It is designed to facilitate quick entry of the patients’ medical records, and to easily extract and upload anonymous data, including echocardiography images and ECG, when advice is sought from the network through the website.

As this project started with very rudimentary means and was the first of that kind, the physicians realized they were breaking new grounds and they began behave like a team.
A team cannot remain virtual. Considerable effort was made with constant stimulation of the staff to keep the “team spirit” alive. Several means were utilized to bring the provincial staff together and meet in UB. Formal lectures and hands-on training were held in common sessions in UB. The project staff, doctors and nurses, was sent abroad by groups of 2 to 4 from different areas for training and study tours. A National Cardiovascular Conference is organized annually in June, which gives some regional visibility, and a Winter Annual meeting is meant to address operational issues. These meeting are felt as important for the doctors as the modern equipment brought by the project.

Results

There is no robust and objective indicator measuring the motivation and the professional satisfaction of the staff. We observed that, in this project, only one physician left her duty station in 10 years and that there was no disruption of service in any place. By comparison with other projects dealing with professionals posted in remote and isolated places, we believe it is significant. Also, there is a continuously growing demand for the introduction of new technologies in the provinces, for training, and for exposure to other professional environments. Holters for continuous monitoring of blood pressure or for arrhythmia were recently introduced at the request of the provincial doctors.

A new, more convenient, medical software was developed 30 months ago. Since then, 439 calls for advice were posted (54.87 per province) that generated a total of 1135 answers, 464 coming from the center and 671 from the provinces, that is an average peer to peer assistance of 83.87 advices per province.

In the meantime the Dornod province issued 71 requests for advice and answered 129 messages, thus demonstrating a need for assistance and a high commitment to contribute to the network.

With consideration to the project objectives, unnecessary referrals (that is referrals for investigations or treatment that could be provided locally) continuously decreased from 60.7% to 39.2% during last three years in the Dornod province.

Case management also improved in the province. Before the installation of the network, standardized treatment protocols following modern guidelines were hardly known and practically never implemented. By the end of 2011, 59% of the patients are treated according to established guidelines.

Screening for early detection of diseases resulted from awareness being raised through the network, and was made feasible with the equipment
provided by the project. As an indicator, the detection of hypertension in its early stage raised from 52% to 67% of the cases.

Conclusion

Telemedicine should not be limited to the distant control of medical acts or procedures. Providing the physicians with means of communication with equal access from anyone point of the network induces the building of a team spirit, which highly contributes to the stability of the staff and to the continuity of service.

Telemedicine should be geared at the satisfaction of the needs of the physicians as much as it contributes to the security of the patients and to the accessibility to health care. The network then becomes a routine tool frequently utilized and cost efficient with consideration to the initial investment it represents.

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The “Canadian e-Health for Haiti” Initiative

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Abstract: On 7th January 2010 the worst earthquake in the Hispaniola region for over 200 years struck Haiti. There was an immediate global response that is now fading despite continued need. This need includes Haiti’s health system, which was in crisis even before the earthquake. The growing use of Information and Communication Technologies (ICTs) in the health sector - referred to as e-Health - is driving change in access to health and to delivery of health services. e-Health offers Haiti the means to support urban, rural, and remote communities and healthcare providers with distance education, information, and clinical service capabilities. Combining Canada’s extensive experience and expertise with e-health implementation could ease the path, but given pre-existing health and e-health related activity in Haiti - where and how should Canada help?

A partnership between Health Canada, the Pan American Health Organisation (PAHO), and Haiti’s Ministère de la Santé Publique et de la Population (MSPP), explored this issue. A situational assessment and high level action forum have identified 5 areas where Canada might help Haiti: 1. e-Health Strategy Development; 2. Infrastructure and Infostructure development; 3. Capacity Building (e-Learning) Capability; 4. Service Provision; and 5. Health Surveillance.

Introduction

The 2010 earthquake caused dramatic loss of life, immediate and extensive homelessness, and profound damage to infrastructure, including the already struggling healthcare system. In the aftermath of the earthquake it quickly became apparent that Haiti would require massive and long term international assistance to help the country, its people, and its healthcare system recover. At the same time the massive destruction opened the opportunity to not just reconstruct the health system as it was, but instead to move Haitian health and healthcare forward through introduction of innovative solutions. One option is the use of e-Health (the application of Information and Communications Technology (ICT) to the health and healthcare sectors) to support urban as well as rural and remote communities and healthcare providers.
Health Canada, in partnership with the Pan American Health Organisation (PAHO) and Haiti’s Ministère de la Santé Publique et de la Population (MSPP), has explored options. Three circumstances led to this approach. First, Haiti acknowledged that it required greater capacity to understand its strategic, technical, human resource, service provision, and operational e-Health needs, especially in rural and remote locations. Second, in 2011 PAHO renewed its commitment to e-health regionally (‘Strategy and Plan of Action on e-Health’ (CD51/13) [1]). Third, Canada has considerable e-Health experience and expertise to offer, particularly in response to the needs of rural and remote locations. Given the significant health related interventions by NGOs, governments, and other entities already taking place in Haiti, the partners had to first determine where and how Canada might best help. The Office of Global e-Health Strategy at the University of Calgary was contracted to assist with the ‘Canadian e-Health for Haiti’ Initiative (CeHHI).

Methods

A ‘Situational Assessment’ (literature review; telephone-based key informant interviews (KII)) was performed to provide insight regarding entities in Haiti who might be using e-Health, and for which specific purposes. A total of 273 stakeholders were identified and contacted (via e-mail, website message board, or telephone), and of these 32 accepted and booked an interview. Additional insight was gained from an interview with a telecommunications company representative located in Haiti, and through participating in and listening to perspectives provided at a meeting of the Association des Médicins Haitiens à l’Étranger (AMHE; or Association of Haitian Physicians Abroad) in Washington, DC.

Subsequently a High Level Action Forum (HLAF) brought together 20 participants in Ottawa, Canada (4-5 November 2011). This included the partners and a broad spectrum of ‘high-level’ representatives of the Canadian e-health and health communities to discuss the findings. Their goal was to determine how Canada could contribute to filling some of the identified gaps/needs for e-Health solutions in Haiti.

Findings

The situational assessment highlighted several issues: Despite efforts to register and coordinate, there are many, many NGOs operating in Haiti with no synergy or common goals (most typically work independently and with little or no accountability); there remains a significant lack of Health Human Resources (HHR; in terms of initial training, ongoing maintenance of competence and skill building, and in support of practitioners in rural and
remote locations); and although improving, there remains poor infrastructure and infostructure (public and private). Of note was recognition that Haiti could not wait for the healthcare system to be strengthened before introducing e-health, rather these activities had to go hand-in-hand; i.e. e-health is viewed as a tool by which to support the process of health system strengthening. This would necessitate a clear e-health strategy to complement current and planned health initiatives.

A series of 5 thematic areas emerged that identify where Canada can best serve Haiti’s needs through providing e-health related support:

1. **e-Health Strategy Development**

Growing expectations, changing demographics, resource limitations, and high cost of some solutions requires wise investment in “technologically appropriate and culturally sensitive” e-health solutions that address major health needs, and establish an understanding of the practice, policy, and technology infrastructure required for decades to come. Sustainable e-health solutions require development of a sound, evidence-based, and defensible e-health strategy [2, 3]. Absent, poor or vague e-health strategy is a significant barrier to effective implementation of sustainable e-health solutions.

2. **Infrastructure and Infostructure development**

The situational assessment noted that without adequate ‘infrastructure’ (i.e. sufficient Human Health Resources (HHR), and a functional health system), adding e-health solutions into the milieu may not resolve anything. Indeed, it may simply cause confusion, create a larger “digital divide” and represent poor investment. There is the need to “build the capacity, to build the capacity” [4]. An efficient and cost-effective model is required that allows training and upgrading of knowledge and skills in situ (avoiding loss of services during training).

Furthermore, without ‘infostructure’ (i.e. a functional and reliable ICT environment within the public and private sectors) e-health solutions would not be able to function reliably. Telecommunications infostructure in Haiti has been summarized as “among the least developed in LAC, with domestic capabilities being barely adequate, and international capabilities only slightly better” [5]. Clear evidence of planned and adequate development is needed.

3. **Capacity Building (e-Learning) Capability**

Once trained, ongoing Continuing Professional Development (CPD) and/or Maintenance of Competence (MOC) is necessary. Two aspects are of relevance here: i) the need for ongoing CPD / MOC of healthcare providers
(HCPs) to upgrade or maintain their clinical knowledge and skills; and ii) the need to ensure all those in the healthcare system (HCPs, managers, ICT professionals, and policy- and decision-makers) are able to upgrade or maintain their e-health knowledge and skills. The distributed e-Learning capabilities of e-Health can be leveraged to address both needs.

4. Service Provision

It is acknowledged that the maldistribution and low number of HCPs has led to reduced service capability in rural and remote locations. The post earthquake influx of people from urban to rural regions, combined with loss of hospitals and clinics, has exacerbated the ability to provide access to even basic, quality healthcare services in rural and remote areas. Facilitating service capability through telehealth (virtual clinics; second opinion consultations; specialist access) would enhance provision of health care in these locations.

5. Health Surveillance

Health Information System (HIS) applications to gather, collate, analyze, and disseminate data and knowledge to central and rural / remote health system and HCPs remains a necessary element in all parts of Haiti. This includes HIS within institutions, but in particular on a national scale for health surveillance needs. Horizontal solutions for specific diseases (cholera, HIV) have been implemented, but a lack of efficient and bi-directional sharing of epidemiological data between rural/remote locations and the MSPP still exists. Such insight could provide public health intelligence for the central MSPP but also, when fed back to rural and remote sites, could inform, encourage, and guide them to take swift action as and when needed.

Discussion

Each of the 5 thematic areas requires identification of clear and tangible goals, and specific outcomes, in order to provide a means of evaluating success. This could be achieved through two levels of consultation with Haiti. First, broad consultations (e.g. during development of the e-Health Strategy for Haiti) to ensure the e-Health Strategy matches high priority health needs with only viable e-health solutions are adopted. Second, more focused consultations with key stakeholders from the Haitian Ministries of Health and Education, Haitian communications service providers, PAHO, selected NGOs working in Haiti, and Canadian stakeholders with practical e-Health experience and technical e-Health expertise to establish an e-Health Strategy implementation plan.
Recommendations

Based upon the findings, the following recommendations were made to ensure success of the Canadian e-Health for Haiti Initiative.

• Awareness and Advocacy. Action: Disseminate findings broadly, and engage in meetings with agencies to advocate for their support and involvement.

• Leadership. Action: Establish a strong, committed, tri-lateral leadership group to guide the initiative to successful completion – design, funding, implementation, and evaluation of evidence- and needs-based Canadian e-Health solutions in Haiti.

• Site visits to Haiti. Action: Meet with MSPP and other Government officials, local PAHO personnel, TelCo’s, and NGOs to undertake broad and focused consultations during 2012.

• e-Health Strategy Development. Action: Develop a country-specific e-Health Strategy for Haiti that aligns with and informs PAHOs ‘Strategy and Plan of Action on e-Health’ (CD51/13) for the Region.

• Small Project Initiatives. Action: Identify and mobilize small project development activities (e.g. exchange of process and policy documents).

• CeHHI Program Proposal. Action: Identify funding for the design phase of a Program for evidence- and needs-based Canadian e-Health solutions in Haiti.

Conclusion

A set of evidence-based, specific, and actionable recommendations have been developed. Together, these will ensure successful completion of the fundamental goal: To use e-health and Canadian experience and expertise in a meaningful manner to support the health of Haiti’s population and development of Haiti’s health system, as well as to contribute insight and lessons learnt of value to PAHOs ‘Strategy and Plan of Action on e-Health’ (CD51/13).

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Dr. Richard E. Scott is Director, Office of Global e-Health Strategy, and an Associate Professor in the Departments of Community Health Sciences and Family Medicine, University of Calgary, as well as Director, NT Consulting. Richard focuses his interests on examining the role of e-health in the globalisation of healthcare, including aspects impacting the implementation, integration, and sustainability of e-health globally and locally (termed ‘glocal’ e-health).
The Child and Adolescent Telemedicine Outreach Service (CAPTOS) Story:

15 Years of Rural Professionals’ Capacity Building Through Video Conferencing

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The CAPTOS story began in 1992 when a joint child protection, radiology and paediatric education project gave a glimpse of the possibility of a video conference service to Rural and Remote centres. Australia is a very large country with relatively small population in rural areas. Whilst rural areas appear idyllic in films and from airline windows, the incidence of mental health difficulties for children, young people and adults is rising. The long distances and small size of service towns means that establishing and maintaining primary and secondary services is very difficult. Access to tertiary consultation is impossible!

In 1996, a government Department of Health in collaboration with the Australian Federal Government Health Department funded a small project to provide telepsychiatry consultations to two remote towns. This was later to involve expansion to nine major rural centres and about twelve smaller centres. The goal of the supplementary and tertiary consultation was the assessment and management of serious mental illness, neuropsychiatric disorders and provision of psychopharmacology assistance.

An evaluation of the pilot project demonstrated high levels of satisfaction from rural clinicians and families [1, 2, 3]. It was also concluded that CAPTOS had provided a cheap, efficient and highly valued service that enhances rural mental health services and enables a service to young people from disadvantaged or deprived circumstances for the rural clinician to ask questions and to watch the modelling of assessment treatment and formulation processes provided by the psychiatrists. Allied health staff provides clinical supervision or consultation although they may also provide direct clinical services at times. Medical and Psychiatry staff also provide teaching, consultation and supervision sessions. The CAPTOS model is based in relationships that are established between rural and city hospital
clinicians. Rural site visits occur regularly and some rural clinicians also visit the hospital for placements, providing opportunity to interact with a broader range of colleagues with a different set of skills. Such interactions reduce isolation and increases creative options for skills and knowledge development. In essence, CAPTOS teleconferencing offers the opportunity to amplify existing expertise. One important goal of all CAPTOS services is to increase confidence and competence.

Some thoughts about how this has been a sustained process.

Any service that is incorporated into another requires champions to keep it going. There have been significant changes, restructures, staff changes, technological developments and structural changes in the past fifteen years. Regular evaluations and research activities have helped to inform collaborative service development [5].

Additional CAPTOS programmes included a partnership with several area services to provide specialist assistance to Aboriginal Mental Health clinicians [6] and regular Family Therapy training onsite seminars followed by video based supervision, consultation and skills based assistance. This Family Therapy model was also applied to a specialist eating disorder training program.

Site visits have included interactions with school counsellors, paediatricians, general practitioners, adult mental health staff, sexual assault, and community health and child protection staff. This “community development” activity is highly valued by participants. In 2010, the developments in technology at CHW, increased access to video conferencing equipment, and has allowed further development of educational activities. Favourite topics have included Obesity and children and young people, Counter Transference and Psychological Services; Therapy with Complex Cases; Understanding formulation: Attachment issues in Child and Adolescent Mental Health treatment: Intellectual Disability; Autism Spectrum interventions, and Pharmacology and Children. CAPTOS has provided resources to clinicians including library resources, reference materials, specialist information and specialist assessment.

An early morning Trauma Think Tank is an example of this specialist process. Video and audio material is part of a CAPTOS journal club type activity. Clinicians at the Children’s Hospital join clinicians from four different sites around the state every second Wednesday. Additional sessions offer case consultations, live presentations by specialists, group consultation sessions using reflective teams across two or three sites. These tertiary activities seek to both enhance knowledge and skills and increase
confidence by confirming that the rural and remote clinicians indeed have the skills and are “on the right track”. For isolated clinicians these sessions serve as an alternative to “corridor conversations”. A confidential electronic survey in 2011 – 2012 gave very strong feedback about the value of this service.

Technology
Initial technology for the telemedicine was part of the pilot project. Over the past 15 years there has been significant change to the technology map. The telemedicine machines have increased in quantity and quality and are funded by government. It has also meant technical challenges, with new “gateways” not “talking to each other” and technology staff struggling to keep up with new demands for multisite links across area health services.

Despite these challenges with change and development in many levels, CAPTOS has continued to provide the main Child and Family Psychiatry telemedicine services throughout the state. Links have been made with Toronto Sick Kids Telepsychiatry program and ideas were shared about use of the links between a large, specialist based Children’s Hospital and rural and remote clinicians. We have sought to identify the challenges and issues for staff and evaluated whether the Children’s Hospital clinicians, medical and non-medical, can assist.

A 2003 presentation by author two notes that CAPTOS was then achieving the following goals:

- CHW has expanded its clinical walls to include an important group of clinicians throughout NSW.
- We are developing clinicians who are more flexible, less office bound and more ready to address the needs of the most seriously mentally ill children.
- Clinicians at CHW are becoming increasingly aware of the special needs and skills of clinicians in regional areas.

The philosophy in these statements is now embedded in the practises of medical and non-medical staff. In the past week one rural team, 800km away from a major hospital was able to consider ways of working with young people with Asperger’s Syndrome who are also struggling with depression and social anxiety. Another service who are struggling following the loss of a local Child and Family psychiatrist were supported to negotiate with local adult psychiatrist and CHW staff to ensure that children in crisis are able to access specialist services in a timely fashion. CAPTOS has managed to grow and develop and change through ongoing consultation, collaboration and service evaluation. Both the rural and the hospital clinicians benefit from the interactions. All the authors are very
committed to the CAPTOS service. They have been champions of the responsibility of this funded city service to remain responsive to the needs, wishes and resource gaps of our rural colleagues.

Thank you to all who contribute to the ongoing capacity development project.

References


Sue Foley is a senior Social Worker and Telepsychiatry Coordinator at the Children’s Hospital at Westmead in Sydney Australia. She is a member of the Council of The International Society for the Prevention of Child Abuse and Neglect (ISPCAN) and is pursuing doctoral studies through The University of Technology, Sydney in the area of Social Workers as Educators.
The Experience of Developing an Electronic Advance Care Plan for Residents of Aged Care Facilities in Australia

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Background

In 2011 the Australian Government, through the Department of Health and Ageing (DoHA) announced the anticipated implementation of a national Personally Controlled Electronic Health Record (PCEHR) system, due to go ‘live’ in 2012. Acknowledging difficulties that other countries have experienced in implementing similar national electronic health records in the past, ‘wave sites’ around Australia, such as the Cradle Coast in Tasmania, were selected to work towards providing evidence-based information as a means to supporting the National eHealth Strategy and inform the design, build and rollout of the PCEHR system.

For our role in the national project, the Cradle Coast was tasked with developing an electronic shared record including an Advance Care Plan (eACP) in conjunction with implementing a framework of care and a training program to support uptake, across five Residential Aged Care Facilities (RACFs) encompassing 500 residents in the North West of Tasmania, Australia. One of the key responsibilities of this project was to identify potential benefits, barriers and lessons learned to inform other sites and the broader PCEHR Program.

Advance Care Plans (ACPs) were introduced in aged care facilities in Australia in 1993 [1]. There is general consensus that an ACP is a ‘process’ involving ongoing communication between patients, caregivers and their family members that involves medical history, likely prognosis, values and preferences [1 -6].

ACPs are considered to be very positive for older people, their family members and the community in general [7]. The process and existence of
ACPs can reduce patient depression and anxiety, reduce patients’ length of stay in hospital Intensive Care Units (ICUs) and improve the quality of a person’s death [8-9]. But despite enthusiastic promotion in Australia, as well as other countries such as Canada and the USA, uptake of ACPs has been slow [1, 3]. Remedies to this situation have been found in the facilitation of closer working relationships, including communication pathways and improved documentation, between RACFs and Emergency Departments [10, 11]. It is anticipated that the eACP, with multidisciplinary access, will bridge the divide between the RACFs, Emergency Departments and GPs to deliver all the expected benefits that ACPs have promised to patients, families and the community.

The development of an eACP for RACFs at the Cradle Coast in Tasmania is a complex task that needs to combine lessons learned from local and international experiences in implementing both a multidisciplinary electronic health record as well as an ACP in RACFs. The desktop analysis of documents developed and actions undertaken to date was considered in light of best practice evidence for the development of an electronic health record and best practice in ACP implementation.

In November of 2011 the Australian Health Minister endorsed the use of the ‘Electronic Medication Management (EMM) System: A Guide to Safe Implementation’ (System Guide) for use when implementing electronic medication management systems in Australian hospitals. The guide has been validated by the Australian Commission on Safety and Quality in Health Care for use in hospitals and provides a framework for best practice in electronic health record development and implementation. The System Guide notes the complexity of introducing an electronic system and the need for extensive planning, scoping, development and implementation strategies for success to be realised. The System Guide encapsulates five sequential stages: Project Initiation; Implementation Planning; System Build and Configuration; Implementation and Go-Live Activities; and Ongoing Operations.

The System Guide was designed specifically for the implementation of electronic medication records; we examined the process using the recommendations from a project undertaken in 2001 in Australia involving the successful implementation of paper Advance Care Planning program with a number of RACFs in New South Wales (NSW) [1]. Universal satisfaction of all stakeholders involved with the use of the ACP and high uptake of the plans lends credibility to the approach undertaken in that project.
Methods

Using the System Guide as a framework, the Development Matrix was created and populated with the suggested key documents/actions (see Table 1). A desktop analysis of documentation that was available (some access restricted for legal or commercial reasons) concerned with the eACP project such as scoping, preparation, governance, implementation, system build and implementation planning, was plotted against the System Guide sequential stages in a Development Matrix.

Table 1: Key Documents/Actions needed for each Stage

<table>
<thead>
<tr>
<th>Stage</th>
<th>Key Documents/Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: Project Initiation</td>
<td>Key influencers involved; Scoping studies completed; Organisational structure in place; Governance framework; Qualified Project Manager; Tendering – process/evaluation; Contract Management Plan; Contract management/monitoring</td>
</tr>
<tr>
<td>Stage 2: Implementation Planning</td>
<td>Implementation Plan; Current State Process Map; Future State Process Map; Implementation Map; Change Management Plan; Quality Management; Baseline Indicators Audit; Evaluation Plan; Benefits Register; Training Plan; Project Communication Plan</td>
</tr>
<tr>
<td>Stage 3: System Build</td>
<td>Design Diagram; System Validation; Identify/Establish Technical Environments; Testing Schedule; Clear run of User and Technical (UAT) Testing and sign off; Inclusion of key software functions ie patient information displayed on each screen; alerts for same name patients; user logs; incorporation of policies/protocols on ACPs.; Adherence to state/national/international standards on web pages; user ID; archiving; and information standards; eHealth interoperability and System Support Integration</td>
</tr>
<tr>
<td>Stage 4: Implementation</td>
<td>Implementation Checklist; Established Project ‘Go Live’ Centre; ‘Go live’ Plan; Escalation Plan; Rollback and Project Suspension Strategy; Project Team Exit Strategy; eCAP Ongoing Support Strategy; Business Continuity Strategy; Offline Access to all eACPs Plan</td>
</tr>
<tr>
<td>Stage 5: Ongoing Operations</td>
<td>Tools to Manage Risks and Failure; Log of Failures; New User Information and Training; Refresher Training Schedule</td>
</tr>
</tbody>
</table>

Details on the contents of each of the documents required or the actions needed to be undertaken, according to the System Guide were recorded. Corresponding working documents, taken from the Project were then examined for detail and matched, where possible, to the required documents/actions.
Findings

Although the model proposed by the System Guide suggests independent and discrete ‘stages’ undertaken sequentially, documentary evidence from the Project demonstrates that, in fact, these stages and their documents/actions often overlapped and were often undertaken out of the given sequence. Support for the actions/documents proposed in the System Guide was found, however, as the Project documentation contained most of the suggested documents and their inclusions (although named differently) and followed the same approximate timing of the given stages.

The key finding that emerged from this study was evidence of a ‘top down’ style of approach and management that appears to have been in place at the outset. A top down driven approach involves directives and information being passed down an established hierarchy and often, minimal or controlled input and access to information for stakeholders or proposed users of the project.

Recently, research conducted on the ‘early adopter’ hospitals and specialist care settings in the UK on the failed implementation of the national electronic health record found that a ‘top down’ approach was instrumental in undermining the project. One example of a ‘top down’ approach in this Project was identified in the ‘Project Initiation Stage’. The System Guide lists the development of a ‘Procurement Plan’ as a key document during this stage.

There was no development of a Procurement Plan. The government agency responsible for the electronic infrastructure in the state undertook a tendering process for their Electronic Medical Records. As the eACP needed to integrate with this, the same system vendor was used. Thus there was no specific tendering process for the eACP.

Moving through the stages to date there has been a number of instances of data gathering and resultant reports created on stakeholder needs and their opinions on first releases of the eACP program. For example, although General Practitioners (GPs) and RACFs provided information for the Stakeholder Consultation Report they were not named on the distribution list for the report.

In 2001 an Advance Care Planning (ACP) service was successfully introduced to a number of RACFs in New South Wales, Australia. The ‘grass roots’ approach adopted by the ACP service embraced wide consultation and stakeholder inclusion and led to widespread acceptance and support for the ACP and the service [1]. Four key prerequisites for success were identified: involvement of the expertise of an experienced nurse (CNC); extensive discussion; ongoing education; and a
multidisciplinary team approach [7]. The National Rural Health Alliance, in a submission in October 2011 to DoHA regarding the introduction of the PCEHR in Australia also stressed the importance of being more inclusive ‘of the full multidisciplinary healthcare team’ [12]. The project employed an experienced nurse and has implemented an education program on the Gold Standards Framework in all participating RACFs. Whilst the project team does not include individuals from the ‘full multidisciplinary healthcare team’ it did contain a range of medical, nursing, allied health and IT professionals.

Conclusion

The purpose of this paper was to analyse the documented process of the development of an eACP. Documents and actions were compared to a ‘best practice’ model in the implementation of an electronic record and second model regarding ACPs in RACFs. Despite no knowledge of the System Guide, the project was generally consistent with its suggested processes.

Evidence of a ‘top down’ approach may largely be attributed to State and Commonwealth government approaches to procurement as well as issues inherent to attempting to introduce new ways of working in deeply ingrained hierarchical systems, are possible explanations.

Finally, the System Guide implies that their five stages are distinct and sequential. This limited desktop analysis, undertaken only part way into the project, demonstrates that this is unlikely to occur in practice, and is at risk of imposing an impractical artificial framework on projects.

Acknowledgment

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References


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Telecardiology
A Device for Separation of Heart Sound from Respiratory Sound Using Lab-View during Auscultation

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Abstract: In a conventional stethoscope, during auscultation, a physician hears both heart and lung sounds simultaneously. Generally it is found that Heart sounds interfere with lung sounds, which hampers accurate interpretation of respiratory sound for appropriate diagnosis of respiratory diseases. The objective of this paper is to identify the techniques for filtering heart sounds from lung-sound recordings to assists physicians to correctly interpret the respiratory sound. A systematic approach for recording and analysis of respiratory sound was used. Hardware that record respiratory sound and a VI for heart sound (HS) cancelation from the lung sound (LS) by using Advance Signal Processing Toolkit of Lab-View was developed.

Introduction

Auscultation, by conventional stethoscope, is one of the most important non-invasive and simple diagnostic tools for detecting disorders of respiratory tract [1-2]. Despite its effectiveness, auscultation by stethoscope, have some limitations like due to their inability to provide objective interpretation of the respiratory sounds and variable sensitivity of different stethoscope [3].

Respiratory sounds present noninvasive measures of lung airway conditions [6]. However, features of lung sounds may be contaminated by heart sounds because lung and heart sounds overlap in terms of time domain and spectral content [7]. Therefore, Heart Sound reduction from lung sounds without altering the main characteristic features of the lung sound has been of interest for many researchers [11]. Modern digital processing techniques and computer analysis may overcome human ear’s subjective interpretation of auscultation sounds.

With this background we undertook this study to develop techniques for filtering heart sounds from lung-sound recordings to assists physicians to
correctly interpret the respiratory sounds. In this experiment, we extract the respiratory sounds by filtering the heart sounds by using Multiple Frequency Resolution Analysis (MRA) technique by using lab view [4, 8, 10].

During auscultation, lung sounds propagate through the lung tissue and can be heard over the chest wall. The tissue acts as a frequency filter with special characteristics based on physiological and pathological changes. Lung sounds exhibit a Power Spectral Density (PSD) that is broadband with power decreasing as frequency increases [5]. The logarithm of amplitude and frequency are approximately linearly related in healthy subjects provided that the signals do not contain adventitious sounds.

Heart sounds produces an intrusive quasi-periodic interference sound that masks the clinical interpretation of lung sounds over the low frequency components. The main components of Heart Sounds (HS) are in the range 20–100 Hz, in which the lung sound has major Components. High Pass Filtering (HPF) techniques that used an arbitrary cut-off frequency between
70 and 100 Hz as well as linear adaptive filters are not efficient to filter heart sounds.

Proposed Methods for Heart Sound Cancellation

Lung sounds were acquired with a Piezoelectric Contact Accelerometer (Siemens EMT25C) and were digitized at 10240 Hz and 12 bits per sample .WAV format. We interface audio recording software with this to generate data base for the detail futuristic, comparative disease diagnosis system.

Heart sound localization was done by Multiresolution analysis of wavelet approximation coefficients. Three scales were used in wavelet decomposition with the fifth-order Symlet wavelet as the mother wavelet. The rationale for using this technique is different behaviour of signal and noise in the wavelet domain. Signal and noise have totally different behavior in the wavelet domain.

The DWT of the original lung sound record was obtained using the Symlet (order 5) wavelet, which is a compactly supported wavelet with least asymmetry and decomposing the signal into 3 levels. Then, the product of the wavelet coefficients was calculated. The cancellation of heart sounds is done by applying a thresholding technique.

Results

The devise was tested at Datta Meghe Institute of Medical Sciences. Six subjects were chosen for the experiments. The recording locations include top left, middle left, low left, top right, middle right, and low right of the front chest. Each collected signal with the length of 10 seconds was recorded to exam the reduction of heart sounds. It was observed that the reduction of heart sound was significant to assist the physician to
objectively interpret the lung sounds. The resultant wave form of heart and lung sound of one subject is presented in figure 3.

Conclusion

Using the proposed technique a convenient and effective heart sounds reduction was achieved. We propose the same technique to be used in electronic stethoscope that may facilitate the extraction and objective interpretation of the respiratory sounds.

References

A Public Telecardiology Network in Southern Brazil: Results of Phase II (1st Year)

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²The Medical Association of Sao Lourenço do Sul (SOMESUL), Brazil

Abstract: Addressing a shortage of cardiovascular assistance in remote and small towns, a digital Tele-ECG system was established in 4 public institutions, starting in the year 2000, in the State of Rio Grande do Sul (RS), Brazil. Motivated by the successful experience of the first decade, coordinated by the eHealth Centre of the ICFUC-RS, in 2008 the method was established in 11 more towns (Phase I) and, since 2011, the network is being expanded to a larger number of towns, now covering 30 locations (Phase II). Besides offering immediate Tele-ECG diagnosis the method allows medical counselling via videoconferencing facilities (second opinion) and a telecardiology training program.

Introduction

In recent years, thanks to the accelerated development of information and communication technologies (I.C.T.), e-Health has emerged as an important tool for medical assistance in general. Heart diseases, mainly coronary heart diseases, are the most common causes of death in many countries [1]. Telecardiology - due to its importance - causes significant impact when implemented in remote and underserved regions. Timely assistance of acute cardiac urgencies like S-T Elevation Myocardial Infarction (STEMI) should be based on the implementation of an emergency medical system (EMS) [2].

Rio Grande do Sul (RS) is the southern Brazilian state, with a population of 11 million inhabitants living in 496 cities. 396 villages (79,8%) are quite small, having a population of less than 20,000 inhabitants. Addressing the lack of cardiology assistance in remote areas, a pioneer regional Tele-ECG project was implemented in the region of São Lourenço do Sul in 2000, which includes 3 hospitals and 1 outpatient care unit. Since 2008, coordinated by the eHealth Centre of the ICFUC-RS, a public telecardiology project (Phase I) was implemented in 11 more towns. Besides Tele-ECG diagnosis, the project included a face-to-face based telecardiology training program prepared towards promoting professional qualification of remote teams, whose educational program was jointly prepared and deployed by both ICFUC-RS professionals and students [3,4].
Based on Phase I successful experience, the RS Telecardiology Network is being expanded to a larger number of villages (Phase II). As a result of a partnership established between the ICFUC-RS and the State Government, through its Health and Science and Technology Secretariats, the project was implemented in 30 remote institutions in 2011. Aiming at better serving remote health teams, improved infrastructure was incorporated to the original project, which includes a new telecardiology unit, a data processing centre, a 24/7 on duty telecardiology service and a qualifying program that combines a presence mode and a multi-seat web conferencing training program. The results of Phase II first year are reported in this paper.

Objectives

To describe the first year’s results of RS Telecardiology Phase II, including: (1) Data from the telecardiology training program; (2) Digital TeleECG network cases; (3) Medical counselling via videoconferencing.

Methods

The implementation of Phase II started during the year 2010. Financial support was provided through three different deals and contracts established between the ICFUC-RS and the State Government, that funded: 1) the construction of the 24/7 Telecardiology Central Unit, which included rebuilding a physical area and the acquisition of equipment for a data processing center and licenses for video-consultation and for multi-seat interactive web conferencing sessions (up to 100 simultaneous participants); 2) the monthly costs pertinent to the operation of a 24/7 Telecardiology service and; 3) the implementation of a qualifying program in the field of Telecardiology, which count on the participation of two multidiscipline teams composed by nurses, IT experts, cardiologists and administrative personnel.

The selection of remote institutions was based on the criteria of distance (more than 100 Km from the capital city), population of less than 50,000 inhabitants, difficult road access, and a lack of cardiology “on-duty” emergency services. The Telecardiology method provides near real time digital ECG diagnosis and lives cardiology second opinion for potential emergencies, over a distance.

In order to qualify the involved professionals, a 6-hour face-to-face training session held at IC-FUC-RS eHealth Centre starts the training process, whose content includes discussing basic concepts of eHealth, Telecardiology RS project overview and specific operation of related software. After that, a second round of training activities is held in the remote institution (regional hospital or outpatient care unit), where technical
skills are checked and a “hands-on” practical approach is emphasized and monitored by the eHealth team of ICFUC-RS. Having finished this stage, a multi-seat web conferencing program (Blackboard Collaborate® Vclass platform with up to 100 seats) composed of medical, nursing and IT interactive lectures, allows keeping network members integrated through the periodical transmission of seminars, clinical case presentations and discussion of selected topics of major interest.

Results

During 2011, from March to November, the IC-FUC RS eHealth team promoted a series of both face-to-face and web conferencing training activities. As part of this qualifying program, a total of 326 professionals received telecardiology technical training: 114 were trained at IC-FUC (1st round) and 212 received onsite training at the remote institutions (2nd round). A total of 62 multi-seat web conferencing sessions, transmitted every 15 days via the Blackboard Collaborate® platform, included 17 interactive lectures (topics of medical relevance mainly related to cardiology urgencies and assistance) and 45 Web-Nursing and Web-Informatics (TI) sessions.

In the same 2011 period, 4366 digital Tele-ECGs were remotely recorded from potential cardiology urgencies and transmitted to the 24 h Telecardiology unit of the IC-FUC, with 2313 (53%) from the female sex. Its analysis found 611 (14%) cardiologic urgencies, 1616 (37%) normal ECGs and 2139 (49%) were classified as non-urgent cases (chronic/non-specific ECG diagnosis). Acute Myocardial Infarction with S-T segment elevation was diagnosed in 63 cases (1.44%). Low technical quality (ECG recording interference, electrodes placement inversion) was registered in 82 exams (1.9%).

Medical counseling through live cardiology second opinion for potential urgencies/emergencies was requested in 36 opportunities: 16 (44.4%) using project’s video-consultation software (Digital Recording System: DRS), 15 (41.7%) via Skype call and 05 (13.9%) through conventional phone calls.

Discussion

Telecardiology Network expansion are very enthusiastic. This initiative was implemented throughout the state as part of a public health program named “Saúde Perto de Você” (Health Near You) [7]. A partnership established between the IC-FUC and the State Government - through its Secretariats of Health and of Science and Technology - provides financial and technical support for Phase II, which guarantees its regular operation.

The establishment of new paradigms of public health assistance - through telemedicine and eHealth applications - can raise the quality of patient care, being vital for the nations’ development [8]. The expansion of the RS Telecardiology Network represents a practical and efficient way of delivering real time assistance for those living in remote and underserved areas of the state. During the Phase II first year, 1950 (44,66%) of the requested ECGs were sent from remote institutions as potential medical urgencies/emergencies, from which 611 (31,33%) had a final ECG diagnosis compatible with an acute cardiac disease. Moreover, almost half of the total sample - 2139 exams (49%) - showed evidence of chronic diseases through the ECG analysis.

Aiming at both the successful implementation and sustainability of eHealth services deserves paying special attention to human factors and to existing geographical and technological barriers in remote areas. Web-based educational opportunities, for isolated professionals, can be of utmost importance to reduce the digital divide, representing a key component for the project’s sustainability [9-10]. In this project, a qualifying program that combines face-to-face and multi-seat web conferencing-based sessions resulted in 326 trained professionals and in 62 periodic web conferencing activities transmitted on a regular basis. Through continued eHealth education this strategy opens a new window that can help reducing the scientific gap that still separates tertiary medical centres from primary care institutions.

Conclusion

In remote RS/Brazil, a 24/7 telecardiology strategy emerged as a real and efficient way towards providing urgent cardiological support. Besides ECG diagnosis, live second opinion and professionals’ education are key components of this initiative. In order to foresee a sustainable scenario, major challenges represented by administrative, cultural, technological and financial barriers need to be addressed on a broad scale.

References


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Applicability of Tele-Electrocardiography at Public Health Systems

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Abstract: Telemedicine may be defined as the offering of medical care at distance, through communication and information tools used for diagnosis, prevention and treatment, and permanent education of health professionals, in order to enlarge quality and resolutiveness. Studying the technical viability and applicability of telemedicine in digital diagnosis applied to digital electrocardiography, at health units of different intricacies, in a crowded city, where an ECG exam takes at least 30 days to be got. Five health units embracing primary attention to health (PAH), secondary attention and emergency care were observed during one year. A mobile 12-lead ECG was used and the exam was recorded and transmitted to a central where the cardiologist makes the diagnosis, sending the award by e-mail. The same physicians also make consultancy in emergency cases. The professionals have been trained for the use of the new technology and the users could make the exam without previous appointment. 10,623 examinations were made, 3,735 (35%) into a secondary unit and 3,031 (29%) into a PAH unit. 6,865 (64.54%) of the patients were women. 2,587 (48.01%) people were between 50 and 59 years old. Most of the patients complained of chest pain. Prevalence of repolarization: 1,609 (3%); branch blocks: 1,361 (27%); myocardial infarction: 628 cases (12%). The average time for award addressing was 3 minutes. The researched model showed efficient to enforce resolutiveness, to identify early occurrences and so allowing immediate care and reducing the risks and damages, besides it reduced the expenses as well as patients suffering. This study made possible implementing such a technology at public health services, without any extra costs for the system, substituting the traditional pattern.

Introduction

The World Health Organization defines Telemedicine as”’ the distribution of health services, where distance is a critical factor, in which the health professionals use information and technologies of communications to the exchange of valid information to the diagnosis, treatment and prevention of diseases or damages, investigation and evaluation; and to the continuous education of public health providers, who are interested in the development of the individual’s and his community’s health.” The Municipal Secretariat
of Health and Civil Defense of Rio de Janeiro has taken on the implantation of an effective, democratic and qualified health system by making the Basic Attention and the attention to health webs organization strong from this one, like a structural and strategic axis to the strengthening of the Municipal System. The process of modernization of the public sphere gains importance through the need to guarantee activities that result in a positive impact, which justify investments and facilitate the building up of an agenda orientated by difficult choices, what presupposes the establishment of tools as systems of information that permit a fast, safe and trustful access to data, besides providing management tools to the managers so that they may follow up and orientate the decision processes. This study intended to study technical possibility and applicability of Telemedicine, in the area of digital diagnostic in digital electrocardiography, in Health Units of different complexities. The pilot project belongs to the group of proposed initiatives by SMSDC Rio, to the development and implantation of Telemedicine as far as the Saudepresente.Net program is concerned, in the City of Rio de Janeiro, in the State of Rio de Janeiro, using Information and Communication Technologies, aiming at qualifying the management and the free and universal assistance to the population.

Methodology

Five Health Units were selected involving primary attention in health – PAH, secondary attention and emergency care, and were followed up during one year. A mobile 12-lead ECG was used and the exam was recorded and transmitted to a central where the cardiologist makes the diagnosis, sending the award by email, besides making consultancy in emergency cases. The professionals were trained to use the new technology and it was not necessary for the users to make any appointment to do the exam.

Results

10623 examinations were carried out, 3735 (35%) in a Secondary Unity and 3031 (29%) in a Unit of HPA. From the total of patients, 6865 (64,54%) were women. As to the age, 2597 were between 50 and 59 years old (48,01%). In order to request exams, chest pain was the most prevalent with 442 cases (51%) and dyspnea with 262 cases (30%) (table1).

Table 1: Main health problems that caused the exams

<table>
<thead>
<tr>
<th>Reason for consulting</th>
<th>Quantity</th>
<th>Acute Coronary Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain</td>
<td>377</td>
<td>2</td>
</tr>
<tr>
<td>Chest pain + palpitation</td>
<td>32</td>
<td>0</td>
</tr>
</tbody>
</table>

604
In relation to the diagnostic, the most prevalent were repolarization: 1,609 (3%), branch blocks: 1,361 (27%). 628 cases of myocardial infarction were diagnosed (12%).

Table 2: Frequency of access to the Internet for studying

<table>
<thead>
<tr>
<th>Result Report</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrhythmias</td>
<td>634</td>
</tr>
<tr>
<td>AV Conduction (BAVs)</td>
<td>222</td>
</tr>
<tr>
<td>IV Conduction (branch blocks)</td>
<td>1361</td>
</tr>
<tr>
<td>Arterial and ventricular overloads</td>
<td>189</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>628</td>
</tr>
<tr>
<td>Repolarization</td>
<td>1609</td>
</tr>
<tr>
<td>Voltage and axis</td>
<td>433</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5076</strong></td>
</tr>
</tbody>
</table>

In relation to the award guiding time, it lasted an average of 3 minutes, surpassing the estimated time of 30’ as well as the previous standard of 30 days.

Conclusion

The tested model proved to be effective to amplify the resoluteness, to identify events in advance, permitting immediate attention and reduction of risks and damages, decreasing not only costs to the system but to the users’ suffering as well. From this study on, it was possible to implant this technology in public health services, without increasing costs to the system, in substitution for the traditional model.

References

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Heart Failure Model for Assessment of Different Intervention Programs

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Abstract: The increasing population, particularly regarding the proportion of people over the age of 60, causes new challenges to public health care systems. Disease management programs or new solutions in health care such as telemedicine systems can be essential for reducing the future financial burden. For that reason a detailed heart failure model was developed, which allows to compare the incurred costs of conventional medical care and different interventions of heart failure patients. For modelling the discrete event technique was used. The model takes account of outpatient care as well as inpatient care for calculating the total costs. Based on this, different scenarios can be simulated and analysed to develop sustainable health care solutions. For this work a virtual study group of 54 patients was used for simulations. To consider the severity of symptoms these patients were classified with different NYHA groups. Three different scenarios were simulated. A disease management program with care of a physician and additional costs for patient education, a telemedical care model and finally the conventional medical care were compared in this work. The results show that overall costs can be reduced up to 21% by using a disease management program. However not all simulated scenarios show that conventional medical care had to be the most expensive treatment. With the developed HF model different scenarios can be simulated and analyzed to develop sustainable health care solutions.

Introduction

The demographic development shows that the proportion of people over the age of 60 increases enormously. Estimations have calculated that in about 20 years every forth is above 60 and every ninth above 75 years [1]. This causes an increase of chronic illnesses and therefore new challenges to public health care systems. Even the prevalence of patients with the clinical syndrome of heart failure (HF) will rise considerably in the next years [2]. Disease management programs or new solutions in health care such as telemedical systems can be essential for reducing the future financial burden. For that reason a detailed heart failure model was developed, which
allows to compare the incurred costs of conventional medical care and different interventions, like disease management programs or telemedical care of heart failure patients.

Methods

The model was developed using the simulation software AnylogicTM® (XJ Technologies, Russian Federation). For modeling the discrete event technique was used, where objects and resources are utilized to describe the treatment procedures. The model takes account of outpatient care as well as inpatient care for calculating the total costs. It enables the treatment of patients by a physician, a specialist or a clinical ambulance for the simulation of the outpatient care. Regarding the inpatient care the model considers not only total-costs of the hospitalization and rate of readmission, but also the costs which occur because of special medical treatments. Based on these characteristics of the HF model three different scenarios were simulated. A disease management program with care of a physician and additional costs for patient education, a telemedical care model, as described in [3] and finally the conventional medical care were compared in this work. The simulated disease management program comprises regular trainings and meetings with nurses to talk about symptoms, problems and health status. These measures result in lower hospitality and mortality rates,
which were considered in the HF model [4]. The simulation time was 5 years, whereas in the first year higher costs were assumed because of the more intensive contact and training in the beginning. Based on results from the MOBITEL study [5], the study group contained 54 patients and to consider the severity of symptoms these patients were classified with different NYHA groups (13% NYHA 2, 69% NYHA 3, 18% NYHA 4).

Results

The summarized costs of all NYHA groups for each model after 3 and 5 years are presented in Fig. 1. After 3 years the telemedical care is not cost-efficient compared to the conventional care. However after 8 additional months the telemedical care surpasses the conventional one, resulting in a decrease of total costs by about 2% after 5 years. As opposed to this the implementation of a disease management program leads to a reduction of total costs by 11% after 3 years. This trend continues with potential savings of about 21% after the whole simulated time span.

Discussion

In the simulated telemedical care system lower expenses could be shown after 42 month, but it had to be considered that the NYHA classifications of the study group influences calculated costs considerably, as discussed in [3]. By using a disease management program results show that overall costs can be reduced up to 21%. Comparing these outcomes, the telemedical care seems to lose ground compared to the disease management program. The fact of the matter is that several assumptions, which had to be made due to the lack of data and the small patient study group, are decisive so that the cost-efficiency of the telemedical solution seems to disappear. However, other simulated scenarios with different financing alternatives for telemedical care show more distinctive results [3].

Conclusions

The developed model provides the opportunity to simulate various scenarios, whereby cost estimations for future health care solutions can be compared with each other. It is essential to know boundaries and assumptions of the models for the interpretation of the results. Not all simulated scenarios show that conventional medical care appears to be the most expensive treatment. It has to be mentioned that both methods have the potential of further cost savings, which strongly correlate to the assumptions in the model, like the distribution of NYHA patients.
Therefore it is important to have the opportunity to simulate and analyse different scenarios to develop sustainable health care solutions.

References


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Identification of Heart Patients’ Everyday Need – Based on User-Driven Innovation

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Abstract: In Denmark, only 3%, of the more than 86,000 Danes hospitalised each year with heart- and circulation problems are offered full course of rehabilitation. Through user-driven innovation, the Teledi@log project focuses on developing and testing telerehabilitation. The goal is to create a more coherent course of rehabilitation for heart patients by introducing new methods of patient education and organisation. Needs of heart patients and their relatives relevant to the use of telerehabilitation technologies have been identified through the use of user-driven innovation and ethnographic studies. This paper focuses on two specific patient needs: The need related to technology and the need related to information about their own disease.

Introduction

In Denmark, only 3%, of the more than 86,000 Danes hospitalised each year with heart- and circulation problems are offered full course of rehabilitation. Rehabilitation of heart patients has been shown to reduce mortality by 35% and the risk of blood clots by 29%. Evidence suggests that rehabilitation of heart patients reduces the risk factors connected to having a heart disease.

The Teledi@log project seeks to develop new ways of rehabilitating heart patients by employing telerehabilitation technologies to create a closer connection between the heart patient and the healthcare system. The project offers the heart patient a more active role in their own rehabilitation. The Teledi@log project is targeted at patients with the following diagnoses: heart failure, arrhythmia, bypass operated patients, and patients with acute myocardial infarct (AMI).

Through user-driven innovation, the Teledi@log project focuses on developing and testing telerehabilitation in scenarios seeking to create a more coherent course of rehabilitation for heart patients by introducing new means of patient education and organisation. The term “telerehabilitation” denotes rehabilitation cutting across sectors and physical distance in the healthcare system.
In the first phase of the project, ethnographic studies, such as qualitative interviews with patients and their relatives, home health tours (observations in homes), workshops etc., are used to identify the (known and unknown) needs of heart patients and their relatives relevant to the use of telerehabilitation technologies. This paper describes and explores two key patient needs: The need related to technology and the need related to general information about their own disease. The description of different needs has created the basis for further development of new concepts and technologies for telerehabilitation of heart patients and created new channels of communication between the heart patients and healthcare system.

Background

There is general agreement in the literature on the effect of cardiac rehabilitation regarding the importance of heart patients being rehabilitated. It is documented that a coherent education based rehabilitation programme of heart patients reduces mortality by 35% and the risk of getting a blood clot by 29% [1]. A recent review on cardiac rehabilitation confirms that cardiac rehabilitation has a very beneficial effect on some of the risk factors connected to having a heart disease [2]. A Danish review of the literature, within the field of cardiac rehabilitation, also acknowledged the beneficial effect of rehabilitation on patients with cardiac problems [3]. In spite of the massive documentation of the beneficial effect of cardiac rehabilitation in the literature, a problem remains of getting heart patients through a full course of rehabilitation. There are many factors that may explain the low rate of participation. Based on the literature, it seems that rehabilitation targeted to each heart patient’s individual needs pose a challenge. Before tailored rehabilitation targeted at the individual needs of a heart patient can be accomplished, the everyday needs of heart patients must be identified. Telerehabilitation technologies designed to meet the individual need of heart patients, might have the potential to promote this tailored rehabilitation.

Method

Ethnographic studies [4] have been conducted in order to identify the (known and unknown) needs of heart patients and their relatives relevant to the use of telerehabilitation technologies. The patients must have completed or must be enrolled in a rehabilitation process. Ten heart patients were selected for inclusion in the ethnographic studies. The group was distributed as follows: AMI (1 patient), arrhythmia (4 patients), heart failure (1 patient)
and 4 patients have undergone bypass surgery. Data were collected through user-driven innovation [5] using the following methods:

**Home Health Tours** (n = 10): Collection of data through observation and interviews with the patient and relatives in the patient’s own home. These tours were completed in approximately 3 hours.

**Interviews** (n = 10): The interview guide has been constructed with inspiration from Steiner Kvale [6]. Interviews are conducted with the patient and relatives together, but they are also interviewed separately.

**Workshops**: Three workshops have been held with researchers, heart patients, relatives, representatives from companies and healthcare professionals. The intention of this broad spectrum of participants was to have representatives from the entire environment surrounding the heart patients during the course of treatment and rehabilitation. All gathered data were analysed and condensed in the Nvivo research software.

**Findings**

Through the innovation process, founded on a user perspective, numerous needs of heart patients and their relatives relevant to the use of telerehabilitation technologies have been identified. The condensation of data has led to a division of these needs into an overall theme with related subthemes. Two overall themes have been identified: Needs related to technology and needs related to rehabilitation.

**Needs related to technology**: The patients express a need for the technology to be a flexible according to their level of technological skills. They also highlight motivation as a key factor for integrating technology into their course of treatment and rehabilitation. The patients saw it as important that the technology give them the ability to conduct self monitoring and manage their own disease at home.

**Needs related to information on disease**: Through the ethnographic studies it has become clear that it can be rather difficult for heart patients to handle and comprehend the massive amount of information they receive from the healthcare system today. The patients express desire to receive general information about their disease in a more easy manageable way e.g. the general information should be assembled in one place and be easily accessible on the web. The patients also express a need for more individual guidance and consultation regarding specific issues about their disease, and maybe an easier method of getting into contact with healthcare professionals through for instance telerehabilitation technologies.
Conclusion

Needs of heart patients and their relatives relevant to the use of telerehabilitation technologies have been identified through the use of user-driven innovation and ethnographic studies. This description of needs has created the basis for further development of new concepts and technologies for telerehabilitation of heart patients as well as new channels of communication between the heart patients and healthcare system.

Acknowledgement

We thank heart patients and their relatives for participating in the Teledi@log project [7]. The research project is part of the UNIK partnership financed by the Danish Agency for Science Technology and Innovation. We thank industrial partners and clinical partners at Vendsyssel Hospital and the municipalities of Hjoerring and Frederikshavn, Denmark.

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[7] www.teledialog.dk
Prevalence of Normal Electrocardiograms in Primary Care Patients: A Study by a Telemedicine Service in Brazil

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Abstract: Telecardiology provides support for primary care physicians through transmission of electrocardiogram (ECG) results and feedback from cardiologists. The objective of this study is to assess the prevalence of normal ECGs in patients who were attended at primary care centers of 658 cities in Minas Gerais province, Brazil. All ECGs analyzed by cardiologists of the Telehealth Network of Minas Gerais, a public telemedicine service, in January 2011 were assessed. A total of 19,370 ECGs were analyzed (mean age 51 ± 19 years), 54.6% of them were normal. This proportion was higher in women (60.5 vs. 54.1%, p<0.001) and lower in patients with hypertension (45.1% vs. 64.2%, p<0.001) and diabetes (45.5% vs. 58.6%, p<0.001). Progressive decrease in the prevalence of normal ECG was observed with increasing age. Among patients under investigation for chest pain, 59.3% had no ECG abnormalities. In conclusion, normal ECGs account for more than 50% of all examinations in primary care patients, but this prevalence decreases with aging and comorbidities. Furthermore, it was observed that most ECGs performed to investigate chest pain in primary care had no abnormalities.

Introduction

The Telehealth Network of Minas Gerais is a public telemedicine service in Brazil, which attends primary care of 658 cities in Minas Gerais province by providing services of tele-electrocardiography and teleconsultations. Tele-electrocardiography provides support for primary care physicians through transmission of electrocardiogram (ECG) results and feedback from cardiologists. There are benefits through avoidance of unnecessary referrals and identification of patients who required urgent intervention [1, 2].

There is lack of information regarding the prevalence of normal ECGs in primary care patients, and the analysis of the ECGs performed by the telemedicine service may allow the knowledge of the proportion of normal
ECGs and ECG abnormalities in primary care patients. Associated with the knowledge of epidemiological data of the population, it allows estimating the proportion of patients whose ECGs may be analyzed by the family physicians with minimal training in ECG interpretation, and also the proportion of patients who require further investigation. The objective of this study is to assess the prevalence of normal ECGs in patients who were attended at primary care centers in Minas Gerais, Brazil, whose ECGs were analyzed by cardiologists of the tele-electrocardiography service.

Methods

In this observational and retrospective study, all 12-lead standard digital ECG analyzed by cardiologists of the Telehealth Network of Minas Gerais in January 2011 were assessed. ECGs were sent by remote professionals through internet to be analyzed by cardiologists who are trained and experienced in the analysis and interpretation of ECG. The prevalence of normal ECGs was assessed. The statistical analysis was carried out using SPSS statistical software (SPSS Inc., Chicago, IL) release 18.0. Categorical variables were expressed as counts and percentages, and Chi-square test was used to compare prevalence regarding comorbidities. A p value of 0.05 was considered statistically significant, and all p values are two-tailed.

Results

During the study period, a total of 19,370 ECGs were analyzed (mean patient age 51 ± 19 years, 58.5% women), 54.6% of them were normal.
proportion was higher in women (60.5% vs. 54.1%, p<0.001). Progressive decrease in the prevalence of normal ECG was observed with increasing age (Fig. 1).

Additionally, the prevalence of normal ECGs was lower in patients with hypertension (45.1% vs. 64.2%, p<0.001) and diabetes (45.5% vs. 58.6%, p<0.001). As expected, it was also lower in patients with history of prior myocardial infarction (36%) and Chagas heart disease (30%), an infectious inflammatory dilated cardiomyopathy caused by the protozoan Trypanosoma cruzi which is still a prevalent disease in South American countries.

A total of 13,589 ECGs were performed to investigate chest pain (70.2% of all ECGs). The mean patient age was 50 ± 19 years, 58.6% were women. No abnormalities were observed in 59.3% of ECGs.

Discussion

To the best of our knowledge, this is the first study to evaluate the prevalence of normal ECGs on primary care patients. It showed that in primary care patients, normal ECGs account for more than 50% of all examinations, suggesting that family physicians with minimal training in ECG interpretation can analyze the majority of ECGs of primary care patients, mainly patients without comorbidities.

Additionally, this study depicts another potential of telemedicine use: to know epidemiological data of the population. Therefore, when the telemedicine service is integrated to the usual care, as is in this case, the results of digital ECG analyses may have an important role in public health planning.

Important diagnostic information is conveyed by a single ECG in the evaluation of acute chest pain [3]. A systematic review showed that a normal ECG is reasonably useful at ruling out a myocardial infarction (LR+ 0.14 [95% CI 0.11 to 0.20]) in primary care patients [3]. Despite the fact that acute coronary syndrome is a rare cause of chest pain in the primary care setting [4], and that 59.3% of the ECGs of patients under investigation for chest pain in the present study had no abnormalities, physicians should be aware of the importance of a careful evaluation of clinical symptoms, and to perform serial ECGs in suspected cases.

Conclusion

This study showed that in primary care patients, normal ECGs account for more than 50% of all examinations. This prevalence decreases with aging and comorbidities. Furthermore, it was observed that most ECGs performed to investigate chest pain in primary care had no abnormalities.
Acknowledgments

This study was supported by the Provincial Health Department of Minas Gerais, and by the Brazilian Ministry of Health.

References


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Teleconsulting for Collaborative Diagnosis and Care of Heart Malformations in Balkan Countries

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Abstract: Medical cooperation with clinical centers of Balkan Countries was developed by the “G. Pasquinucci” Heart Hospital of “G. Monasterio” Foundation in Massa, with the support of the “Un Cuore un Mondo” Association and the Tuscany Region, in diagnosis and care of congenital heart malformations. A teleconsulting network over the Internet was set up for multi-center collaborative medical-decision making. Tele-echocardiography was implemented at Pediatric Clinical Centers of Banja Luka (Bosnia-Herzegovina) and Rijeka (Croatia), and at Gynaecology University Hospital in Tirana (Albania) using videoconference equipment. Further workstations have been later installed in Bosnia-Herzegovina (Tuzla, Sarajevo and Mostar) and in Romania (Bucarest) (Figure 1). Limitations of commercial solutions suggested exploitation of Open-Source technology to set up low-cost devices implementing both live and store-and-forward teleconsulting as well as videoconference and image storage/management.

Introduction

Information and communication technology have provided a foundation for telemedicine breaking down geographical barriers and providing specialized medical care virtually anywhere in the world [1]. Teleconsulting usually involves the transmission of medical images over the network, serving multi-center collaborative medical decision-making in diagnosis and care planning. Hospitals interconnect through the Internet and health-care services can be linked to remote clinical centers that will provide them with specialized assistance. DICOM, the standard in medical imaging systems [2], has provided a standard framework for such data exchange. The store-and-forward, i.e. asynchronous, approach, when images or bio-signals are acquired from equipment, stored and transmitted through a network later on, allows for off-line consultation/evaluation at remote health-care centers. Core technology is data compression (up to 1:500) while preserving diagnostic quality of images is a challenge [3]. When
clinical conditions are critical or complex, hospitals themselves may lack the needed experience and specialists may be called upon for help. Such cases require real-time (i.e. synchronous) transmission capability for assisting the remote operator during echo scanning.

Methods

While echography studies allow recognizing abnormalities in neonates or even in the foetus, the experience of operators is not often adequate in many hospitals. Thus it is frequently necessary to transfer urgently to specialized cardiac units newborns suffering critical cardiac disorders while early diagnosis and care planning would limit risks. Real-time tele-echocardiography was implemented (Figure 1 and 2) [4] using a couple of commercial videoconference devices, one installed at the echocardiography room in the remote hospital and the other one at the specialized unit, connected together through Internet. Upload transfer rate greater than 512 kbps was needed for limiting degradation of diagnostic accuracy of echo images. Nevertheless occasional limited bandwidth and/or, instability or discontinuity of Internet connections, may require the store-and-forward solution as back up.

Videoconferencing allows clinicians at remote sites to interact via two-way video/audio transmissions, facilitating collaborative diagnosis by evaluation of medical images in real-time.

Open-Source Teleconsulting

While videoconference commercial equipments are easily used, they are usually expensive, use proprietary technology and are limited in scalability and functionality. Open-Source technology was exploited to set up a low-cost device providing both on-line and off-line teleconsulting as well as videoconferencing [4]. Basic requirements were: video signal acquisition
from imaging equipment; effective digital image compression; secure transmission of image data (DICOM and not) through public network; videoconferencing capability for on-line operator interaction; DICOM server utility for storage, management and distribution of image studies (PACS capability). Small-size prototype was designed, using mini-ITX low-power motherboard and standard video card for digitizing video signal from echo-cardiographer. 

LAMP (Linux, Apache, Mysql, Php) architecture was applied and application software included: EKiga (Video Conferencing and Instant Messenger over Internet); VLC (cross-platform multimedia player and framework); Flowplayer (embedding video streams into web); DCM4CHE (Open Source Clinical Image and Management software, with DICOM and HL7 services to provide image storage/retrieval); Oviyam (web-based DICOM viewer) [5].

At the diagnostic center the operator is provided with the following functions: streaming in real time echo images (LIVE); managing and distributing image studies achieved from echo or other modality equipment as well as PACS (DICOM); recording images acquired from echo-cardiographer (ARCHIVE). At the receiving side (i.e. at cardiac department in Massa) by means of a standard web browser, connecting by Internet to the remote workstation, diagnostic images are reproduced invoking video streaming (LIVE or ARCHIVE) or retrieving DICOM records by Ovijam.

Figure 2. Tele-echocardiography by videoconferencing equipment

Results and Conclusions

Tele-echocardiography was implemented at Pediatric Clinical Centers of both Banja Luka (Bosnia and Herzegovina, BIH) and Rijeka (Croatia), and at Gynaecology Hospital in Tirana (Albania). Further workstations were later installed at other BIH clinical centers (Tuzla, Sarajevo and Mostar) and in Bucarest (Romania). During teleconsulting sessions, requested by remote centers, young patients (often neonates) suffering by cardiac disease were examined by echocardiography jointly with cardiologists at Heart
Hospital in Massa. Fetal echocardiography was also performed for allowing early care planning before delivery. Live teleconsulting was preferred to plan timely care of patients and to interact with the remote operator for guiding scanning of heart anatomy, particularly in fetus or neonate. Sometimes limitations of Internet, unstable in time, affect quality of images making it difficult detection of abnormalities also by expert cardiologists. In such situations the store-and-forward approach is suggested to transfer imaging records (possibly DICOM) preserving diagnostic information.

Commercial videoconference equipment allowed easy implementation of tele-echocardiography but new solutions are challenging to overcome limitations in functionality, versatility, scalability and cost/effectiveness. Open-Source technology is appealing for diffusion of medical teleconsulting. A prototype was set up and first successfully tested in Mostar in connection with Heart Hospital in Massa.

Acknowledgment

Thanks to “Un Cuore un Mondo” Association for support of this project, to our colleagues of Information Technology in Pisa for technical advice and to the developer of the web site of telemedicine project [5], Mr. Andrea Gori, who contributed guidelines and utilities to set up teleconsulting.

References


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TelMedHome - Fast and Cheap Home Care Monitoring of the Patients with Cardiac Diseases

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Abstract: The aim of the project was to investigate the usefulness of home care telemonitoring of the patients using selected diagnostic tools. We have used advanced numerical analysis of biomedical data such as ECG records, pulse wave, etc. to allow to obtain more detailed information about the patient state. The project was monitored continuously in 21 patients with congenital aortic valve, 35 patients underwent implantation of coronary artery bypass graft CABG and 5 patients diagnosed with aortic aneurism. Taken as a group study 50 healthy subjects to determine the fundamental norms and standards for selected parameters, the results of advanced analysis of heart rate and ECG. HSR-PW (high signal resolution pulse wave) and NURSE-ECG (numerical resolution signal enhancement ECG) method are based on a special computer programs, which increase the resolution of the pulse wave signals and electrocardiography signals and set the parameter values that inform about the state of the circulatory system. Thanks to this method, it becomes possible to show the details of the pulse wave and electrical activities of the heart parts, which are invisible in standard records. The pulse waves were recorded using a standard wireless electronic pulsoximeter CMS-50E, and electrocardiography signals were recorded by standard digital ECG device. The input data, which come from standard pulse oximeter and ECG devices, were collected from patients staying at home through a system of telemedicine network MONTE (TelMedHome). During the monitoring recorded the number of incidents related to arrhythmia, the oxygenation deteriorated, with the work of a pacemaker was detected. By monitoring cardiologists could take the appropriate medical intervention. The telemedical system TelMedHome provides better care for patients discharged from the hospital and improves control of patients staying at home.

Introduction

The aim of the paper was to investigate the usefulness of home monitoring telemedicine patients scheduled for cardiosurgery using selected diagnostic tools to optimize health care program in the Poznan, Poland. In addition to the planned development of new methods of medical telemonitoring we have used advanced numerical analysis of biomedical
data such as ECG records, pulse wave, etc. to allow obtaining more detailed information about the patient state.

Materials and Methods

Monitoring of the patients staying at hospital and at home was carried out in accordance with the system MONTE (www.monte.net.pl). We monitored records of pulse oximetry, blood pressure, temperature and body weight, glucose levels, rate well-being, occasionally, ECG, and once a week, patients were requested to submit a survey in which spoke about his health. These data were automatically transmitted via the Internet to the Department of Cardiac Surgery, University of Medical Sciences, where they were collected and monitored. The pulse waves were recorded using a standard wireless electronic pulsoximeter CMS-50E, which allows measurement of oxygen saturation in the range of 35%-99% with a resolution 1 % for SPO2. To interpret the obtained results, the ultrasound examination and other biochemical patients data were compared to high signal resolution pulse wave (HSR-PW) parameters of the same subjects. The resolution of pulse wave signal was enhanced by special software using the method of linear transformation based on Fourier analysis and deconvolution of original pulse wave [1-4] (Fig.1). Thanks to this method, it becomes possible to show the details of the pulse wave, which are invisible in standard record (Fig.2). Based on the analysis of individual peaks, computer calculates values of some parameters defining the state of the cardiovascular system.

Results and Discussion

The project was monitored continuously in 21 patients with congenital aortic valve, 35 patients underwent implantation of coronary artery bypass graft CABG and 5 patients diagnosed with aortic aneurysm. Taken as a group study 50 healthy subjects to determine the fundamental norms and standards for selected parameters, the results of advanced analysis of heart rate and ECG. HSR-PW (high signal resolution pulse wave) and NURSE-ECG (numerical resolution signal enhancement ECG) method are based on special computer programs, which increase the resolution of the pulse wave signals and electrocardiography signals and set the parameter values that inform about the state of the circulatory system. Thanks to this method, it becomes possible to show the details of the pulse wave and electrical activities of the heart parts, which are invisible in standard records. The pulse waves were recorded using a standard wireless electronic pulsoximeter CMS-50E, and electrocardiography signals were recorded by standard digital ECG device. The input data, which come from standard...
pulse oximeter and ECG devices, were collected from patients staying at home through a system of telemedicine network MONTE (TelMedHome).

Fig. 1. Pulse wave before a) and after b) high signal resolution processing.

Fig. 2. Pulse wave analysis result of HSR (numerically increased) a healthy person a) and qualified for a heart transplant b). Standard pulse wave looks like the same in both cases.

In healthy people, in the averaged HSR pulse wave recording, the amplitude of the first peak is clearly higher than the second peak amplitude (Fig. 2a).

In people with heart disease such as valve problems, it is observed the reverse situation - the amplitude of the first peak is lower than the amplitude of the second peak (ratio of amplitudes is <1). These changes represent
also volume ratio of the left ventricle to the volume of the aorta > 6 (Fig. 2 b).

The HSR - PW shows very well changes of the pulse parameters after heart transplantation (Fig. 3). We can observe how, after heart transplantation and other cardiac operations, some of the parameters of the circulatory system are normalized.

During the monitoring recorded the number of incidents related to arrhythmia, the oxygenation deteriorated, with the work of a pacemaker was detected. By monitoring cardiologists could take the appropriate medical intervention. The telemedical system TelMedHome provides better care for patients discharged from the hospital and improves control of patients staying at home.

Fig. 3 HSR pulse wave recording a patient with aortic valve defect before the operation a) and after implantation of artificial valve b). Standard pulse wave looks like the same in both cases.

Conclusions

The High Signal Resolution Pulse Wave allows fast, inexpensive and non-invasive diagnostic of cardiovascular system diseases, for example: heart ventricle disorders etc. The telemedical system Monte provides better care for patients discharged from the hospital and improves control of patients staying at home.
Acknowledgment

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References


Ryszard Krzyminiewski is a head of Medical Physics Division Faculty of Physics A. Mickiewicz University. His main field of research is a medical physics, an application of spectroscopic methods EPR and ENDOR to investigate electronic structure of free radicals in biologically active compounds, numerical signal processing of electrophysiological signals and telemedicine. Ryszard Krzyminiewski is the author of an original computer method for enhancement of spectral resolution of electrocardiography and pulse wave records.
The EVOLVO Study: Remote Monitoring in Heart Failure Patients with Implantable Defibrillator

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Abstract: The EVOLVO study is a prospective, randomized, parallel, unblinded, multicenter clinical trial designed to compare remote monitoring of 200 heart failure patients with implantable defibrillator with the current standard of care. The purpose of this paper is to summarize the long-term clinical and economic benefits

Introduction

Recent guidelines based on the evidence of randomized clinical trials (RCTs) recommend the use of implantable cardioverter defibrillators (ICD) and defibrillators for resynchronization therapy (CRT-D) for the management of selected chronic heart failure (CHF) patients. The conventional approach to cardiac device follow-up consists of scheduled in-office visits at intervals ranging from 3 to 6 months. Due to increasing patient volumes, routine follow-up contributes a significant resource burden to already overstrained clinics, as well as to patients and caregivers in terms of travel and time. Remote device monitoring allows clinics the ability to immediately be aware of changes in device functionality to proactively respond to actionable events, and may represent a safe, effective, and cost-saving alternative to conventional in-clinic follow-up programs [1].

The EVOLVO (Evolution of Management Strategies of Heart Failure Patients with Implantable Defibrillators) study aimed at measuring the long-term clinical and economic benefits of remote monitoring of CHF patients with ICD.

Methodology
**Study design**

The EVOLVO study is a prospective, randomized, parallel, unblinded, multicenter clinical trial designed to compare remote monitoring of CHF patients with ICD with the current standard of care [2]. 200 patients were enrolled and randomized to receive either the Medtronic CareLink monitor [3] for remote transmission or the conventional method of in-person evaluations. Patients in the standard arm were followed for a 16-month period with scheduled visits at 4, 8, 12 months and 16 months. The intervention arm had remote transmissions replacing their in-office visits at 4 and 12 months and in-office visit at 8 and 16 months. The automatic wireless communication allowed data transmission without patient intervention at scheduled intervals as well as alert-based downloads.

**Objectives**

The primary endpoint was the rate of cardiac or device-related unplanned in-office or emergency room visits. Secondary endpoints were: the rate of unplanned visits related to episodes of worsening of CHF, the rate of unplanned visits not related to episodes of worsening of CHF, and the rate of total healthcare utilization (all planned and unplanned hospital admissions) for cardiac or device-related events. Quality of life was investigated by means of the Minnesota Living with Heart Failure Questionnaire. Economic evaluation was performed using the health care system perspective, the patient perspective, and the hospital perspective. A cost utility analysis was performed to measure whether the intervention was cost effective in terms of cost per QALY gained.

**Results**

**Study Timelines and Population**

Two hundred patients were enrolled from May 2008 through July 2009 from 6 centers. Ninety-nine patients were randomly assigned to the remote arm and 101 patients to the standard arm. Demographic data, clinical parameters and pharmacological treatment were similar between the study arms. During the course of the study 15 patients died (7 in the remote arm and 8 in the standard arm), and 9 patients were withdrawn (3 patients in the remote arm and 6 in the standard arm).

**Primary Endpoint**

A total of 192 unplanned cardiac or device-related visits (129 in-office visits and 63 emergency room visits) occurred in the study population. 75 events were reported in the remote arm and 117 in the standard arm (0.59 events/year versus 0.93 events/year; IRR, 0.64; p=0.001).
Secondary Endpoints

Remote monitoring reduced the risk of unplanned visit for episodes of worsening of CHF (0.38 events/year versus 0.73 events/year; IRR, 0.52; p<0.001). Comparable rates of unplanned visits for episodes not related to worsening of HF were reported in remote and standard arms (0.21 events/year versus 0.20 events/year; IRR, 1.07; p=0.398). Overall, there were 1285 healthcare utilizations for cardiac or device-related events, and there was a statistically significant difference between the 2 arms (4.40 events/year versus 5.74 events/year; IRR, 0.77; p<0.001).

Quality of Life

Baseline values were comparable between remote (19) and standard arms (20; p=0.817). However, the change in quality of life from the baseline to the 16-month was favorable in the remote arm (-2) with respect to the standard arm (2; p=0.026)

Economic Evaluation

From the health care system perspective, the mean annual cost for the management of the patients in the remote arm (€2089.97) was lower than that in the standard arm (€2102.06; p=0.986). The economic benefits deriving from the use of the remote management balanced the additional cost required to perform unscheduled remote visits and use the technology.

From the patient perspective, the mean cost for a planned or unplanned visit was €68.37. Results showed a significant reduction (p=0.013) of the annual cost for the patients in the remote arm (€225.02) in comparison to that for the patients in the standard arm (€301.89). Remote monitoring therefore implied savings to patients of about 25% of the total annual cost.

From the hospital perspective, results show a significant increase (p<0.001) in the annual time per patient required by hospital professionals to follow the patients with the remote management (148.6 min.) in comparison with that in the standard arm (89.4 min.). Remote monitoring therefore implied a 66% increase in the annual workload per patient, mostly due to the management of the unscheduled remote transmissions.

QALYs were available for 180 patients, 91 in the standard arm and 89 in the remote arm. Cost data were available for all those patients. Mean utility scores at baseline were slightly imbalanced between remote arm (0.737) and standard arm (0.793). Controlling for baseline, there was a differential QALY of 0.065 between the remote arm (1.031) and to the standard arm (0.966). The mean cost for the patients in the remote arm (€2074.70) was lower than that in the standard arm (€2962.80). Therefore patients in the remote arm gained 0.065 QALYs more than those in the standard arm, with
a saving of €888.10 per patient over 16 months. This yields a cost utility ratio of -€13663.08 per QALY gained.

Conclusions

Remote management of CHF patients implanted with ICD decreases the rate of unplanned hospital admissions, and in general reduces total healthcare utilization. The cost utility analysis shows that the remote monitoring is also a less costly and more effective intervention than the traditional care, thus representing a dominant solution. Positive results emerge from the cost analyses conducted with the perspectives of the main stakeholders.

Acknowledgment

The EVOLVO study is supported by Italian Ministry of Health Grant RFPS-2006-2-335243 and by Regione Lombardia – Direzione Generale Sanità, and sponsored by Medtronic Italia.

References


Yardsticks for Telemedicine Maturity: A Teleradiology Case Study

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Abstract: A teleradiology service has recently been established in the public health sector of the Eastern Cape South Africa. The challenge is to enhance the maturity of the parts of the system where teleradiology is working and to learn from these parts in order to gain maturity throughout the entire province. This paper builds on an existing telemedicine maturity model to come up with a framework that can be used for teleradiology maturity assessment within this context.

Introduction

Since the South African department of health recognized in 1998 the potential of telemedicine to address the need for healthcare in rural areas, many telemedicine projects have been launched, of which, few have sustained past the pilot phase. Apart from the obvious waste of equipment and human resources, Yellowlees [1] considers the damage to the reputation of telemedicine as an even greater cost.

In response to this dilemma, a telemedicine maturity model (TMMM) was proposed in a previous paper [2] to measure, manage and optimize all the components of a telemedicine system. Maturity models firstly enable the capability maturity of a specific domain to be measured. Secondly, it facilitates an improvement process that is best suited to an enterprise and which is in accordance with the prescribed best practices of the domain [3]. Table 1 shows the generic Telemedicine Maturity Level Indicators. The TMMM prescribes that each of the 25 measures shown here should be applied to each step of the telemedicine process.

One of the regional tele-radiology infrastructures of department of health in the Eastern Cape Province is one of the recent telemedicine success stories. The Eastern Cape has 22 hospitals connected, sharing radiology images to a central PACS and being diagnosed by offsite radiologist. The hospitals include Dora Nginza, Umtata General and Nelson Mandela Academic Hospital. In a maturity level audit, the teleradiology process of this region scored 3 (standard) for most of the categories showed in Table 1.
<table>
<thead>
<tr>
<th>Table 1: Telemedicine Maturity Level Indicators</th>
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<tbody>
<tr>
<td><strong>Level 1</strong></td>
</tr>
<tr>
<td><em>Ad hoc</em> Chaotic</td>
</tr>
<tr>
<td>Technology</td>
</tr>
<tr>
<td>Users</td>
</tr>
<tr>
<td>Financing</td>
</tr>
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</table>

- **Useful (but not standard) technology to execute this task through telemedicine. Its availability cannot be ensured by the institution.**
- **Useful (but not necessarily standard) technology to execute this task through telemedicine. It is made available by the institution.**
- **Industry standard technology is available to execute this task when needed. This technology is available at the same rate as other standard equipment.**
- **The availability, reliability and maintainability of this technology is measured, reported and reviewed.**
- **Appropriate and useful technology and technology upgrades are continually and efficiently introduced.**
- **It is merely coincidence if the person who performs this activity is qualified, capable and willing to perform this activity using telemedicine equipment.**
- **Some of the persons performing this activity are qualified, capable, comfortable and willing to perform this activity using telemedicine equipment.**
- **All persons performing this task are qualified, capable, and willing to perform this activity using telemedicine equipment and they have the technological and procedural support needed.**
- **Users are empowered and encouraged to embrace the acquisition of new skills and technology. They also play a role in the improvement of current or new design methods.**
- **This task is funded by the institution, but standard tariffs and budgeting procedures do not exist, due to the novelty of this process.**
- **The allocation and dissemination of funds to execute this task using telemedicine, is part of the standard budgeting process of the institution.**
- **Information concerning the return on investment for this telemedicine task is effectively captured and reported on.**
- **Business models exist to ensure the continuation of the telemedicine endeavor.**
No telemedicine-specific protocol exists for this task. Executing this task, using telemedicine, is a deviation from the standard protocol.

A standard working protocol exists for the execution of this task, but it is not seamlessly linked with the previous or next step in the telemedicine process.

A standard working protocol exists for the execution of this task, as well as its step-by-step progression in the telemedicine process.

Process performance metrics for the execution of this task using telemedicine is included in the quality control process.

Protocols are easily updated and operationalized to incorporate improved methods and technology.

No telemedicine-specific protocol exists for this task. Executing this task, using telemedicine, is a deviation from the standard protocol.

A standard working protocol exists for the execution of this task, but it is not seamlessly linked with the previous or next step in the telemedicine process.

A standard working protocol exists for the execution of this task, as well as its step-by-step progression in the telemedicine process.

Process performance metrics for the execution of this task using telemedicine is included in the quality control process.

Protocols are easily updated and operationalized to incorporate improved methods and technology.

For each of the maturity levels (Table 1), a TMMP tailor-made for tele-radiology with the Eastern Cape DoH in mind, is proposed in Table 2, 3, 4, 5 and 6 respectively. This tailor-made TMMP can be used in the first instance to help other regions and other provinces to reach a maturity level of 3 and, secondly, to facilitate the process of moving toward continuous measurement and improvement.

Table 2: Level 1 (Ad Hoc/ Chaotic)

<table>
<thead>
<tr>
<th>Technology</th>
<th>ICT in used for tele-radiological purposes has other primary purposes, e.g. e-mail.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>Early adopters are willing to use system, although not formally trained.</td>
</tr>
<tr>
<td>Financing</td>
<td>No deliberate investment. E.g. availability of email is an co-incidence.</td>
</tr>
<tr>
<td>Proto-cols</td>
<td>Old protocols and processes are followed. ICT is simply replacing some steps.</td>
</tr>
<tr>
<td>Policy</td>
<td>Exciting policies discourage PACS and its processes</td>
</tr>
</tbody>
</table>

Table 3: Level 2 (Stable, but to standard)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Imaging software installed (not necessarily full PACS. Radiology Machines (RM) and workstations are connected. Intranet and internet available, although not necessarily for radiology purposes.</th>
</tr>
</thead>
</table>

Users | Some motivated radiologists/ cardiologists? Only some users are willing and able to use PACS.
---|---
Financing | Working pilot projects through seed/ donor funding.
Protocols | New work processes are being followed. However, this is not standard.
Policy | Exciting policies neither discourage nor encourage PACS and its processes

**Table 4: Level 3, Standard, Consistent Execution**

<table>
<thead>
<tr>
<th>Technology</th>
<th>PACS technology, computers, network and workstations (WS) available as well as digital radiology machines (RM) available. Constant working server; Constant line speed PACS used in standard procedure; PACS Server and HIS interoperable Connection plan clearly outlined and marked (IP database) Alternative standard technology available for patients who are referred to other institutions (e.g. CDs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>Standard PACS administrator; All users are willing and able to use PACS as work standard; There are IT personnel onsite to support PACS.</td>
</tr>
<tr>
<td>Financing</td>
<td>PACS is funded by the hospital self PACS system and users are included in hospital budget - Specific funds for tasks: radiologist, cardiologist, IT.</td>
</tr>
<tr>
<td>Protocols</td>
<td>New process becomes standard procedure; Clear working standards on usage of system and System fail-over; -Service agreements in place in case of failure.</td>
</tr>
<tr>
<td>Policy</td>
<td>Exciting policies are effective in facilitating the consistent execution of PACS and its processes</td>
</tr>
</tbody>
</table>

**Table 5: Level 4 (Measured; Quality and Productivity)**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Measures in place: Data-Line connection speed; Network usage; Downtime; System usage (doctor/ patient); Backup success Packet analyzer and lab testing installed and used. Monthly stats of LAN wireless utilization in order to verify the effectiveness of COWS (Computers on wheels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>Measures in place: System usage as in logging periods and log files from servers, number of patients seen, patient consultation time, time to diagnosis. Patient waiting time; Reports pulled from senior radiologists.</td>
</tr>
<tr>
<td>Financing</td>
<td>Cost of PACS vs. traditional radiology is known. ROI is known, tracked and reported.</td>
</tr>
<tr>
<td>Protocols</td>
<td>Metrics for measurement is known. Line usage, system usage, patients seen, patient time to diagnosis, time for consultation, waiting time.</td>
</tr>
<tr>
<td>Policy</td>
<td>Exciting policies are effective in facilitating the formal evaluation of PACS and its processes</td>
</tr>
</tbody>
</table>

**Table 6: Level 5 (Optimizing; Continuous Improvement)**
Technology

<table>
<thead>
<tr>
<th>Technology</th>
</tr>
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<tbody>
<tr>
<td>Enough server space ensured; Increased server reliability; Create servers redundancy; Inter-hospital connection database; Increase network speed; Computers in all wards and theaters for viewing</td>
</tr>
</tbody>
</table>

Users

<table>
<thead>
<tr>
<th>Users</th>
</tr>
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<tbody>
<tr>
<td>Continuous training is received and encouraged and rewarded. Users trained on low level IT support, in order to minimize system downtime. Dedicated IT Staff available on standby 24 Hours and 7 days a week in case of failure</td>
</tr>
</tbody>
</table>

Financing

<table>
<thead>
<tr>
<th>Financing</th>
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<tbody>
<tr>
<td>Business model is sustainable PACS will sustain growth system and costs of cardiologist increasing</td>
</tr>
</tbody>
</table>

Protocols

<table>
<thead>
<tr>
<th>Protocols</th>
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<tbody>
<tr>
<td>Work protocols are constantly reassessed and improved. Feedback system is in place and communication is possible.</td>
</tr>
</tbody>
</table>

Policy

<table>
<thead>
<tr>
<th>Policy</th>
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<tbody>
<tr>
<td>Policies are in place to encourage continual improvement of processes and practices related to PACS</td>
</tr>
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</table>

Acknowledgement

Jill Fortuin, director of Telemedicine and mHealth, Medical Research Council of South Africa (MRC).

References


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Telenursing
International Council of Nurses eHealth Programme: Vision and Reality

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Abstract: eHealth in all of its manifestations is changing healthcare globally through the productive integration of the healthcare community, healthcare recipients and constantly improving interface modalities. The potential for information and communication technologies to improve the health of individuals, groups and communities worldwide depends on vision, strategic thinking and communication among individuals and across organisations. Of most importance, however, is the ability to assess, plan, implement, evaluate and improve ICT-supported healthcare delivery. The vision of the International Council of Nurses (ICN) eHealth Programme is to transform nursing through the application of information and communication technology. The purpose of this paper is to describe ICN’s new Programme and its involvement in the worldwide eHealth phenomenon.

Introduction

One must have an open mind and a strong heart to keep reasonably up to date with ICT developments today. Mills & Ottino [1] noted in January 2012 that we are again on the cusp of three grand technological transformations which potentially rival the almost incredible changes seen in the 20th century: information technology in the big-data era, smart manufacturing, and the wireless revolution. The cloud network of thousands of data centres far exceeds anything seen a decade or two ago. Manufacturing from the molecular level with devices and products generated computationally is within the realm of reality. And more than a billion people are communicating now in real time and this will only increase. Telehealth technologies and strategies are implemented and evaluated in a dynamic environment where constant improvement and replacement are the new normal.

ICN adds eHealth to its Portfolio

The International Council of Nurses is a federal organization of 135 National Nurses Organizations, representing millions of nurses. ICN’s mission is to advance nursing and health worldwide. For more than 20 years, ICN has worked to develop and implement the International
Classification for Nursing Practice (ICNP), which is a standardized nursing terminology. The goal for the ICNP terminology is to support standard nursing documentation wherever nursing care is rendered. With standard documentation for nursing diagnoses, nursing interventions and nursing outcomes, ICNP data can be stored in data repositories and then re-used for management decisions, clinical decision support, and research. For the last decade, a Strategic Advisory Group convened annually to guide the ICNP programme’s development, implementation and evaluation. The Advisory Group had representatives from North America, South America, Europe and Asia. Its members had deep roots in international informatics and healthcare terminologies through the International Medical Informatics Association, International Standards Organization, International Health Terminology Standards Development Organisation, and World Health Organisation-Family of International Classifications.

Between 2009 and 2010, the ICNP Strategic Advisory Group recognised a need to redefine the programme. The ICNP terminology was mature, with biennial releases and a lifecycle model that organised and articulated ICNP’s research and development, maintenance and dissemination. A steadily growing ICNP subset library was being developed so that users (e.g. nurses, vendors) would have pre-coordinated statements for documentation that were specific for care groups, specialties and settings. The subsets helped to bridge the distance between users’ information needs and the more than 3,000 concepts in the ICNP terminology which are managed in web ontology language in a Protégé software environment.

In a parallel development, as a follow-on to an international telenursing survey and the publication of the ICN Competencies in Telenursing [2], a group of telehealth nurses advocated for international recognition and support through ICN. A Telehealth Nursing Network with a 12-member advisory group was established in early 2009. The Network was formally launched in June 2009 at the ICN Congress in Durban South Africa. Nurses from all countries were welcomed to the Network through conferences and a biannual Telenursing Bulletin. The ICN website was expanded to include Telenursing Network web pages that included a web-based process for joining the Network.

The ICN staff involved with ICNP and the Telenursing Network, and the newly appointed ICN Chief Executive Officer, grappled with envisioning a unifying direction for these technology-focused programmes in view of the expansion, possibly even explosion, of interest in eHealth and telehealth in most areas of the world, certainly including the 135 ICN member organisations. Countries and regions were convening conferences, panels and research programmes to gain knowledge and understanding about the
potential of eHealth [3]. Private and government funding was becoming available for eHealth development.

Perhaps the greatest unknown for rapidly advancing the application of technology to healthcare was the level of readiness of healthcare recipients to use offerings such as web-based resources, telephone and video-based communication, and fewer in-person experiences for their care. Nurses are exquisitely sensitive to healthcare recipients’ needs and responses. Thus, the nursing community, represented to a great extent by ICN, was realising the need to be involved in many levels of eHealth and telehealth nursing, to include extending nurses’ reach to clients (e.g. rural and remote telenursing) and assessing recipients’ responses to the technology itself and, for example, to technology-supported symptom management and self-care.

ICN eHealth Programme Established

The ICN eHealth Programme was launched during the ICN Conference in Malta in May 2011. The Programme aims to transform nursing through the visionary application of information and communication technology. Benton [4] noted that “eHealth is increasingly part of nursing practice worldwide. There are tangible benefits for both low-and high-income countries. Nurses across the world are at the forefront of many innovative developments and continue to actively improve their practice for the benefit of individuals, communities and society.”

With policies and strategies applicable throughout the ICN pillars and programmes, the ICN eHealth programme seeks to advance nurses’ knowledge of and involvement in eHealth worldwide. The desired outcomes of the Programme were developed to broadly address healthcare technology, the nursing profession and the business of healthcare. The technology-oriented outcome of supporting eHealth practice will be achieved through the provision of tools and techniques to help meet the eHealth needs of nurses, other healthcare workers and patients worldwide. The profession-oriented outcome of being recognised as an authority on eHealth is to be accomplished through the identification and promotion of best eHealth practices and policies. The business-oriented outcome of being positioned centrally in the eHealth community will come with productive collaboration with internal and external eHealth stakeholders.

An unanticipated effect of the new Programme is that it has established a structure putting informatics nurses together with telenurses. The two professional practice areas reflect their larger communities, informatics and telehealth, which are both in the healthcare domain but with separate conferences, journals and professional organisations. Informatics nursing is considered a nursing specialty while telehealth nursing is not, since the
nursing process and scope of practice are not different in telenursing. Two biannual ICN publications, the ICNP Bulletin and the Telenursing Network Bulletin, have been merged into one publication: ICN eHealth Bulletin. We look for synergy among the two groups with greater appreciation for what each can bring to nursing and health worldwide. One area with potential for collaborative exploitation would be in using ICNP as the standard terminology for nursing documentation in electronic health records and with mobile health devices.

The new ICN eHealth Strategic Advisory Group, organised in 2011, has eHealth experts representing clinical practice, clinical administration, education, consultation, and professional health organisations. The Group convenes annually to build on Programme accomplishments, analyze the eHealth environment and determine new directions for the Programme. The ICN staff is responsible for the day-to-day directions, actions and products of the Programme.

Future Directions

ICN has established a balanced scorecard approach that allows each programme to establish measurable objectives in the four categories of members and stakeholders; financial stewardship and performance; organizational processes; and learning and innovation. The ICN eHealth Programme objectives are to exploit ICNP and derived products as part of the global information infrastructure to support nursing practice and improve patient outcomes worldwide; maintain cost-effective professional eHealth networks; maintain a robust supporting technical infrastructure; maintain a visible public profile for ICN eHealth to empower nursing at policy and practice levels; and, integrate eHealth across ICN to support the core business of ICN. All of these objectives reflect the need for constant collaboration with individuals and partnering with related organisations.

The ICN Telenursing Network continues to grow, with over 200 members representing 50 countries as of January 2012. The Network will meet at the 2013 ICN Congress in Melbourne Australia. The Advisory Group is developing a new ICN Position Statement for Telehealth Nursing, to articulate ICN’s perspective and recommendations for telenursing education and practice. The Network members are notified of national and international conferences with encouragement to participate and disseminate their work.

The 2013 ICNP Release will take place during the 2013 ICN Congress, and will contain a substantial increase in the number of pre-coordinated nursing diagnosis, intervention and outcome statements in the release. There is a steady increase in the number of ICNP users (nurses, researchers,
vendors). ICNP is available at no-cost to non-profit individuals and entities. An ICNP workshop will be held at the 2013 ICN Congress.

As part of the eHealth Programme, ICN is partnering with Sanofi and others in the Connecting Nurses Care Challenge recognition programme [5]. Care Challenge gives nurses a web-based platform to communicate innovative patient care ideas and projects. The overall project, Connecting Nurses, is an international initiative to champion the extraordinary accomplishments of nurses around the world.

We anticipate more collaborations internal and external to ICN, as the eHealth Programme pursues its outcomes and objectives. As the global voice for nursing, ICN is leading, encouraging and advocating nurses to be actively involved in all aspects of eHealth and telehealth nursing the will contribute to improved health worldwide.

References


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Nursing Professionals’ Barriers for the Use of Educational Technologies: An Integrative Literature Review

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Introduction

The use of educational technology in health directed to nursing workers is important and necessary not only to update knowledge and provide continuing education, but also to provide safe and quality care, as well as to encourage communication between professionals and patients.

The literature reveals that nursing workers benefit in their learning processes from the use of educational technologies [1]. A current example is the hand-held mobile technology that has emerged as an effective clinical tool in evidence-based care [2]. However, professionals face many obstacles in the use of these technologies, which hinders their adherence to it within their work routine [1,3].

This study identifies in the literature those barriers that hinder the access of nursing workers to educational technologies.

Method

An integrative literature review was conducted. An integrative review summarizes studies conducted on a given subject arriving at conclusions based on various studies that are conducted separately but address similar or identical issues. The results are analyzed in such a way the reader is actually investigating knowledge on the studied subject [4]. We searched the Web of Science, Bireme (Medline and Lilacs) and Scopus databases using the descriptors 'barriers', 'educational technology' and ‘nursing professionals’. Inclusion criteria were: full-text papers published between 2001 and 2011 in English, Portuguese or Spanish. A total of 35 papers were found, but since 23 did not meet the inclusion criteria and/or did not address the study’s question, a total of 12 papers were evaluated.
Results

All the papers were written in English; the periodicals’ impact factor (IF) varied from 0.761 to 1.785 in eight (66.7%) periodicals, one (8.3%) obtained an IF of 3.008, while no such value was found for three (25%) periodicals. Two (16.7%) papers were published in 2011 and most papers (91.6%) presented a level of evidence of 4. A synthesis of the most recent papers (from 2007 to 2011) is presented in Table 1.

Table 1. Content of papers concerning objectives, results and conclusions

<table>
<thead>
<tr>
<th>Publication s/IF/Metho d</th>
<th>Study’s Objective</th>
<th>Results</th>
<th>Conclusion / Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin, J.S.; Lin, K.C; Jiang, W.W; Lee, T.T. Journal of Nursing Research, 2007. FI: 1.785 Descriptive - exploratory, cross-sectional.</td>
<td>To investigate the relationship between nurses’ computer skills and their satisfaction with the educational network, and explore related factors.</td>
<td>Nurses attending computer training &gt;4 hours/week and those who had their own PC are more satisfied with the online education program than those who attended &lt;3 hours of training per week. Barriers concerning the use of technology included lack of knowledge and ability to operate different kinds of software and to search for data on the internet.</td>
<td>Health facilities should improve their computer infrastructure and encourage nurses to become interested in the subject for them to learn and apply such skills in clinical practice.</td>
</tr>
<tr>
<td>King, G.; Richards, H; Godden D. Journal of Telemedicine and Telecare, 2007 FI: 1.274 Qualitative study.</td>
<td>To examine the attitude of primary health care workers toward the use of telemedicine.</td>
<td>Many barriers impeding the adoption of telemedicine were identified. One of them is related to the fact that videoconferences may reduce the quality of communication in educational and clinical contexts. There are factors that hinder telemedicine from being implemented in the organizational routine of health facilities.</td>
<td>There is a need for technical support and appropriate training to be provided to professionals for them to implement telemedicine in their practice.</td>
</tr>
<tr>
<td>Anderson, A.S.;</td>
<td>To reflect on whether nurses</td>
<td>A lack of nurse training in teaching cancer</td>
<td>Nurses should understand how the</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Study Type</td>
<td>Findings/Implications</td>
</tr>
<tr>
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<tr>
<td>Klemm, P.</td>
<td>Clinical Journal of Oncology Nursing, 2007.</td>
<td>Reflective study.</td>
<td>Patients who care for cancer patients are prepared to help them to find, evaluate, and use self-care information available on the internet. Internet influences the way patients learn to deal with their diseases and should be responsible for supporting them in choosing appropriate content from <a href="http://WWW">WWW</a>. Nurses are the best-suited to guide and educate patients in supporting the use of online resources. That’s why they have to have computer knowledge to enable an integration of online resources into the provided services. <strong>Level of evidence = 5</strong></td>
</tr>
<tr>
<td>Turcato, N.; Roberson, C.; Covert, K.</td>
<td>AANA JOURNAL, 2008.</td>
<td>Reflective.</td>
<td>To present an overview of the current state-of-the-art simulation-based training. Simulation-based training can help educators and professionals to overcome the challenges faced in the training of nurse anesthetists. Simulations permit replicating not only the interaction among the patient’s physiology, anesthetics and equipment but with the clinical and dynamic environment in which professionals will eventually work. The creation of and collaboration in partnerships can help overcome barriers to the use of simulation-based education. Simulations offer professionals a unique and important learning experience. This valuable tool should be applied in the teaching of nursing students and specialized professionals. <strong>Level of evidence = 5</strong></td>
</tr>
<tr>
<td>Miller, L.C.; Devaney, S.D.; Kelly, G.L.; Kuehn,</td>
<td>To develop the “Long distance” learning project to teach public health.</td>
<td>Reflective.</td>
<td>Nursing students and professionals used an online program called “E-mentoring” to learn about public health issues. For more than “E-mentoring” is a viable strategy to connect nurses to a learning environment, overcoming the obstacles of distance, isolation and work schedules.</td>
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<tr>
<td>Source</td>
<td>Description</td>
<td>Study Details</td>
<td>Findings</td>
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<tr>
<td>A.F. Journal of Continuing Educationa l Nursing, 2008.</td>
<td>Descriptive</td>
<td>three years, 38 students participated in the project and reported they valued the experience and the guidance provided by the professionals. Professionals in turn gained confidence in their teaching practices and skills. Some of the barriers reported were: a lack of involvement of some professionals, lack of feedback, and the physical distance.</td>
<td>Level of evidence = 4</td>
</tr>
<tr>
<td>Bergquist-Beringer, S.; Davidson, J.; Agosto, C.; Linde, N.K.; Abel, M.; Spurling, K.; Dunton, N.; Christophe r, A. Journal Continuing Educationa l in Nursing, 2009.</td>
<td>To describe the evaluation of a training program developed by NDNQI (National Data Base Of Nursing Quality Indicators) addressing pressure ulcers.</td>
<td>The program was developed with online modules and a CD to teach nurses to identify the stages of pressure ulcers, discriminate ulcers acquired at the hospital from those in the community, and collect data concerning the subject. The identified barriers were: technological problems, lack of content clarity and in the conception of the program, which led to the training program being reviewed.</td>
<td>Level of evidence = 4</td>
</tr>
<tr>
<td>Jarvis-Selinger, S.; Bates, J.; Araki, Y.; Lear, S.A. International Journal</td>
<td>To describe how the use of an internet platform can favor collaboration between professionals and patients and Telehealth can improve the access of professionals during care provided to patients through the exchange of health-related information with effective communication</td>
<td>The NDNQI program was developed to improve the precision and reliability of nursing in identifying pressure ulcers. The final evaluation indicated that the program is efficient in teaching nurses on the subject.</td>
<td>Level of evidence = 4</td>
</tr>
</tbody>
</table>
of Telemedicine and Application, 2011.
IF: not found.
Descriptive Qualitative

| improve behavioral changes in patients. | among health services. The lack of experience with internet-based platforms is a significant barrier to the development of useful and innovative platforms. | concerning the potential of technology to change service delivery, especially for patients living in rural areas.

**Level of evidence = 4**

| Guise1, V.; Chambers, M.; Välimäk, V. | To discuss the use of simulations in nursing education, including potential benefits and obstacles to their use. | Example of the implementation of simulations in psychiatric nursing and mental health education. An identified barrier was the lack of a broader theoretical framework to support and guide the use of simulations. The lack of tools to develop and/or maintain a simulation scenario also hinders its use on a large scale. | The continuous development, implementation and evaluation of virtual simulations of patients through a diversity of care actions could be an educational tool.

The results provided evidence that lack of knowledge, time, skills, technical support, and training for using computers makes nurses uncomfortable and constitute barriers to their adherence to educational technologies in their practice.

**Conclusion**

We conclude that further studies focusing on this subject are very important since there is a need for professionals to overcome such barriers because the use of educational technologies enables improvements that reflect on the quality of care provided to patients.

**References**


Technology Use for Health Education to Caregivers: An Integrative Review of Nursing Literature

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Abstract: This study presents an integrative literature review in the field of nursing concerning the use of technologies used in health education provided to caregivers.

Introduction

The literature reports a growing number of elderly people and individuals with chronic health conditions whose family caregivers need to be instructed concerning the delivery of appropriate, safe, and quality care [1-3]. Therefore, providing health education to caregivers through educational technologies enables safe care, promotes the decision-making process and communication among professionals, caregivers and patients, reduces overload, and favors greater quality of life to both patients and caregivers. Thus, this study identifies the educational technologies that have been employed in health education as provided to caregivers.

Method

This is an integrative literature review in nursing. An integrative review summarizes studies addressing a given subject and reaches conclusions based on studies conducted separately but that investigate similar or identical issues. The results are analyzed in such a way that the reader examines knowledge concerning the studied subject [4]. The Web of Science, Bireme (Medline and Lilacs) and Scopus databases were searched using the following descriptors: ‘educational technology’, ‘health education’ and ‘caregivers’. Inclusion criteria were: full-text papers published between 2001 and 2011 in English, Portuguese or Spanish. A total of 34 papers were found, but since 27 failed to meet the inclusion criteria and/or did not address the study’s question, a final sample of seven papers was gathered.
Results

Three (42.85%) of the papers were published in 2005; five (71.43%) were published in English; all had a level of evidence of IV. Five (71.43%) periodicals had an impact factor between 0.42 and 2.24, while the impact factors of two (28.57%) periodicals were not located (Table 1).

Table 1. Content of papers concerning objectives, results and conclusions

<table>
<thead>
<tr>
<th>Publications/ Method /IF</th>
<th>Objectives</th>
<th>Results</th>
<th>Conclusion/ Level of Evidence</th>
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</thead>
<tbody>
<tr>
<td><em>Magnusson, L.</em>; <em>Hanson, E.</em>; <em>Nolan, M.</em> British Journal of Nursing, 2002.</td>
<td>To describe how work is being conducted through the “ACTION Project”.</td>
<td>Promoted communication among the hospital’s staff and those working in the community and caregivers of elderly individuals. Favored care planning, resulting in patients’, families and caregivers improved quality of life.</td>
<td>Presented the philosophy of the “Action Project” and how it is intended to support elderly individuals and family caregivers in Sweden through the use of new education, information and communication technologies. <strong>Level of Evidence = 4</strong></td>
</tr>
<tr>
<td><em>Chambers, M.</em>; <em>Connor, S.L.</em> Journal of Advanced Nursing, 2002. FI: 1.54 Descriptive and exploratory.</td>
<td>To evaluate the usability of multimedia software applications designed for family caregivers of elderly or impaired individuals</td>
<td>Most users/caregivers found the software useful and informative regarding the relevance of care; software’s terms and languages repetitive, the use of figures and drawings – appropriate; while audio and video material could have been improved.</td>
<td>The authors concluded that the software has potential to provide information and support family caregivers as long as it is refined. <strong>Level of Evidence = 4</strong></td>
</tr>
<tr>
<td><em>Lai, C.K.Y.</em>; <em>Arthur, D.G.</em>; <em>Chaw, W.W.H.</em> Internationala</td>
<td>To show the use of the internet from the perspective of subgroups and delineate some</td>
<td>Older people and their family caregivers have limited access to computers, which aggravates a lack of</td>
<td>It is suggested that access to health care with the use of computers will be a growing field in which elderly individuals and</td>
</tr>
<tr>
<td>Reference</td>
<td>Context</td>
<td>Purpose</td>
<td>Description</td>
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<tr>
<td>Journal of Older People Nursing, 2004. FI: 1.19</td>
<td>Reflective.</td>
<td>problems of elderly individuals and caregivers.</td>
<td>Access to good health care. Caregivers will be able to complement traditional care with telehealth.</td>
</tr>
<tr>
<td>Gonçalves, L.H.T.; Schier, J. Text and Context Nursing, 2005. FI: 0,4221</td>
<td>Convergent -care study/Experience Report</td>
<td>To develop a socio-educational nursing plan to increase the understanding of self-care in elderly individuals and their families.</td>
<td>A construction of a socio-educational action plan called “Grupo Aqui e Agora” [Here and Now Group], which refers to light care technology focused on health education applied to nursing. Possible and feasible implementation in hospital environment, able to increase self-care behavior while moving toward autonomy, independence and inter-dependence, a must for a healthier life, especially for geriatric patients and their family caregivers.</td>
</tr>
<tr>
<td>Malasanos, T.H.; Patel, B.D.; Klein, J.; Burlingame, J.B. Journal of Telemedicine and Telecare, 2005. FI: 1.274</td>
<td>Descriptive exploratory.</td>
<td>To apply the “The Florida Initiative and Education Diabetes Project” (FITE) to diabetic patients and caregivers of diabetic patients, students and nursing professionals.</td>
<td>Development of clinical telemedicine as an integrated system: web-based education, online communication, remote blood glucose monitoring. 50% of nursing students and 100% of patients and caregivers completed an educational module of “FITE” on the website. All participant were satisfied with the use of technology and reported improved communication processes. The “FITE” project improved communication between patients/caregivers living in remote areas and professionals, though the participation of caregivers was below what was expected.</td>
</tr>
<tr>
<td>Moody, L.E.; Faan, B.C. Holistic Nursing</td>
<td></td>
<td>To discuss holistic care centered on patients and their caregivers</td>
<td>The use of health information via the web has helped patients and caregivers to control Various states have implemented regional organizations of health information to develop strategic plans for the</td>
</tr>
<tr>
<td>Practice, 2005. IF: not found. Reflexive.</td>
<td>through services available on the internet.</td>
<td>symptoms, improving quality of life. The efficacy of e-Health reduces costs of maintaining health, while improving safety and the quality of life of users (patients and caregivers). adoption of e-health and information technology systems. These organizations are at different levels of progress and are spread throughout the states, aiming to have totally digitalized agencies. <strong>Level of Evidence = 4</strong></td>
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<tr>
<td><strong>Graf, J.N.; Montagnino, B.A.; Hueckel, R.; Mcperson, M.L.</strong> Pediatric Pulmonology, 2008. F1: 2.239 Retrospective Pilot case</td>
<td>To describe an educational program for the discharge of children with tracheostomies and identify common obstacles faced by caregivers.</td>
<td>Caregivers took an average of 14 days to successfully complete the educational program focusing on care for tracheostomy patients. Discharge occurred an average of 6.5 days after the education program was concluded. Common obstacles to completing the educational program included social issues such as a lack of structure and/or linguistic barriers and complications arising from the child’s hospitalization and also the unavailability of a nurse at home. The implementation of an educational program directed to caregivers aiming to prepare them for the discharge of children with tracheostomies can decrease the length of hospitalization and enable caregivers to become more secure in caring for these children at home. <strong>Level of Evidence = 4</strong></td>
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</table>

The results revealed the use of soft and hard technologies in health education provided to caregivers, focused on the therapeutic discussion of care and the delivery of telehealth services.

**Conclusion**

The conclusion is that research addressing the subject in the nursing field is still incipient and we note the need for further studies using and
evaluating the use of hard educational technologies in the health education provided to caregivers.

References


Telehealth Nursing: Building Knowledge through Research

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Abstract: Telehealth strategies are being used worldwide to decrease the distance between recipient and provider and to increase healthcare access and quality for people in many different environments. The purpose of this paper is to propose the development of a research agenda for telehealth nursing. The proposal will be grounded in a review of current telehealth nursing research and will solicit input from nurses worldwide, including the ISfTeH Telenursing Working Group and the International Council of Nurses Telenursing Network.

Healthcare professionals are strongly encouraged to use research-based evidence to guide their practice and to complement their knowledge gained through experience. While the kinds of telemedicine, telehealth and mHealth specialties and modalities are constantly increasing, it is incumbent on the healthcare community to support research, apply research findings to practice, and carry out research studies when feasible.

A substantial cohort of nurses leads or collaborates in telehealth nursing research and dissemination of findings. The wide variety of research topics and designs benefits clinicians, managers, educators and other researchers. However, the heterogeneity of the research, in terms of topics, designs, samples, technologies and results may delay achieving meaningful, evidence-based guidance for the major areas of nursing practice where telehealth technologies and strategies are deployed.

Brief research analyses in 2009 [1, 2] and a further research review [3] found that nurse researchers were contributing to the body of knowledge for many facets of eHealth through nursing and interdisciplinary research and dissemination.

A recent, more complete search of key databases for telehealth nursing research reports in English that were published in 2010 and 2011 found more than 160 citations. These were examined for meeting the criteria of completed research, publication in 2011 and a nurse as principal or co-investigator. The search was challenging in that authors (nurses and others) may not have had their credentials included and, if the work setting was identified, each person’s profession still could not necessarily be verified. In addition, nurses were often not listed among the authors in reports of
research concerning topics and interventions which strongly implied nurse involvement.

The search did show that telehealth nursing research with nurses as principal investigators or co-investigators continues to proliferate, including topics such as web-based education for self-management [4], nurse telephone triage quality [5], and tele-ICU monitoring for sepsis [6]. Disease entities researched by nurses included physiological systems, diabetes, and cancer. Research subjects ranged from adolescents to the elderly, nurses, caregivers and users of internet sources. Six papers described literature reviews which, while not research-based, could well have the potential to contribute to the body of knowledge for telehealth nursing.

The 42 papers that met the three inclusion criteria (research-based, 2011 publication, nurse investigator) included five randomized, controlled trials [7-11]. RCTs are generally accepted as the most stringent research design resulting therefore in the most reliable and valid results. It must be said that using RCT designs in telehealth research is very challenging, in that so many variables in the research setting are difficult, if not impossible, to control. The remaining 37 papers used a variety of qualitative, descriptive and correlational designs and addressed a broad range of topics.

Theoretical model development and testing is one high-level goal of a programme of research, with the aim being an explanatory model for the phenomenon of interest. Several of the papers described using theoretical models, to include the Technology Acceptance Model with two variants: Unified Theory of Acceptance and Use of Technology, and Telemedicine Technology Acceptance Model (TTAM). Authors also used the Trans-theoretical Model; Health Belief Model; Complex Adaptive Systems Theory; and Change Theory to guide their research. Kowitlawakul’s study using the TTAM [12] found that the principal factors that influenced nurses’ perceived usefulness of technology were perceived ease of use, support from physicians, and years working in the hospital. The TTAM is a promising explanatory model for telehealth nursing, and seems worthy of continued model testing.

Gaps in the literature review were identified that could have relevance for telenursing. No studies addressed the professional nurse’s roles related to client needs and outcomes in telehealth environments in terms of levels of education, certification, clinical practice, or as distinguished from the roles of paraprofessionals or unlicensed personnel. Safety of telehealth applications was not addressed; this is a major issue for all the telemedicine and telehealth community, for example, in terms of safe use of technology and the safety of interventions related clinical decision support-directed interventions. The use of standard terminologies in telenursing was also not
represented in the research reports; this topic is gaining importance as the use of interoperable electronic records and mobile health communication strategies are continuing to increase worldwide.

Considering the proliferation and the heterogeneity of telehealth nursing research worldwide, and also the gaps in the research coverage, we propose that international telehealth nurses and researchers be surveyed using a Delphi method to develop a consensus for setting priorities for telehealth nursing research. The potential value of identifying research priorities would be to advance the goals of evidence-based practice and improved healthcare outcomes through the use of telehealth. Well-done research is always important and useful but a more deliberate and focused approach, based on the views of the international expert community, could support more targeted knowledge generation and synthesis in support of telehealth nursing practice.

A Delphi survey [13] is used to convene a panel of experts to participate in an iterative process to address an issue of concern. It has the advantages of using the expertise of people who are geographically disbursed and of having all participants’ responses considered equally. An international convenience sample would be used at first, with the request of each subject to forward the survey, in a snowball sampling process, to others who are considered experts in the field of telehealth nursing. The ISfTeH Telenursing Working Group and the International Council of Nurses Telenursing Network will serve as sources for expert participants.

The telehealth nursing research survey would use several rounds of questionnaires on a web-based platform to ask experts to consider research topics involving people, groups, or communities; various age groups; diseases with nursing care needs (eg, diabetes); conditions with nursing care needs (eg pregnancy); technology comparisons; nurses themselves; and care settings (eg, home care, eICU). The 2011 literature review and research reports going forward in 2012 would be used to determine commonalities in existing research as a basis for topics under consideration. The data from each questionnaire will be analyzed and summarized as a basis for preparing the next questionnaire. The goal of the Delphi survey is to reach consensus among the expert group.

The survey findings will be disseminated with the aim of drawing interest and commitment from nurses and others worldwide in continuing to carry out research that will support the research agenda and advance telehealth nursing knowledge and practice. The ICN Telenursing Network will have responsibility for this work.
References


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Winner of the 2011 ISfTeH Student Videoconference Session
Musculoskeletal Telerehabilitation User Satisfaction - Preliminary Report

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Abstract: Patients participating musculoskeletal telerehabilitation due to their hip or knee osteoarthritis during the project „CLEAR” - Clinical Leading Environment for the Assessment and validation of Rehabilitation Protocols for home care were recruited to the user satisfaction study. After one month duration of the telerehabilitation participation at home patients were asked to assess their use of the Habilis platform. They were surveyed with use the Preference and Satisfaction Questionnaire. The assessment focused on observed advantages, satisfaction, and ease use of the telerehabilitation platform. Patients were asked additionally about their attitude towards potentially commercial participation telerehabilitation. One hundred and thirty eight patients assessed the platform. Over 80\% assumed the improvement of efficacy and quality of the treatment and treatment enhancement. Approximately 95\% of patients confirmed that use of the platform was good idea, and 87\% of patients thought that telerehabilitation with use the platform were also advantageous for their treatment outcomes. 93\% of patients would recommend this form of rehabilitation to other patients. More than 80 \% would like to continue telerehabilitation. However, 70,12 \% of the study participants would continue their telerehabilitation even if it would be not reimbursed. Obtained results confirm that telerehabilitation is considered effective and improving quality of service in patient’s subjective opinion. The most of the patients would continue home therapy with supervised on remote, having individually tailored schedule and clear instructions.

Introduction

The satisfaction of users became a new important, measurable value that may inform about used system acceptance. It applies not only to computer use. Inserting the computers to remotely supervised rehabilitation made user
satisfaction assessment applicable to telerehabilitation. This new form of rehabilitation becomes more popular for patients suffering chronic diseases and requiring long term treatment. Therefore user satisfaction assessment appears as an important element of the implementation. The aim of the study was to present preliminary results of the user satisfaction study.

Material and Methods

One hundred and thirty eight hip or knee osteoarthritis patients participated in the user satisfaction study. 41,3% of patients were males and 58,7% females. Their average age was 68,92 years (SD 7.94). All of those patients exercised at home for one month period utilizing telerehabilitation platform. Patients were surveyed after finishing their programs. The survey focused on the overall satisfaction including observed advantages and ease use of the telerehabilitation platform. Additionally, patients were asked about their willingness to recommend this form of rehabilitation to other patients.

Results

Over 80% assumed the improvement of efficacy and quality of the treatment and treatment enhancement. 86,95% of patients assumed that using platform was beneficial for their treatment. Approximately 95% of patients confirmed that concept of use of the platform was good (82,6%). 87% of patients thought that utilized form of telerehabilitation was advantageous for their treatment outcomes. 93% of patients would recommend this form of rehabilitation to other patients. More than 80 % would like to continue this form of rehabilitation. The most appreciated parts of the program were short instructional clips, individually tailored exercise program, exercising at home, and improved safety while exercising at home. A few patients were disappointed with mobile internet connections problems.

Discussion

There is little research published on patient satisfaction of the process of telerehabilitation. Tousignant et al. [1] assessed satisfaction in groups of patients who participated in-home telerehabilitation after knee arthroplasty surgery. They found the high level of satisfaction. Also, Eriksson et al. [2] assessed patients' experiences of telerehabilitation at home after shoulder joint replacement. Patients described that aspects which contributed to their recovery after home therapy were: safety, continuity, collaboration and home environment. Piron and al. [3] compared the degree of satisfaction among post-stroke patients with arm motor impairment who underwent a
virtual reality therapy program at home. Level of satisfaction of patients who exercised at home showed equal to or higher than the hospital treated patients. Moreover, patients who exercised at home were able to engage in therapy in home environment and the videoconferencing system ensured a good relationship between them and the physical therapists whose physical proximity was not necessary. Similarly, the research of user satisfaction of telemedicine in the hospital-assisted home for INR monitoring service for long-term warfarin using children [4] have shown high level of all aspects of the service evaluated. Similarly to our study Burdea conducted research that [5] shown remarkable advantages of telerehabilitation in domains of patient’s motivation, adaptability and variability. Finally, Sugarman [6] described some benefits of a "smart" system, self-adapting to the patient's needs in real time, inexpensive and easy to use for patients, and capable for remote monitoring and control of the patient's computer and analysis of patient status by the therapist in the clinic.

Conclusions

Presented results show good level of satisfaction among patients who were received the telerehabilitation program. They were convinced that telerehabilitation contributed to the improvement of their health and treatment. Obtained results confirm that patients consider telerehabilitation as effective and improving quality of their service. The conclusion can be drawn that telerehabilitation evolves to be a promising support to traditional face to face rehabilitation treatment.

Acknowledgment

This study was partially supported by CLEAR project ((ICT-PSP-224985) Clinical Leading Environment for the Assessment and validation of Rehabilitation Protocols for home care.

References

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