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Vol. 1, 2008



Editors: **Malina Jordanova** & **Frank Lievens**

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Global Telemedicine and eHealth Updates: Knowledge Resources

Vol. 1, 2008

Editors

Malina Jordanova, Frank Lievens

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Foreword

Dear Readers,

We are proud to present this first book in the series “Global Telemedicine and eHealth Updates: Knowledge Resources”.

The book includes 86 papers from 40 countries, representing a broad spectrum of the Med-e-Tel 2008 program.



J-M. Collignon, CEO, Luxexpo

Med-e-Tel 2008 brought together participants from over 55 countries, networking among themselves and with representatives of international organizations such as WHO, ITU, EC, UNOOSA and WABT/UNESCO.

With the publication of this book, Med-e-Tel strengthens its position as a widely recognized International Educational and Networking Forum for eHealth, Telemedicine and Health ICT.

With this series of books, the comprehensive and freely-accessible online library (www.medetel.lu) and all the information available on the website, Med-e-Tel confirms its status as a First-Class World eHealth Networking and Knowledge Resource Centre.

Enjoy your reading!

Jean-Michel Collignon

CEO, Luxexpo, Luxembourg

Producers of Med-e-Tel

Preface

The first volume of the series “Global Telemedicine and eHealth Updates: Knowledge Resources”, is an eclectic collection of essays. With 86 papers from 40 countries, the book presents a collective experience of eHealth experts from different continents. Papers reveal various national and cultural points of view on how to develop Telemedicine / eHealth for the treatment of patients and wellbeing of citizens.

The aim of the publication is to reveal practical applications in Telemedicine / eHealth. Thus it gives a chance to those who are planning to introduce applications in their regions or countries to rely on experiences of others in order to avoid mistakes and to reduce potential problems. There is no need to re-invent the wheel.

Yet, let’s underline that:

- The content of the book is divided in several chapters. The papers in each chapter are organized in alphabetical order.
- Despite its value as an excellent knowledge resource, the book is not a handbook on Telemedicine / eHealth.
- “How”, “Where”, “When” and if possible “How Much” – are only part of the questions that authors are trying to answer.

We trust that everyone involved in Telemedicine / eHealth will find this book extremely interesting.

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Chapter 1

Telecardiology and Chronic Disease Management

Cardiac Tele-Rehabilitation with the SAPHIRE System

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***Abstract:* The intelligent healthcare monitoring and decision support system developed by the SAPHIRE project is based on a platform integrating medical sensor data with hospital information systems. Agent technology supported by intelligent clinical decision support systems based on computerized clinical practice guidelines are used to support patient monitoring. In this paper, one of the two demonstrator environments - the homecare scenario - will be described from the medical and technical point of view**

Introduction

Europe is experiencing a demographic development that leads to an increasingly aging population and poses a new challenge to social and health services: With limited financial and human resources, an increasing number of people with complex diseases need to be treated efficiently. This challenge is spurring a development resulting in shorter hospital stays towards ambulant care and rehabilitation. Recent advances in communications resulting in better connectivity at home offer new options and make homecare a cost efficient way of continuing the treatment at the patients' homes. The EU-funded project SAPHIRE [1] (IST-27074) aims to establish a framework for intelligent monitoring to increase efficiency in healthcare. Both pilot applications (hospital and homecare scenario) are being tested on patients who suffered from an acute myocardial infarction (AMI). The hospital scenario covers the sub-acute phase of the treatment, whereas the homecare scenario is focused on rehabilitation and secondary prevention.

The SAPHIRE system

The homecare scenario of SAPHIRE offers a platform for tele-rehabilitation of cardiac patients by providing a modified ergometer bike and a set of wireless sensors (3-lead ECG, SpO₂, and blood pressure) to facilitate a safe and supervised training that emulates and continues the exercise experienced in the rehabilitation clinic. The patient communicates with the SAPHIRE system by using the touch screen of a Panel PC that has been mounted on the ergometer. The PC also controls the ergometer bike, gathers and analyzes sensor data received via Bluetooth, and serves as gateway between the patient's home and the rehabilitation clinic. The modified SAPHIRE ergometer is shown in Fig. 1. Analysis of the ECG data is done by a commercial third-party component. The homecare scenario shares the sensor platform that was implemented for the clinical scenario and was implemented using OSGi [2] technology. OSGi, a Java-based service platform, was chosen because of its advantages in the deployment and maintenance phase of the project, as it allows components to be updated automatically during runtime.



Figure 1. The SAPHIRE ergometer

Exercising with the SAPHIRE system

A patient using the homecare application SAPHIRE system is instructed in the rehabilitation clinic, where several reference trainings are conducted to determine the parameters for the patient's training program, including the patient's workload and the thresholds for blood pressure, oxygen saturation, and heart rate. This exercise testing is done in accordance with guidelines such as [3].

After the ergometer system has been started up and the patient identified, the most recent version of the training program is downloaded from the clinic as soon as the patient allows the connection to the clinic to be established. Before the actual training session starts, the patient answers a number of questions about the current status and the experience during and after the last session that are used to determine whether or not the patient should be exercising today. The answers also help the clinician to interpret the sensor data gathered during the training session. If the patient's answers indicate that the training can begin, the system guides the patient through the process of attaching the sensors. Once the sensors are attached and activated, a measurement in rest is taken and compared with thresholds defined by the treating physician. If the measurement is within the limits, the patient can start the exercise. Depending on the training mode, the resistance is changed to meet a load profile defined by the physician, or it is adapted to meet a defined target heart rate. During the training, SpO₂ and ECG are analyzed continuously, and the blood pressure is measured at specified intervals. If the ECG indicates an adverse cardiac event, or if the blood pressure or SpO₂ are outside the limits defined by the physician, the system either lowers the workload or aborts the training, depending on the severity of the transgression. By pressing a yellow or red button on the screen, the patient can also lower the workload or abort the training. In either case, an alert message is sent to the treating physician in the clinic. After the training session ends, the patient answers questions that are similar to those asked before the training. These answers, as well as the sensor data, are compiled in a report that is sent to the rehabilitation clinic to be validated by the treating physician. Sensor data, the patient's answers given before and after the training, as well as the perceived rate of exertion (RPE) specified by the patient allow the physician to modify the patient's training plan to match the patient's progress.

First Results

Patients who have experienced ergometer training at home using a programmable chip card with a customized training program were satisfied

with the technology and showed high acceptance and motivation. No problems or MACE (Major Adverse Cardiac Events) occurred during the exercise sessions, and the patients showed satisfactory progress comparable to the progress in [4]. SAPHIRE removes the necessity of exchanging chip cards and allows a tighter control of the patient's status and progress. In addition to the daily reports, the physician can monitor ongoing training sessions, adding a similar level of supervision that patients experience during the latter phase of their stay in the rehabilitation clinic.

Conclusions

A system like SAPHIRE can be an important tool for tele-rehabilitation of cardiac patients and secondary prevention. The length of the expensive in-patient phase can be shortened, allowing the patients to return to their familiar surroundings sooner, without diminishing the quality of care or making safety trade-offs. During the out-patient phase and beyond, the patient takes a more pro-active role in fighting their cardiovascular disease. During the SAPHIRE project, the hospital and homecare scenarios were separated because of practical considerations. However, the SAPHIRE system as a whole would allow an integrated scenario, beginning with the sub-acute phase of the hospital scenario in a long-term scenario that also covers rehabilitation and secondary prevention. Since virtually any guideline can be executed within the SAPHIRE system, an expansion of the mission scope is possible. This would enable tele-rehabilitation for patients with chronic heart failure (CHF), or the management of chronic diseases like diabetes by adding (or exchanging) sensors.

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Cardiological Diagnosis Network (CARDIODIAGNET)

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Abstract: Cardiovascular diseases represent nowadays a major social and economic impact in EU and recent new EU member countries, being the leading cause of death in developed countries. The main concept of the project is to create and promote a clinical and a telemedicine network, named **CARDIOLOGICAL DIAGNOSIS NETWORK (CARDIODIAGNET)**, for acute and chronic patients with cardiovascular diseases. Also this network must offer the possibility to be accessed by various physicians, such as specialists and family doctors or other persons involved in health care. The clinical activities are proposed to be organized in the structure of an outpatient department, included in the structure of a district or regional hospital (i.e. in Romania, Emergency County Hospital Timisoara) for each specific country that will join this network. **CARDIODIAGNET** is proposed to be an efficient outpatient department for the clinical assessment of the patients and a space for researches in the field of non-invasive cardiology, with main focus on clinical cardiology, ECG signal processing, vascular diseases assessment and telemedicine, specifically telecardiology.

In the **CARDIODIAGNET** project we propose to involve partners that are separated geographically by great distances. This type of telemedicine projects have the advantage to offer the possibility to provide healthcare and continuous medical education, including e-

learning to people at their site, avoiding in some measure the mobility of patients and doctors. CARDIODIAGNET was designed to be a functional solution in clinical cardiology decision, to be a tool for a better diagnosis. Implementation of this solution could be the chance for a better healthcare in many European and Non-European countries.

Cardiovascular diseases represent nowadays a major social and economic impact in EU and recent new EU member countries, being the leading cause of death in developed countries. Similar cardiovascular epidemiology aspects are noticed in new EU member countries, like Romania. Another increasing social and economic phenomenon noticed in the last decade consists in human mobility. Telemedicine projects have big qualities that consist in removing barriers between peoples, countries and regions. Our project reflects the possibility for interregional telemedicine cooperation between Romania and other countries. Timisoara, an important city in the South-West region of Romania, near to main European cities as Vienna, Budapest, Belgrade or Milan, Munich has the human resources to participate in this project by two main poles: the Cardiology Clinic of the Emergency County Hospital and the Polytechnic University of Timisoara. The main concept of the project is to create and promote a clinical and a telemedicine network, named CARDIOLOGICAL DIAGNOSIS NETWORK (CARDIODIAGNET), for acute and chronic patients with cardiovascular diseases. Also this network must offer the possibility to be

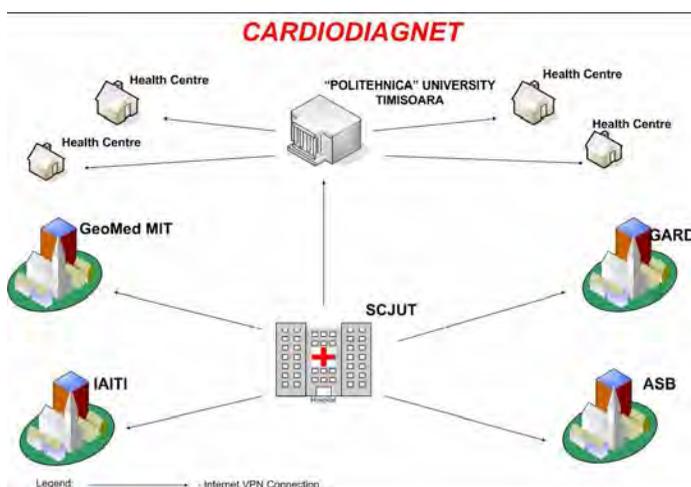


Fig.1 The architecture of the CARDIODIAGNET project

accessed by various physicians, such as specialists and family doctors or other persons involved in health care.

The main focus is on the novel methodologies for diagnosis in non-invasive cardiology (i.e. ECG) signal analysis using wavelet transform, heart rate turbulence) and the utility of developed software for sound and data signal processing, cardiovascular related signals data bases and data analysis.

A consortium of 7 partners has been formed with complementary expertise in:

- ECG and heart murmurs signal processing;
- Wavelet Analysis and/or Neural Networks;
- Image based CFD of cardiovascular flow;
- Software development and system integration;
- Research in image processing and neural networks;
- Developing pre-processing algorithms for ECG signals and heart sounds;
- Cardiovascular related signals data bases and data analysis;
- Database management system to archive signals and images.

The partners are as follows:

1. Emergency County Hospital Timisoara, Romania
2. Institute Agilus for Innovation in Information Technologies, Matosinhos, Portugal
3. GeoMed MIT, Matieland, South-Africa
4. Department of Mechanical, Materials Science and Engineering 31C Archbishop Kyprianos, Limassol, Cyprus
5. GARD Ltd, Holon, Israel
6. S-IN Soluzioni Informatiche Vicenza, Italy
7. University “ Politehnica” Timisoara, Romania

In the CARDIODIAGNET project we propose to involve partners that are separated geographically by great distances. This type of telemedicine projects have the advantage to offer the possibility to provide healthcare and continuous medical education, including e-learning to people at their site, avoiding in some measure the mobility of patients and doctors. Despite this physical barrier, telemedicine projects brings together specialists from different domains (medical, IT) and cultures.

The possibility to record and to share biomedical signals of patients in various clinical conditions and the solutions offered by tele or video consulting will improve the quality of health care for many patients.

The CARDIODIAGNET project will be oriented in the following main fields:

- Clinical cardiology, in which we propose to introduce novel techniques (i.e. by developing pre-processing algorithms for ECG signals and heart sounds, implementation of digital filters for both the ECG and heart sound data) of assessment of heart murmurs;
- ECG signal processing, using wavelet techniques and time-frequency methods for identification of ECG signals components in various cardiovascular diseases as myocardial infarction and arrhythmias;
- Spectral analysis of the ECG signal;
- Telemedicine units for rural clinics and family doctors.

Using a user friendly platform it will be possible to transmit biomedical signals like ECG, echocardiographic signals and 2D vessels echo-graphic signals, from the data record position to the partner centers.

Another objective of this project is the assessment of patients with deep venous thrombosis and pulmonary embolism, by performing 2D echocardiography and Doppler examinations with the possibility to transmit the images over the Internet in real time, or to be stored for later transmission using a virtual private network between the partners of this project, that will be developed in the future.

Telemedicine offers the possibility to increase the role of physicians, by direct dialog person-to person, using modern IT techniques, like internet, tele-consulting, videoconferences and, not at last, offers to the patients the possibility to achieve a universality of the health care.

CARDIODIAGNET will be conceived to satisfy the following criteria:

- **Non-invasive:** information will be acquired through non-invasive methods (ECG, electronic stethoscope, echocardiography and 2D vessels echography)
- **Open architecture** – it will be possible to upgrade the system by adding or replacing components with new ones, once available on the market
- **Advanced and adaptive decision support capability** – classical signal analysis techniques will be integrated with new ones (i.e. wavelet analysis, neural networks, image processing).

The primary objective of this project is to deploy the CARDIODIAGNET services in the countries involved in this project. During this project we propose to implement a complex non-invasive cardiology service that will deploy ECG and heart murmurs analysis, vascular echographic signals analysis, and we will create a tele-cardiology network using a virtual private network between the partners of this project. The communications between the partners will be performed using a virtual private network, with the possibility to be open to further partners. In the first stage of the project we

will have as objective the coordination of the partner centers. The implementation of standards in transmitting ECG signals and X-ray images is one of the main objectives of this project.

Signal processing will include the implementation of existing software or new software at the site of each partner. The main focus in signal processing will be the ECG signal recorded in mainly 3 sites. The ECG signal analysis will be performed by the following partners: SCJUT (Romania), GARD (Israel) and GeoMed MIT (South-Africa). Also we propose to perform heart murmurs analysis using specific software that will be implemented by GeoMed MIT. Cardiac diseases as heart failure, cardiomyopathies and vascular diseases will be assessed by analyzing 2D echographic cardiac and vessels images. The cardiac and vascular assessment and blood flow analysis will be performed by ASB (Cyprus). All this biomedical data will be recorded using specific tools and software. The communication between the partners in the project will be performed on web based portal with software for telecardiology. During telecardiology sessions we will use the HL7 protocol for ECG signal transmissions and DIACOM protocol for transmitting X-ray images. The second important objective of the project consists in creating a telecardiology platform in which we will provide tele-counselling, video-conferences, transmissions of data online and asynchronous. The project will provide:

Tele-counseling in which hospital specialist will request the opinion of tertiary hospital specialists on a clinical case;

Asynchronously (secure e-mail type interaction): The requesting professional sends the query to the tertiary hospital specialists and waits for a reply. The maximum delay in replying to a query must have been agreed beforehand between the requester and the tertiary hospital. Both the request and the counselor's answer make use of standard forms, agreed among all the actors involved in the tele-counselling. Such forms must contain all the clinical and anamnesis information needed to provide effective feedback through tele-counselling.

Interactively (through video-conferencing facilities): In this case, the healthcare professionals can talk and see each other and thus share information about the patient.

E-learning – through video-conferences: In this case specialists in medical or IT field will interact with various specialists and participants from other sites than the partner centers.

Shared clinical records - A referring general hospital specialist and tertiary hospital specialists will have access to the same set of patient's clinical records during a virtual referral or during the entire stay of the patient in the tertiary hospital.

E-Health - the CARDIODIAGNET project aims at building a reliable software tool to support health professionals in taking promptly the best possible decisions for diagnosis and treatment. Another important schedule in the development of the CARDIODIAGNET project will be the development of software modules to aid in future diagnosis:

- Automatic extraction useful pathological symptoms from patient's data recorded (medical history, treatment, ECG, Echo...).
- Analysis of patients' data to find possible new patterns correlated with different stages of diseases.
- Automatic probabilistic estimation of patient's diagnosis and treatment prognosis based on
- Personal data analysis.
- Probabilistic estimation of risk and impact on patients' cardiovascular system.

The database (including images and biomedical data) of the project will be managed by GARD and S-IN partner centers. Also it will be a process for the development and customization of the database.

Telemedicine and strong links with reputed specialty centers of excellence could represent for a hospital an extremely important competitive edge compared to other hospitals. This could be enough of a driver for individual hospitals to deploy telemedicine services.

Therefore, the project will have, as a result, the development of a healthcare network between the Cardiology Clinic of the Emergency County Hospital Timisoara (Romania) and various medical centers or research centers.

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Studying Factors in Telemedicine Sustainability

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Abstract: This paper describes a post-graduation study to identify the key factors for sustainability of telemedicine projects in Brazil, its methodology for measuring results into categories and show them as indicators of sustainability based on a *gold standard* established from a qualitative study we are running with different initiatives within Brazil.

Introduction

Recent systematic review for the efficacy of telemedicine [1], reported that there is still a lack of evidences for it. We believe that this result, among other possibilities, is explained by the fact that many projects are launched but are not sustained over reasonable length of time to prove their efficacy. Therefore, we have decided to study the probable determinant factors to a telemedicine service to be continued. And based on this study we will propose a management strategy adapting some concepts first proposed by Kaplan and Norton on their Balanced Scorecard – BSC [2]. The objective of this study is to identify which are the key factors, create a systematic method of measuring their results into categories and show them as indicators of sustainability based on a *gold standard* established from a qualitative study we are running with different initiatives within Brazil. [3].

Methodology

Literature review was done followed by a definition of the key factors for the sustainability of telemedicine projects. In fact, we have found thirty-six factors, which were separated into seven different categories as shown in Table 1. To build the survey questionnaire some multidisciplinary professionals have been consulted with an appropriate methodology. The Delphi technique has helped us. At the moment, the survey is being cared out. However, we have already done the majority of the interviews; the study must be conducted until the end of 2008 to be finished.

Table 1. Multi-perspectives of the Telemedicine Sustainability

	Perspectives
1	Institutional
2	Functional
3	Scientific
4	Economic-Financial
5	Renovation
6	Social Well Being
7	Relational

Preliminary Results

At the moment, we have some preliminary results from the interviewed centers, which are still unpublished [3]. An example follows on the Fig. 1. Additionally, it is included the created range of sustainability indication. Table 2.

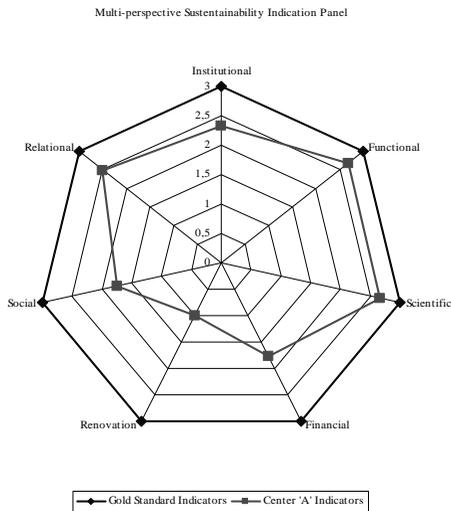


Fig. 1. An example of the Multi-perspective Sustainability Panel

Table 2. Ranges of Sustainability Indication:

Type	Range	Polygon Area	Sustainability Indication	Recommendation	Interviewed by now
A	28,88 – 38,50	76 – 100%	High performance – probable sustainability	Maintenance of the praxes.	4
B	19,26 – 28,87	51 – 75%	Medium Performance – need of concepts review.	Take a look at the alert signs on the general panel.	5
C	09,63 – 19,25	26 – 50%	Low performance – low probability of sustainability	Review of the general commitment with the project and plans.	none
D	01,00 – 09,63	0 – 25%	Under low performance – no sustainability at all	Should end the project	none

Conclusion

Even though reports and published studies have been consulted to identify key factors to a sustainable telemedicine service, we consider that a study should be set out to examine our own territory to concern a perspective from Brazilian groups of professionals involved. The utility of this study is to be seen from the point of view of the health service administrators as a possible manner to organize initiatives and help the eHealth and teleHealth strategies for the future.

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Telemedicine for HIV/AIDS Care in Resource-Limited Settings and Users' Satisfaction

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Abstract: We hereby present the results of a users' satisfaction survey done by the Institute of Tropical Medicine, Antwerp (ITMA) to evaluate the clinicians' perception of a hybrid e-mail/web based teleconsultations system. The aim of the ITMA Telemedicine service is to facilitate the scaling up process of HIV treatment and care in developing countries, through remote consultations supporting physicians working in low resource settings.

Introduction

In 2003, the Institute of Tropical Medicine in Antwerp (ITMA) set up a hybrid web/e-mail discussion forum, accessible on a medical website (<http://telemedicine.itg.be>), to support and guide physicians working in resource-limited settings in the medical decision-making and management of HIV/AIDS difficult cases.

In a four-year period this program offered almost 650 teleconsultations to clinicians located in 35 different countries, mainly resource constrained ones. Patients' clinical data (laboratory findings, x-rays, and other components of the medical record) are sent to the ITMA Telemedicine system through a web- or e-mail-based format for a second opinion advice: a network of HIV/AIDS specialists or expert in other specialties (dermatology, ophthalmology, radiology, cardiology,) is available to discuss the clinical cases and formulate a final advice which is returned to the field by an administrator.

Methodology

A total of 642 teleconsultations were carried out between April 2003 and March 2007: 75% of the teleconsultations directly supported management of complex medical problems in a new patient, while 25% were more questions in the field of organization of health services for HIV prevention, treatment and care (Fig. 1).

In 47% (n = 299) of cases the second opinion request was related to the general use of antiretrovirals (ARVs), ARVs side effects, second line antiretroviral therapy (ART) options, prevention of mother-to-child transmission (PMTCT), immune reconstitution syndrome (IRIS), TB/HIV and management of other co-infections during ART; in 40% (n = 262) of the cases the request was related to the diagnosis and treatment of specific opportunistic infections (OIs) and 13% (n = 81) to the general topic of HIV services organization.

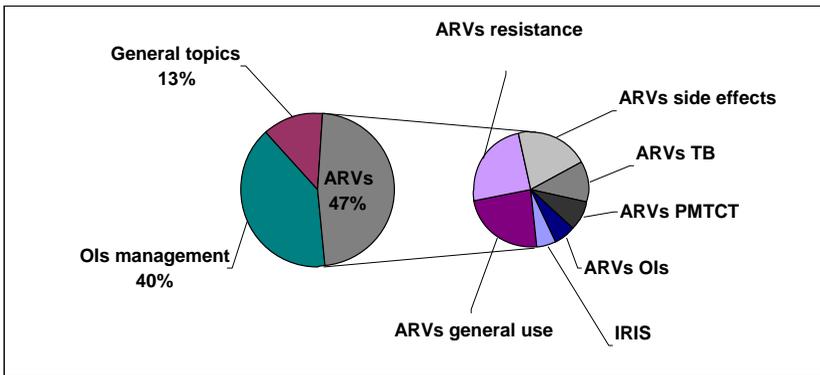


Figure 1. Telemedicine referrals (n = 642); April 2003-March 2007
 ARVs: antiretrovirals; IRIS: Immune Reconstitution Inflammatory Syndrome; OIs: Opportunistic Infections; TB: tuberculosis; PMTCT: Prevention of Mother-to-Child Transmission

In these 4 years of ITMA Telemedicine service a significant increase in the proportion of teleconsultations related to organizational issues of HIV programs and HIV drug resistance has been noticed, while the opposite has been observed for questions on general use of antiretrovirals, mirroring the change in problems clinicians working in HIV/AIDS care are facing while ART programs mature.

Users' satisfaction survey

In July 2006 and January 2008 a standardized questionnaire (either web-based anonymous, Fig. 2, or as format e-mail attached) has been sent out by e-mail to the members of the Telemedicine discussion forum in order to assess the clinicians' perception of this service.

TELEmedicine

General Cases/Questions Discussions Education Links Search Events RefJournal News Questionnaire

You are logged in as adminforum Logout

Questionnaire

Telemedicine website users' satisfaction Institute of Tropical Medicine, Antwerp (ITMA)

QUESTIONNAIRE

This questionnaire aims to gather information from the members of the ITMA Telemedicine website on the clinical perception and acceptability of using the ITMA Telemedicine service in the field. The collected data should help to optimize this service in order to meet the needs in the field.

All information will be handled strictly confidentially.

1. How did you hear about the Telemedicine website?

- ICAMT or another ITMA source
- Internet
- Conference
- Information from a colleague
- Other, please specify: _____

2. Why did you subscribe to the discussion forum?

- To submit cases/questions
- Curiosity
- To be aware of other way to manage patients
- To learn from others' experiences
- To explore the technology
- Other, please specify: _____

3. Have you submitted questions/cases to the telemedicine discussion forum?

Figure 2. Users' satisfaction questionnaire

The members were divided in “active users”, participating in the discussion forum, and “passive users” (clinicians who consulted the telemedicine forum but did not post clinical cases and/or questions on the forum). In July 2006 the questionnaire has reached 205 members of the discussion forum and in January 2008, 182 new members. The discussion forum is a dynamic community where the users are numerically a third of the subscribers (Fig. 3).

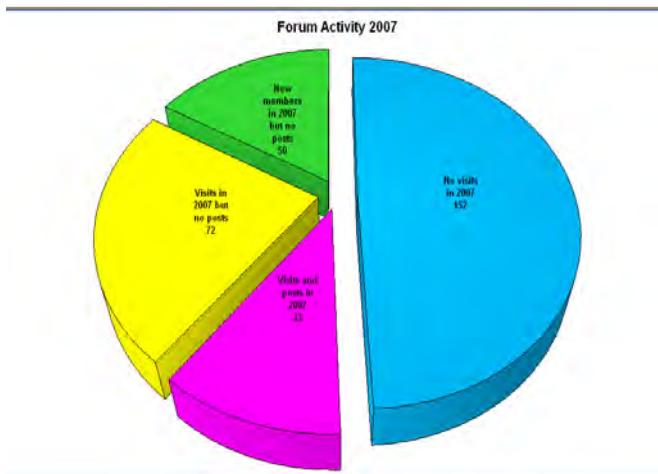


Figure 3. Telemedicine discussion forum members, year 2007

The overall response rate to the survey has been 19% (72 questionnaires returned out of 387 delivered). Out of these 72 respondents, 38 (53%) were

active users: these clinicians reported that the service influenced the management of the patients in 94% of the cases and they perceived that the advice has been beneficial for several reasons and particularly for the establishment of the diagnosis (61%), for the referring clinician's education (42%) and reassurance (24%).

The other 34 respondents (47%) were "passive users". The main reason to subscribe to the discussion forum for these "passive users" has been to learn from others' experience (22/34) and to be aware of other ways to manage patients (20/34).

Conclusions

This users' satisfaction is conceived as a part of a continual assessment of the first ITMA Telemedicine service. Despite the slight number of replies, the overall perception and acceptability of this service in the field seems encouraging in terms of feasibility. It has been anyway very difficult to plan an assessment of such kind service and to evaluate its impact on health outcomes as no direct effect can be measured in terms of quality of care, cost-utility or accessibility to patients' health. We fear that clinical effectiveness (reduction of mortality or morbidity) is a resultant of many components moreover in low resource settings and that the benefit of this project can only focus on users' perception.

Acknowledgment

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Telemonitoring – the Intelligent Solution for Chronic Patient Care

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The demographic situation, with a clear international trend towards a society largely populated by the aged and the chronically ill (with an earlier onset of chronic illness), presents a huge challenge to the resources of the global healthcare system. It is evident that existing structures and processes cannot provide an adequate qualitative and quantitative response to the problem – innovative patient care systems are the only way forward in a fast-changing world.

This is especially true when considering how best to deal with chronic ailments such as coronary heart disease, cardiac insufficiency, asthma/COPD and diabetes with its numerous, debilitating manifestations (unhealing wounds, diabetic foot syndrome etc.). Integrated patient care concepts offer the most promising solution – in Germany a new law governing the modernization of the public health system makes provision for interdisciplinary healthcare systems combining inpatient/outpatient/rehabilitation models. This is where the strategic significance and practical advantages of telematics as practical application of modern telecommunications and information technology in the field of healthcare lie - whereby “eHealth” encompasses all healthcare services, quality improvements and cost-optimizations which can be achieved through the implementation of modern means of data acquisition/management/communication.

Digitalized data allows for faster, secure and more efficient healthcare knowledge transfer together with networked data access and an altogether better quality in the field of diagnostics, therapy management and post-treatment care.

Rapid technical progress, with the development of ever-more efficient logistic frameworks, allows for the creation of an efficient telemedical system for optimized patient service and interdisciplinary patient-physician-hospital-rehab-homecare data flow - a system where all the healthcare players strive for concerted action to the benefit of the patient, bringing about tangible cost reductions at the same time.

Methodology e.g. in the field of cardiology

The advantages of telemonitoring can be made transparent by examining applications in the field of cardiology. Such applications are now well-established and the associated benefits scientifically and economically documented. They safeguard the health of the patient at high risk of ischemic events or heart-rhythm disorders, and find use in the therapy-management field for chronic heart-insufficiency patients. Heart of both scenarios is a central Telemedical Service Centre (TSC) with cardiologists and specially-trained medical personnel on call 24/7 [1]. In an emergency (e.g. with acute cardio-pulmonary symptoms), networked information between general practitioner, paramedic and specialist can be of life-saving importance. The relevant clinical data is grouped in an electronic patient record managed by the TSC. The patient is registered with the TSC on the basis of clear indications by the healthcare professional concerned - whether GP, specialist or clinic. A benchmark-ECG of patients at high risk is taken as yardstick and the patient is instructed in the use of the appropriate Tele-ECG instrument (1-channel, 3-channel or 12-channel ECG device) for the telephonic transfer of the relative ECG data. The patient at high risk from ischemic events can therefore **manually** monitor his condition and transmit the ECG data 24/7 to a dedicated healthcare structure staffed by cardiologists who can compare the latest ECG with the benchmark ECG, draw the appropriate conclusions in real time and initiate patient-specific emergency rescue procedures as needed.

The patient suffering from chronic heart insufficiency presents a different scenario. Here, the patient **automatically** transmits a range of biosignals (body weight, blood pressure, blood oxygen saturation levels) to the TSC, where this data is compared with patient-specific threshold data – should the current data deviate from these standards, the system activates alarms and counter-measures can be immediately initiated.

In both instances, the patient is additionally pro-actively monitored by the TSC and provides valuable information concerning the quality of life, response to medication and frequency of physician contacts. Here, the aim is to improve patient compliance in terms of timely medication intake with a view to recognizing changes in patient condition as early as possible. Another valuable function of the TSC is to increase patient awareness and thereby help to achieve a better quality of life through correct nutrition, exercise and medication intake - an informed patient is tendentially a healthier patient. In keeping with a trend towards growing patient empowerment, the patient can access his own electronic medical records and assume more responsibility for his condition. The cost-bearing entity

(e.g. medical insurance) may also access similar data in order to evaluate the quality of treatment and the associated costs (frequency of emergency assistance, hospital treatment, time off work etc.).

In this respect, Telemedicine can - as integral component of an overall therapeutic strategy aiming to streamline the flow of information - improve diagnostic quality, coordinate individual therapies, rationalize costs and optimize patient-physician-hospital communication (see illustration 1).

Of course, the telemedical system must be structured in an open, modular way so as to allow for various different disease-specific scenarios.

The TSC must - as central institution within this concept - be officially certified in order to guarantee quality throughout the process [2].

Current data

An evaluation of international studies (mainly from England, USA, Australia and Sweden) confirms the effectiveness of telemonitoring for chronic patients [3]. In Germany, recent medical and financial data reasserts the particular validity of the concept for patients with chronic cardiovascular insufficiency - this is the only heart disorder with a growing number of patients: in Germany alone, 200 000 new patients are registered annually.

Uninformed patients, unsatisfactory compliance and ineffective medication therapy - together with inadequate levels of information concerning the patient's health - are factors contributing to a very high rate of re-hospitalization. On average, such heart patients remain more than 2 weeks in hospital and consequently 2.7 billion Euro is spent every year for the in-patient care of chronic cardiovascular insufficiency patients.

The largest random research project conducted so far in the field of chronic cardiovascular insufficiency has confirmed that patient participation in a Disease Management Programme (DMP) led to an appreciable decrease in mortality amongst those suffering from symptomatic systolic congestive heart failure [4]. An electronic biosignal transfer by telephone led to a further reduction in mortality and, tendentially, to a reduction in in-hospital times [5]. Data revealed that the rate of hospitalization decreased by 55%, that the in-hospital times were reduced by 60% and that the number of unproductive physician contacts dropped by approx. 70% [6]. Resulting from optimized compliance a better adherence to guideline-oriented medication could be demonstrated when compared to control. In many cases in the NYHA classes II – IV the patient-specific upper/lower blood-pressure/body weight/blood oxygen saturation level thresholds were exceeded and triggered an alarm at the TSC. A number of patients proactively contacted the TSC to report acute cardio-pulmonary symptoms,

but hospitalization ensued in a very small number of cases and approx. 10% of callers were referred to their physician of hospital for further assistance.

A cost/effectiveness appraisal (Markov model) clearly confirms the efficiency of telemedicine applied to heart insufficiency patients. Relevant criteria is the cost of treatment with/without telemonitoring, and success is defined as the avoidance of hospitalization over a period of 180 days. For statistical comparison groups were matched with regard to NYHA class, comorbidities, age and gender. The success rate for the non-telemedicine-patients reached 59% - the telemedicine patients achieved 75%. The effectiveness-adjusted costs amounted to €6.397 for the non-telemedicine patients – or €3.065 for the telemedicine patients. This conclusively proves the efficiency and cost-effectiveness of telemedicine from the perspective of the GKV compared to conventional patient-care concepts [7].

Telemonitoring of chronic cardiac insufficiency patients significantly reduces the rate of hospitalization, the in-hospital times, the number of unproductive physician contacts and the re-hospitalization rate. Despite the system immanent costs and the increased costs incurred through a consistent pharmaceutical therapy. Telemedicine makes solid economic and medical. At the same time, improved compliance is a result of patient information programmes aiming to improve patient consciousness and self-management – leading to improved quality of life together with better patient safety.

Success or failure of telemedical service concepts is not merely a question of economic improvement for the cost-bearer, but also a question of acceptance by the patient. A self-assured patient is essentially more demanding and expects a more customer-friendly approach on behalf of the healthcare institutions – long-term patient acceptance is an eminently important factor for the success of telemedicine. This aspect transcends monetary considerations – active patients play a most important role in evaluating, developing and spreading innovative medical solutions.

Results of recent studies conducted by the Technical University, Berlin, clearly show that acceptance of telemedical services by patients and physicians alike is very high [8]. A majority of patients feel significantly less at risk, better taken care of, better able to cope with illness-generated anxiety and confident of receiving faster and more effective help in a medical emergency. A small number (15%) expressed concern that the personal contact with their physician might suffer. This data was generated by 460 patients who took part in the “Successful Telemedical Service Concepts“ study initiated by the Ministry for Public Education. Their physicians also expressed great satisfaction – 80% were convinced that the patients are less exposed to risk, 60% meant that the quality of medical care

is significantly improved and every second physician attested that the patient's compliance underwent a marked improvement.

These German results are confirmed by early systematic reviews and meta-analyses [9, 10] and are taken into account in the Health Technology Assessment „**Monitoring of cardiac functions by telemetry**“ [11].

The results clearly illustrate the benefits of telemedical monitoring through improved efficiency and a simultaneous reduction of costs. The “Telemonitoring” white paper sums up the benefits as follows:

- Improved safety, mobility, quality of life and quality of health of the individual patient;
- More effective medical care due to better diagnostics and optimized, coordinated therapeutical strategies;
- Reduced healthcare costs, e.g. due to fewer emergency calls, less frequent physician visits and fewer hospitalizations;
- Optimized flow of information between patient, physician and healthcare institution;
- Standardized, cost-effective and efficient therapeutic processes;
- Better quality of data, greater transparency and valuable inputs for medical research projects;
- Positive effects for Germany as an economic force and home of medical innovation, e.g. self-powered medical sensors;
- Higher acceptance of innovative medical products, economic growth and workplace security;
- An important contribution towards the solution of the healthcare challenge arising from an aging population;
- New applications for the mobile UMTS telecom standard;
- A conduit to the electronic patient file.

Perspectives

The structuring of patient-physician interaction in integrated patient care schemes without rigid interdisciplinary barriers will play an ever stronger role in improving healthcare efficiency and quality. Without the help of data processing and telecommunications technology, this would pose an insormountable logistic problem. Needless to say, the implementation of modern means of telecommunication to bridge the physical distance between patient and doctor will invariably lead to intensive discussions concerning implications and consequences – objections must be countered by founded scientific argumentation. Data security, operational and legal responsibility of the individual „players“ must necessarily be taken into account. Telemonitoring must be perceived as „enabler“ within a change-

management process, as technology at the service of the people and their individual needs. This is fundamental in creating the necessary acceptance for the telemedical solution as a means of attaining a higher quality of medical service to the patient and, at the same time, a reduction in cost and workload for the healthcare professional.

A combination of bundled data, respectfully used for the patient's benefit, together with advanced IT and telecom technology, is a precondition for „evidence-based practice“ and leads to an efficient healthcare system. Patient-oriented technology will not replace - but improve the quality of - the patient/physician relationship and foster patient self-management and active therapy participation; up-to-date instruments will help to intensify the patient-to-doctor relationship and put the patient's best interests at the centre of the healthcare universe to everyone's benefit.

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Illustrations

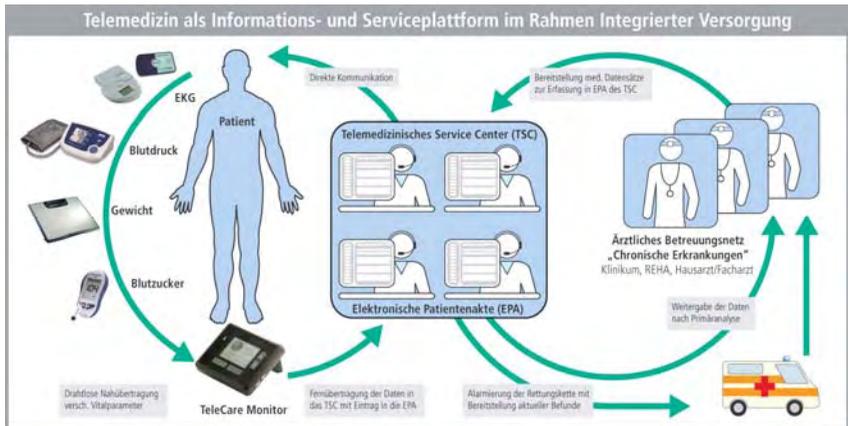


Illustration 1: Schematic overview illustrating a telemedical patient care concept characterized by interaction between patient, physician, hospital, cost-bearer and technical service provider. Telemedicine connects them all and serves as information and service platform for collecting and transmitting data.

Telephone Hotline Service (THS) for Children and Adolescents with Type 1 Diabetes as a Strategy to Reduce Diabetes-Related Emergencies and Costs for Admittance

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Abstract: In 2001 we introduced a 24-hrs 7-day-a-week toll-free TSH service and specific guidelines to help the patients at home to reduce the risk of diabetic ketoacidosis progression during intercurrent illnesses. In 5 years study, 20,075 calls were recorded, equivalent to an average of 11 calls per day. Fifty-two per cent were veritable hot-line calls. Thirty-nine per cent came from Parma area and the remaining 61% from elsewhere in Italy. Eighty-nine per cent of the veritable hot-line calls have concerned the management of diabetes during an intercurrent illness. Thanks to THS, the admittance to hospital because of a DKA acute illness-related fell from an average of 10 cases per 100 children per year in the Nineties to 3 cases per 100 children per year in 2001-2006 period. The costs for admittance decreased of 60%. For THS support the Parents' Association for Diabetic Children and Adolescents paid an average of 2,302 € per year. THS showed to be an useful way to provide a continuous help to families in the management of diabetes in some critical situations. THS provided an important decrease in hospital admissions too.

Key words: Type 1 Diabetes, hotline, telephone care

Introduction

Diabetic ketoacidosis (DKA) is an acute complication that affects many children and adolescents with type 1 diabetes (T1D) during an intercurrent illness, resulting in a significant human and economic toll.

In this critical situation the parents of a child with T1D urgently need to contact a physician for managing this emergency. Medical care often fails to meet the needs of chronically ill patients, even in integrated delivery systems.

It has been tested that this complication may be effectively managed using the phone technology, accessible today to a lot of people. A pilot project in this field has been implemented at the Regional Centre for Children and Adolescents with T1D of the University Hospital of Parma, Italy.

The idea to promote this service dates in the Nineties in which we showed that most episodes of Diabetic Ketoacidosis (DKA) at onset could be prevented using an educational approach targeted both to school personnel and physicians, just supported by a toll-free THS (1). Encouraged by the goals of this experience, THS was extended to all parents of the patients attending our Centre in order to help them to directly manage at home an intercurrent illness. The results were beyond all expectations.

Subjects and Methods

The study carried out from 1st January 2001 to 31 December 2006. At the beginning, diabetes care was provided at our Center for 341 children and adolescents, but the number increased during the study with a rate ranging from 15 to 21 per year due to new diagnoses. Finally, the total number of children involved in the study was 421 (mean age 10.8 ± 3.8 [range 2.1-19.8]; mean duration of diabetes 4.5 ± 3.5 years [1 month to 16.1 years], mean HbA1c value 7.2 % [4.8-12.3])

The THS was planned as restricted to Parma area, but being the only telephone care for children with T1D available in Italy, it came to cover a larger area with thousands of virtual users.

The system adopted in Parma was a *Multititer system* by which the easy calls are managed by a group of first line workers while the most complicated ones were allocated to more experienced health professional people. The THS run during working hours from Monday to Saturday; on Sunday, during holidays and nights the paediatricians and residents on duty in the Department of Paediatrics were requested to answer on behalf of diabetological team.

THS was supplied with software in order to facilitate and standardize operators' answers. The software was developed in 100 screen-pages (corresponding to 100 questions and replies) on which the operators could navigate by links on the basis of callers' questions.

All fees for the toll-free telephone number functioning have been charged by the Parents' Association for Diabetic Children and Adolescents of Parma.

At the time of this experience, the admission rate to Parma hospital of children with a DKA intercurrent illnesses-related ranged from 6 to 13 cases per 100 children per year, resulting in a total cost of €34,000 per year.

Results

From 1st January 2001 to 31 December 2006, 20,075 calls were recorded, equivalent to an average of 11 calls per day. Fifty-two per cent of them were veritable hot-line calls. Thirty-nine per cent of the total calls came from Parma area and the remaining 61% from elsewhere in Italy. Eighty-nine per cent of the veritable hot-line calls concerned the management of diabetes during an intercurrent illness. Thanks to THS, the admittance to hospital because of a DKA acute disease-related fell from an average of 10 cases per 100 children per year in the Nineties to 3 cases per 100 children per year in 2001-2006 period. The costs for admittance decreased of 60%. For the veritable hot-line calls (n.10,037) the Parents' Association for Diabetic Children and Adolescents paid an average of 2,302 €/per year.

The emergency calls were received in the morning (25%), in the evening (59%) or during the night (16%). The calls due to hypoglycaemia episodes were 11% and were specially performed during the night: only 1.6% concerned a severe event with convulsion (31 calls) or emiparesis (4 calls).

Forty-five per cent of calls were no-emergency calls and concerned: Hypoglycaemia prevention (36%), quality of life (19%), and fear for diabetes-related complications (15%). Three percent of the calls were attributed to myth maniac people.

The veritable hot-line calls were from young people with a short duration of diabetes. On the contrary, the no-emergency calls were prevalent in older people with a longer diabetes experience.

Conclusions

Telephone care system used in Parma area showed to be an effective tool to provide a continuous support for patients and their parents in the management of diabetes during an intercurrent illness, directly at home. These facilities allowed Parma Hospital to save thousands Euros in admittance, and families of children with T1D to avoid discomforts which have been reported to negatively impact on the quality of life, to produce conflicts and to disrupt self-management behaviour.

The key-success of this THS may be attributed to 5 strength points:

- 1 Availability of a toll-free access which encouraged the users to call immediately at any time at first DKA clinical signs appearance;
- 2 The advantage to find at any time at hospital an experienced care provider in diabetes management. This equipment was achieved

thanks to the collaboration of all pediatricians, residents and nurses team working in the same department.

- The standardization of the answers from the callers by a software in which the most frequent questions were previewed, and replies were clearly showed and transmitted
- The training process at which all answers were undergone before being admitted to THS.
- The involvement of Parents' Association for Diabetic Children and adolescents which provided financial supports to carry out THS.

In addition to the support in the management of diabetes during an intercurrent illness, THS has been used by a lot of people to obtain information about T1D or practical helps in different critical situations.

After this successful experience, a THS Arabic version has been requested and edited by the Egyptian Association of Diabetic Children. This software will be set up in the hospitals of Cairo, Egypt, under the supervision of Parma Diabetic Team.

Acknowledgments

We thank the Parents' Association for Diabetic Children and Adolescents of Parma for its support in this experience, and Doctor Rossana Di Marzio for editorial assistance.

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Vitaphone Tele-ECG-Card 100 IR: Telemonitoring of Patients with Cardiac Dysrhythmia

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Tachycardial dysrhythmia, in which the major symptoms are “heart racing” and “palpitations”, often cause significant suffering for the patient but is frequently not diagnosed by the conventional means of resting or long-term ECG. ECG documentation is unavoidable for diagnostics, but the documentation is made particularly difficult with the conventional ECG procedure if the episodes occur at irregular intervals and only last for a short time. In these cases the correct diagnosis, an essential prerequisite for individualised and targeted therapy, is only made after a delay, leaving the patient to suffer the symptoms and with frequent and often useless medical appointments and the final result may often be ineffective attempts at treatment. When telemonitoring systems are used with patients with cardiac dysrhythmia, a distinction regarding the indication must be made between documentation and diagnostics. Implantable event recorders are excellent for diagnosis of syncopes that would otherwise be difficult to clarify, while external ECG recorders can be used for both diagnosis and documentation of cardiac dysrhythmia.

In this context it is notable that excellent results have been achieved with the credit-card sized device Vitaphone Tele-ECG-Card 100 IR. The advantages of this device are the availability to the patient over an extended period and the timely documentation of results by the patients themselves. Even though these devices operate reliably they are currently not much used in Germany, even though newer studies show the significant advantages of telemedical care of cardiac patients, i.e. in PAFAC (prevention of atrial fibrillation after cardioversion) and SOPAT (suppression of paroxysmal atrial tachyarrhythmias). We can clearly show that our telemonitoring system is extremely efficient for documentation and differential diagnosis of tachycardiac dysrhythmia and detect a high percentage of relevant events in the monitoring period. In addition, the connection to a telemedical centre and the immediate personal contact with the patient, which can guarantee immediate 24-hour medical help, are particular advantages. This ensures correlation of the symptoms and ECG registration and allows essential

medical action to be taken immediately while avoiding unnecessary emergency calls and hospital admissions. This aspect will become very significant in view of the increasing efforts to reduce the increasing costs in the health system.

A synoptic evaluation of the findings shows that symptoms of tachycardiac dysrhythmia can be efficiently documented and diagnosed by using the symptoms of “heart racing and palpitations”. The direct contact with the patient during the paroxysmal attacks provide a clearer correlation between symptoms and ECG records. This increases the security of the diagnosis and at the same time avoids unnecessary emergency calls and contacts with the physician.

Key words: Telemonitoring, Cardiac Dysrhythmia, Health Oeconomics

Chapter 2

Telecare and Services for the Ageing

Ambient Intelligence for the Elderly (AmIE): An Empowering Way of Independent Living of Elderly

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***Abstract:* In this paper we present the AmIE project. AmIE is a product concept for independent living of elderly people within the field of Ambient Intelligence. Within the research ‘independence’ is defined in a holistic and empowering way. The implications for the design and development of the product concept are presented in this paper.**

Introduction

The aim of the AmIE project is independent living for elderly with mild cognitive impairment (MCI) and early dementia by supporting them with an ambient intelligence application. To achieve this goal, the AmIE product we develop facilitates the work caregivers are doing in everyday life to support the elderly person with MCI or early dementia on the one hand and puts forward support tools for the elderly person on the other hand. For this the AmIE application gathers information not only from human input and conventional hardware sensors – sensors that are, for example, build into a door knob or a light switch - but also from “software sensors” – such as triggers derived from their use of domestic devices like a digital phone or new photos posted on Flickr. Although sensors and ambient intelligence are core in the AmIE product, AmIE embeds an integrated vision on empowerment and support of people with MCI and dementia and their caregivers. The AmIE product is currently in research phase. The work presented in this paper therefore must be seen as work-in-progress.

The AmIE product

The AmIE product concept works upon different areas important for the target groups defined: remembering, life-style monitoring, social contact and enhanced feelings of safety. These areas were selected on basis of research: literature research, interviews with professionals caregivers,

informal caregivers and with elderly with MCI and dementia, and analysis of existing national and international research on these topic.

The AmIE product under research therefore integrates following topics: a shared agenda between elderly and their caregivers, a life book as therapeutic and social tool for the elderly, a life-style monitoring tool that in first phase is defined as a life-style self monitoring tool, and in a later phase becomes a life-style monitoring tool for caregivers, games, video-chat, a share-your-life tool and an item locator that uses touch as interface

Currently research is done upon the seamless integration and combination of the different topics. If, and which topics, match best together in what way is researched by questioning elderly and their network of caregivers and through creating small prototypes to 'feel' what the meaning of such product concept could be.

Deconstructing the notion of 'Independent Living'

When we were looking for innovative ways to create modes for independent living for elderly, we started from a two-dimensional way of defining independent living: the degree of individual's reliance (or not) on the resources of others and the degree in which their lived experience meets their desired level of choice, sense of self, autonomy and other core values [1].

We made some important decisions to support his notion of 'independent living'. First, we put forward the notions of 'privacy, dignity, choice, autonomy, empowerment and fulfillment' as core values in our definition of independence in old age [2] and even so important in the relationship with the ambient intelligent system [3]. We distinguish our research project from a lot of other comparable projects. More often elderly persons are perceived as persons who are passive consumers of systems, and do not have the capabilities to act independently with a system. Ambient intelligence systems then seem the best solution for this target group. We, in contradiction with these assumptions, put other assumptions forward: the anxiety for losing control within the domestic space is of great importance for all, also for elderly. This leads to the decision to put the users of the system in control of the system.

Second, in the empowerment view we put central that the AmIE product will allow the enlarged caring community together with the elderly person to actually define the autonomous actions that the system can and must take when certain problems arise. The power to define actions will not lay with the installers of developers of the application, but with the elderly and their caregivers.

Third, at each supporting action which is undertaken, we look of these as best undertaken by a human or a machine. An example here is that technology can detect if a person with dementia forgot to wash him/herself for several days, didn't do enough physical exercise or didn't drunk enough water during the day and gives a signal to the caregiver to inform him/her about that. In that way the caregiver can visit the elderly person discussing the problem in a subtle, human way without neglecting the causes of the problems. We prefer this kind of solutions above alarm signs, voice messages send to the elderly person to tell them to wash him/her more often or to walk more without taking the possible reasons why it happened into account. We look for the 'best' of the two worlds; by combining the 'situated way' of human interaction and the 'planned way' of machine interaction [4].

Principles taken into account

After defining our vision on 'independent living' we researched what these could mean for the design and development of the AmIE product. A literature study on empowerment and ambient intelligence taught us that Victoria Bellotti and Keith Edwards [5] and Paul Dourish [6] defined design concerns or design principles to take into account when developing ambient intelligence applications from a human-centered perspective. They defined potential design consequences to support the development of context aware applications from a human-centered perspective. Our work, done in a transdisciplinary team, existed of refining and completing these existing principles that we call 'principles for critical user participation within context aware applications'. The principles are discussed within [3] and put the focus on informing the user of the contextual applications they life with by providing feedback, conformation, control and possibilities to interact with the system.

That implementing these principles has impact on the architecture and development of the application is clear and is discussed in the last paragraph.

Technical implications

Our vision on 'independent living' and above stated principles resulted in the Context Aware Empowerment (CAEMP) framework. The CAEMP framework provides a set of architectural blocks that helps (and sometimes enforces) developers in fulfilling the principles mentioned above. We highlight some key aspects of the framework.

First, the framework provides ways for collaborative definition and evolution of the context model and the rules applied on it. This makes it

possible for the caregivers and elderly to interact with the system in their own language instead of one defined by a team of developers. To realize this CAEMP makes use of the Meaning Evolution Support System DOGMA-MESS [7].

Second, because we do not believe that every technical detail should be hidden to the user for sake of usability, CAEMP brought together the sensor information, user-defined concepts and rules in one layered, possible distributed model. Also the linking information between the sensors and the user-defined concepts are kept in that model. This allows that rules, concepts and linking information evolve together and allows users to get deeper insights in the system. We believe this approach, together with DOGMA-MESS, can probably help to overcome what is in literature described as the 'context-gap' [8], the gap between what technologies can measure and calculate from sensor data and other types of electronic information and the complex, individually perceived context in a user's environment.

Third, CAEMP imposes strict rules on who can access context information and who can insert context-based rules in the system. CAEMP ensures that the elderly person or its caregivers should approve each query on the context data performed by other persons or applications. The same strategy is applied on rules; these can only be activated when the elderly person confirms them. We believe that this is the only way the elderly person can be in control of his/her own data and living space.

Although CAEMP is currently under development it already forced us to reflect on best practices like sensor abstraction and forced us to introduce new visions on context modeling, context history location, notification and reasoning strategies. This strengthens our believe that starting from the principles as mentioned in the previous section gives developers and the transdisciplinary team they work in new insights on building ambient intelligent application where critical user participation is taken seriously.

Acknowledgment

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Co-Producing Telehealthcare Systems for Elderly Communities in Multi-Agency Service Environments

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***Abstract:* This paper describes and reflects on a series of ongoing action research interventions in a telehealthcare project called OLDES (FP6) concerned with deploying information systems technology for older people. Drawing upon the principles of socio-technical systems design this paper introduces the notion of co-production as an alternative approach to developing telehealthcare systems in complex multi-agency service settings. In doing so this paper illustrates the deployment of a tool aimed at facilitating the stakeholders' engagement with the design, development and implementation of a telehealthcare system.**

Introduction

This paper aims to illustrate a new approach to the *co-production* of information, communication and organizational architectures in e-services for elderly people. We believe this is particularly appropriate to the complexity of needs found in care environments and the difficulties of configuring e-services when delivered jointly across organizational, professional and occupational boundaries. Whilst ideas such as 'co-production' are not new, few if any effective tools and techniques have been developed to support interventions aimed at developing more user-centred approaches of this type in practice. In this paper we outline the deployment of one such tool in the form of a computer-based graphical demonstrator. This can be used to generate visualizations of sociotechnical scenarios created through a process of shared sense making, exploration and negotiation co-produced by 'user' and 'design' communities. We illustrate the use of this tool through a report of initial developments in a three-year project being conducted in the European Union (EU) to provide electronic delivery of services to older people at home.

The OLDES Project

We are a partner in an EU co-funded project – OLDES (www.oldes.eu) – which aims to offer new technological solutions to improve the quality of life of older people. The project is part of the European Union’s Information Society Technologies (IST) Framework 6 Programme (FP6) for ‘Ambient Assisted Living (AAL) for the Ageing Society’. The OLDES project involves a collaboration of local public health and social care providers, system suppliers, and intermediary research organizations and ourselves as university researchers. The project is a three-year programme that commenced in January 2007. This paper reports on progress and experience to end February 2008. At the core of the project is the objective to develop an easy to use entertainment, health and social care platform intended to ‘ease the life’ of older people ‘in their homes’. The platform will also enable enhanced communication and information sharing between care agencies. The platform will be tested at two different ‘user’ locations: (1) a group of 100 elderly (including 10 suffering with cardio disease) in Bologna, Italy; (2) a group of 10 diabetic patients in the Czech Republic. Alongside these objectives is a commitment to ‘user-centered’ development that, ‘puts older people at the centre and makes their needs the main priority in all developments’ (OLDES Project Description).

A ‘Space’ for ‘Co-production’: Establishing a Space for a Valuable Dialogue with Stakeholders

At the very early stages, the most common mistake that a project such as OLDES can make is one of naiveté: failing to face up to the real complexities of the world in which it is operating, selecting only those aspects that make sense from the rational scientific, clinical or engineering points of view and ignoring the fact that many aspects of the real worlds of the users are, and will remain, incoherent and problematic. This mistake can lead towards developing a system that may be powerful and logical but which bears no real relationship to the needs, constraints, risks and opportunities of older people and their networks of support and care, one which bears little relationship to the way they make sense of and cope with their world.

In this context, one of the major challenges in the area of socio-technical systems design is to develop effective and well informed space for co-productive dialogue between a number of different constituencies with quite different ways of making sense of the world. To bring these parties together requires the ability to draw, share and communicate a ‘big and rich picture’ of the dynamics of the context of use and the ‘realities’ of the practices of

users as an antidote to the reductions and simplifications encouraged by conventional system practices development methodologies. In this sense we might think not in terms of system design or development but of a form of ‘co-production’, ‘co-development’, ‘co-operative design’ or ‘co-realization’ (see e.g. [1], [2], [3]) as a, ‘shared situated practice involving users and IT professionals’ and ‘grounded in the lived experience of users as they grapple with the problems of applying IT’ [1].

In responding to these requirements during the first phase of the OLDES project a corresponding physical and distributed environment (graphical software tool or ‘demonstrator’) was established. This is a fully operational synchronized audio-visual recording environment (including screens; cameras; microphones and editing/publishing suite plus supporting software) which captures the complex social learning interaction activity occurring during co-productive dialogues.

Our empirical research in the first phase of OLDES project has involved observing/constructing, five typical worldview domains which have bearing on the delivery of health and social care in Bologna, Italy. These included:

- The domain of policy and governance at national, regional and local levels.
- The corporate domain of service management and reporting.
- The practitioner domain in which needs and demands are encountered and responded to.
- The client, customer and service user domain where outcomes are experienced.
- The technical and supplier domains where systems are constructed and deployed.

The identification of these domains were used as stimulus to facilitate dialogues in the form of visualizations of sociotechnical scenarios created through a process of shared sense making, exploration and negotiation co-produced by ‘user’ and ‘design’ communities. This resulted to the production of the following projections:

- People and places: this view situates activity from the point of view of protagonists and represents all of the information modalities that are relevant.
- Applications view: this view represents the presentations of applications and the interactions that users make with them
- Systems view: which animates the activities and message passing between network resources.
- Organizational view which identifies the domains of ownership and responsibility for physical resources.

- A business process or workflow view which shows tokens passing round mappings of workflows as a result of transactions and messages.
- A role view which represents abstract responsibilities and intentions and how they are allocated to different actors and organisations in the other views.

An initial version of some of these projections on the OLDES environment is shown in the figures below:

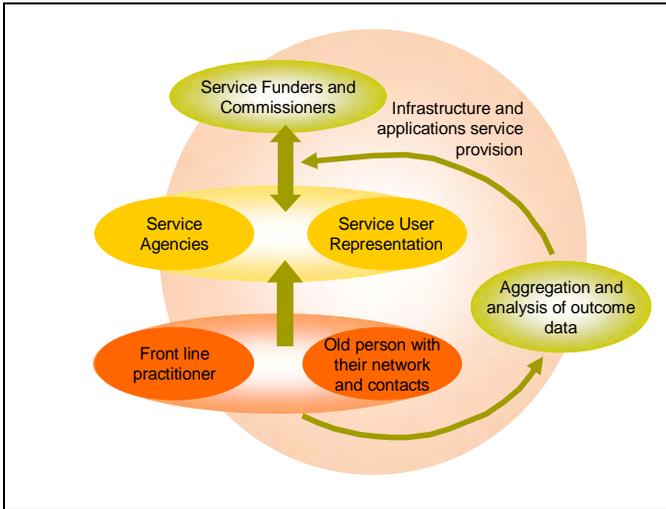


Figure 1: Network of User Relationships

In this context, the purpose of the graphical demonstrator used in OLDES was to initiate and support the process of

envisioning and prototyping possible futures which brought together well grounded approaches to governance, practice and systems with intention of facilitating dialogue between these views. The initial material collected and presented was reflecting the following criteria:

- It was recognizable by the participants as relevant and realistic in their worlds.
- It was reflected and raised issues about the relevant scope, boundary conditions and capacity constraints of policy, resource, technology as well as the legal/ethical conditions.
- It provided a starting point that participants could adopt and appropriate in the process of internalizing and sharing an emerging set of models, plans and designs.

The graphical demonstrator aims to be deployed by a number of multi-agency services wishing to explore and develop solutions for joint working in complex environments, and the governance of shared service infrastructures and applications. The demonstrator can help practitioners, managers, technicians and strategic decision makers to plan how to structure change before putting it into practice. It effectively plays out a scenario that can be explored from a number of different angles, before rushing into implementation.

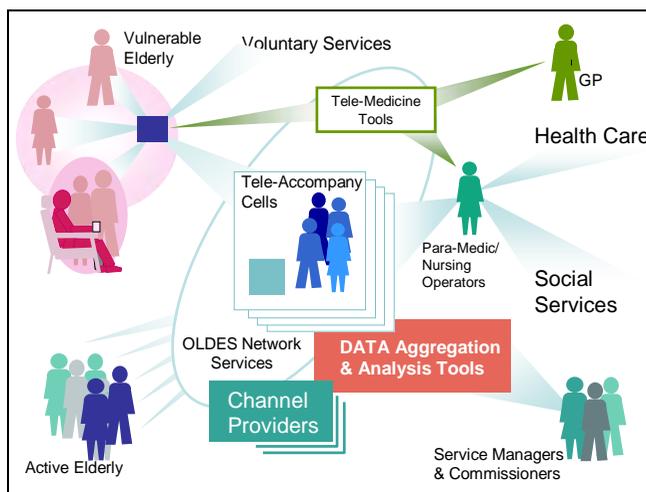


Figure 2: Projection of Systems and Service environment

In the subsequent phase of the project our activities will focus more on the observation and support of the processes by which the OLDES developments are presented to, explored and evaluated by users and by the various actors in the service delivery networks. The outcomes of these observations will then be incorporated in further versions and elaborations of the demonstrator which will progressively include more real connections to the technical platform, technical devices, the electronic patient records, as well as the instruments, resources and content that it supports.

Conclusions

In this paper we outline an approach to the co-production of information, communication and organizational architectures in e-services for elderly people. This approach aims to equip stakeholders -including health informaticians, service providers, system designers, technology suppliers as well as end users - involved into the design of multi-agency information

systems with an orientation to design process that allows them to develop systems that purposively fit the working practices of those using them. The use of the graphical demonstrator in the OLDES project shows how visualization techniques can be used to support the building of different scenarios for change in both technological and organizational architectures. In our approach such scenarios are created (or not created) by stakeholders drawn from 'user' and 'design' communities through a facilitated process of shared sense making, exploration and negotiation.

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Elderly Care and Maintaining a Good Quality of Life in the Rural Communities of Developing Countries and Sub Sahara Africa is a Global Challenge

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Abstract: In the rural areas of Africa, Asia and Latin America, the numbers of the older persons are expected to double by 2025. In Africa, the number of older persons is expected to increase to 50 million and in Asia to 337 million. Mostly in sub-Saharan Africa, the proportion of older persons in rural areas is at least twice as high as that in the urban settings. The proportion of older women is higher in rural areas than men. In many countries in the rural communities, the family is expected to care for the elderly persons, but rural immigration to the cities, international emigration, Aids/HIV, poverty and other social trends are altering family structures and traditional support system. According to international organisation WHO estimates, over 6 million children in sub Sahara Africa are cared by their grandparents. 88 percent of the older persons in the rural areas in sub-Saharan Africa do not benefit from any significant pensions, health insurance, social security support or significant government support. If suitable elderly care programs is not established in the rural communities of sub-Saharan Africa and other developing world countries; it could reduce output and income, and thus adversely affect the overall economic performance of a country.

There are many benefits of ageing that are usually not recognized, such as the wealth of skills and experience that older people brings to the community, to public life and the family. Technology advances and new ways of organizing things can be put to good use to increase the participation of older people in community development programs, and to make appropriate socio economic changes in rural areas.

Statistic from the rural communities in ten countries including; Central Africa Republic, Congo democratic, Cameroon, Ghana, Nigeria, Chad, Uganda, Ethiopia, Kenya and Tanzania shows that the elderly persons in the rural communities in sub-Saharan Africa survive from subsistence farming

and from other incomes as indicate in the diagram below:

The world's population is not only growing larger, it is also becoming older. The proportion of older persons is increasing at a faster rate than any other age segment. In developed countries, the proportion of older people already exceeds that of children. In developing countries, the

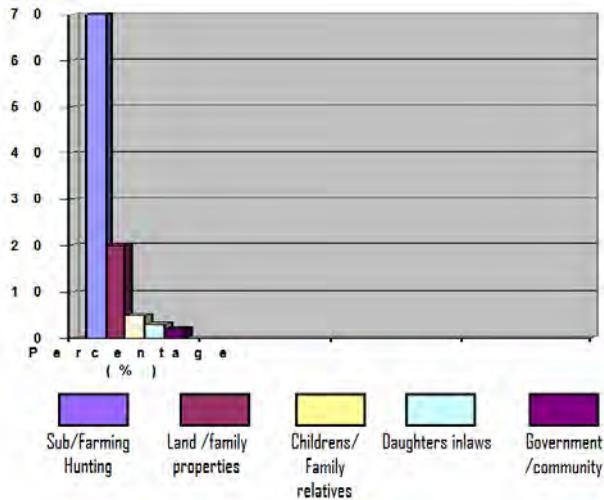


Fig. 1.

older people already exceeds that of children. In developing countries, the growth of the older population is occurring more rapidly due to the faster pace of fertility decline that has resulted from the success of reproductive health and family planning programmes. As more people in developing countries reach 60 years and above, the question now is: ***Are developing countries ready to tackle the health and social problems of older People.*** Although population aging presents major challenges for even the most developed countries, developing countries face particular issues in constructing policies that could address increasing elderly populations. It is a fantastic achievement that so many people reach a respectable age. However, the changing composition of our societies will lead to a structural shift that our global society may not be prepared to handle. The World Health Organisation estimates that 200 million of the 355 million people older than 65 years are in the developing world. In the 30-year period from 2000 to 2030, the population of elderly persons was projected to double in many Sub-Saharan African countries including the Democratic Republic of Congo, Mozambique, Cameroon, and Ghana.

According to the world health organization, by 2015 deaths from chronic diseases such as cancer, hypertension, cardiovascular diseases and diabetes will increase by 17 percent from 35 million to 41 million globally. But few

developing countries have implemented primary prevention programs to encourage those healthy lifestyles choices that would mitigate chronic diseases or delay their onset. WHO projects that Africa, Asia, and Latin America will have more than 55 million people with senile dementia in 2020; caring for the elderly in a way that addresses disability and maintains good quality of life has become a global challenge.

There is almost no social support for elderly people outside the family. Except for a tiny minority who have worked in the organised sector and so receive pensions, economic support does not exist. The focus for most developing countries including sub-Saharan Africa is on maternal and child health care. Research and practical experience have demonstrated that health maintenance in the elderly is possible and that diseases do not need to be essential components of ageing. Early diagnosis and appropriate treatment is required, as well as preventive measures, to reduce disabilities and diseases of the ageing. Furthermore, the living conditions of the elderly in the developing countries make them more prone to risk factors that might have adverse effects on their health. Mal-nutrition and poverty also affects the living conditions of the elderly people; which contributes immensely to poor health .To maintain the well-being and independence of the elderly through self-care,

health promotion, prevention of disease and disability requires new orientation and skills, among the elderly themselves, as well as their families, and health and social welfare workers in the local communities. A proper balance between the role of institutions and that of the family in providing health care for the elderly is important

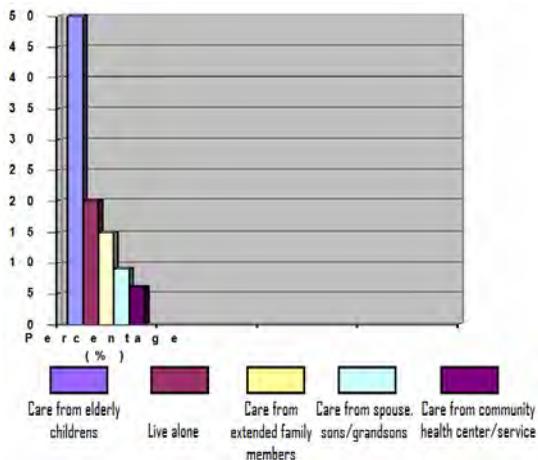


Fig. 2.

Elderly in developing countries have relied heavily on their family for personal care and material support, Fig 2 above indicates the type of care available on a percentage basis. Today, however, such support is under

pressure from trends that include falling fertility rates changing cultural norms; increased longevity of the elderly; and the migration of rural young people to cities and away from elderly relatives. As the family is recognized as a fundamental unit of the society, efforts should be made to support, protect and strengthen it in agreement with each society's system of cultural values and in responding to the needs of its ageing members. Governments should promote social policies encouraging the maintenance of family solidarity among generations. The role and contribution of the non-governmental organizations in strengthening the family as a unit should also be stressed at all levels in developing countries including sub-Saharan Africa. Efforts should be intensified to develop home care to provide high quality health and social services in the quantity necessary so that older persons are enabled to remain in their own communities and to live as independently as possible for as long as possible. Home care should not be viewed as an alternative to institutional care; rather, the two are complementary to each other and should so link into the delivery system that older persons can receive the best care appropriate to their needs at the least cost. Special support must be given to home care services, by providing them with sufficient medical, paramedical, nursing and technical facilities of the required standard to limit the need for hospitalization.

The Use of Visual landmarks in a Wayfinding System for Elderly with Beginning Dementia

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***Abstract:* This paper presents an experiment carried out to study the design options of a GPS-based navigation aid for elderly with beginning dementia. Results suggest that landmark based instructions may yield higher performance of the system than left/right instructions.**

Introduction

One of the main symptoms of dementia is a gradual decline in memory. This can result in topographical disorientation and the loss of one's way during unaccompanied outdoor walks. GPS-based navigational aids have been proposed to assist the users in case of disorientation. An import issue is the interface for such a system. Since we want the interface to be as simple as possible, and we want users to have their visual attention on the surroundings, we chose audio feedback as the sole modality.

Current pedestrian navigation systems predominantly use distance-to-turn information and directional information to enable a user to navigate. However, [1] showed that dementia patients performed better on recognition of landmarks compared with recognition and recall of spatial layout. Studies have been carried out on the quality of landmarks [2,3]. Here we focus on the performance of such a navigational system for elderly and defined the following research question:

“Does the use of landmarks in route instructions lead to better performance and a better acceptance of the elderly patient with beginning dementia?”

In this paper we present an experiment which is carried out to compare landmark based navigational instructions with navigational instructions based only on left/right turn information.

Method

Since we did not have a working prototype with sufficient high accuracy of the GPS system we carried out the experiments in a ‘Wizard of Oz’

(WOZ) setting. In a WOZ experiment the human interacts with a (computer) system of which one thinks that it operates autonomously, but is partly operated by a human. The concept is shown in fig. 1.

System

The system consists of a PDA which sends the audio information via Bluetooth to the patient. The receiver is a small wireless mobile phone headset which is connected to the patient's earphone. Playing the audio files is triggered by the Wizard, following the patient. A second researcher is observing the behavior. The patient was told that the navigation system consisted only of the small receiver and earphone.

Conditions and routes

We compare the following conditions:

1. Navigation information is given as directional (left/right/straight) instructions on decision points;
2. Navigation information is given as directional instructions augmented with landmark information.

We have set out two routes in the vicinity of the day care centre, each approximately 750 meters long. Each route had 13 decision points at which navigational information had to be given. Both routes are as similar as possible with respect to difficulty and the number of instructions. Both contain a shopping area, residential area and a park-like area. In the first route we used only directional information. In the second route we used directional information augmented with landmark based instructions.

Instructions

The instructions were as short as possible, and spoken by a male voice. The

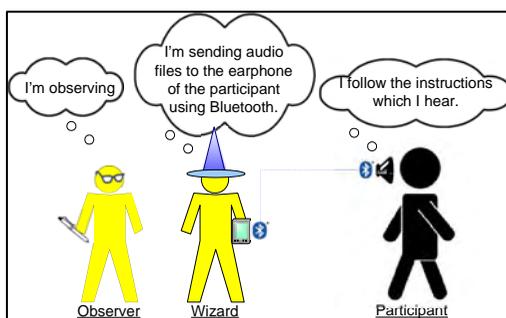


Fig. 1. Wizard of Oz setup



Fig. 2. Left: typical decision point. Right: participant with earphone

instructions are ‘pre-recorded speech’, and not computer generated. The use of a landmark is always an addition to the directional information, where the landmark was always used at the end of the sentence [4], e.g. ‘Turn left *at the IKEA*’. Given the limited number of participants it was not possible to use elderly patients to find the best names for the landmarks, as was suggested by [3].

Participants and design

We used participants with beginning dementia from a day care centre, 4 males and 2 females. Each walked both routes in a random order.

Performance measure

We compared the two conditions on the navigation performance and on the attitude of the users. During the walk we registered at each decision point whether an error was made, and whether the participant was sure about its direction or hesitated. A navigation error is counted if the participant takes the wrong direction and has to be corrected by the wizard. He does this by giving an audio instruction ‘Please try to turn around’. When the participant sees that he or she is going wrong before the correction instruction is given, this is not counted as error. We also measured the hesitation of the participant by observation (0 points for no hesitation, 1 for a little and 2 for much hesitation). At the end of each route we also measured the acceptance and participant’s attitude toward the navigational system. We used a small questionnaire with 10 questions with a 7-points Likert scale. The questionnaire was taken after the first part of the tour, and again after the second part.

Results

Table 1 summarizes the results for the conditions. The landmark condition resulted in a lower number of errors than the left/right condition. The

participant	errors		hesitation		attitude	
	Left/right	landmark	Left/right	landmark	Left/right	landmark
P1	1	0	2	1	67	69
P2	2	1	7	0	48	58
P3	1	0	0	1	68	68
P4	1	1	0	1	67	67
P5	1	1	1	0	69	69
P6	2	1	1	3	65	62
<i>Total</i>	8	4	11	6	64	65.5

Table 1. Results for the 6 participants

amount of hesitation was lower for the landmark condition than for the left/right condition. The attitude of the participants toward the system was only slightly more positive for the landmark condition. Under both conditions an overall high positive evaluation of the system was given.

Discussion and conclusions

A further analysis of the data learned that the 4 errors in the landmark condition were made at the same decision point, where the route instruction was not optimal. The instruction was to turn left at the landmark, while the landmark itself was placed after the decision point. For landmark based navigation, a careful formulation of the instructions is needed. In the final discussion with the participants the overall consensus was that the system is very helpful indeed. Even the use of earphones was not considered as a problem.

Acknowledgment

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Vital Sign Monitoring in Nursing Home for Elderly

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Abstract: Remote vital signs monitoring of an increasing elderly population is to be considered as a key element in healthcare delivery. However, the solutions offered until now meet only partially with the needs arisen in this field: a large number of devices providing remote vital signs monitoring have been recently proposed on the market of telemedicine, but no solution has gained general acceptance.

In this paper we present an evaluation study of remote vital sign monitoring for the elderly in a nursing home. The project pretends to evaluate suitability of existing commercial devices to record and transmit ECG (electrocardiogram (ECG), heart rate, breath rate and pulse, among others, at regular intervals.

Introduction

Life expectancy has experienced a considerable growth over the last years and it is expected that this tendency will continue over the next years. According to [1], three European countries will have the world's highest life expectancies after Japan in 2050: France, Italy and Spain's male population will hope to live over their 80s, and females will expect to live almost to their 90s at birth.

These conditions make healthcare services set up new solutions to respond to the needs created by an increasing elderly population. The adoption of preventive measures, such as telehealth care, will be a key point in chronic disease control [2]. Ubiquitous monitoring of vital constants and the corresponding follow-up will most probably turn into current practice. Nowadays, while a large number of devices providing remote vital signs monitoring are being offered, the use of such technology in clinical routine is still rare. Moreover, while in the domain literature there may be found several examples of telemedicine applications based on PDA or mobile phones ([3], [4]), there is no or very little bibliography concerning other technologies.

In this paper we present a pilot study for the use of a remote vital signs monitoring system in a nursing home. The aim was to conduct a comprehensive study about the requirements and functional specifications that the system would have to fulfill along with the setup of the whole system.

The remainder of this paper is organized as follows: user scenario, requirements, system design and conclusion.

User scenario

A medium sized nursery home was chosen. The facilities counted on basic but compulsory healthcare equipment, such as manual sphygmomanometers and scales. Important improvements were foreseen based on the acquisition of new equipment able to measure patient's health condition. The one addressed in this paper is a vital sign monitoring system that would remotely control patients' condition.

The idea was to use remote monitoring devices to register the patients' vital constants (namely blood pressure, heart rate, breath rate and temperature), as well as, the electrocardiogram. By digitally transmitting them to a workstation and preserving them in electronic format would help clinicians better control elderly's health.

Requirements

The main requirement was to record as many vital signs as possible by means of a single device. Thus, monitoring devices that best comply with that specification were to be sought.

In the above presented scenario, there were several technical issues to take into account. First, patients are mobile, and the system should therefore be based on wireless technology: it should allow taking a measurement at any location within a certain transmission range. The system should allow to record vital signs, while the patient is carrying out daily tasks. Continuous recording is important to keep track of any event occurred at any time, including during sleep.

Regarding wireless transmission technology, the market devices offered two alternatives: the Bluetooth specification and other radio frequency proprietary protocols. Bluetooth is a well-known protocol, but it has the main drawback of a small transmission range (about 100 metres in free space). Therefore, proprietary protocols could be preferred when a high transmission range is required. Another solution is a built-in memory so that to store the measurement for latter transmission.

In addition to these characteristics, as the device is aimed at ubiquitous and continuous recording, battery life is an important factor to be

considered. The system would not be sustainable if batteries were to be replaced constantly.

Moreover, the transmission protocol should be lossless. If prone to failure, it would be regarded as unreliable and not suitable for managing medical information.

Above all, devices had to be easy-to-use. In order to achieve that goal, the user interaction should be minimal.

Our first approach consisted of using the same device for several patients. Having a limited set of devices, the system should therefore be able to manage and identify the different patients. The identification could be done by the devices, or by the workstation receiving and storing the signals.

System design

The first step in setting up the system was to carry out a market study to identify the devices that best fit to our needs. The above requirements were taken into account when conducted our study. A whole range of providers and their solutions were studied. Two main issues were encountered at this point: first, the market lacked a device able to perform continuously all the measurements stated in the requirements. And second, multi-user option was not fully supported by any of the devices.

The selected device does not offer continuous recording or patient identification, but records all the required signals (blood pressure, heart rate, breath rate, temperature and ECG) and is also able to measure oxygen saturation. Besides, the workstation distinguished between patients. However, the chosen device presents the disadvantage of a limited amount of memory.

The design of the system was consequently conditioned limited by the device specifications. It was decided that patients would hold their corresponding device as long as measurements were not transmitted to the workstation. Measurements would be made according to an established schedule so that the clinicians could keep track of them.

A single workstation was set up and the necessary software tools were installed in order to collect and visualize the patient measurements. As the system was not able to automatically switch between patients, a device would be used by one single patient during a complete day. Then, clinicians would verify that the measurements were correctly transmitted to the workstation. The following day the device would be used by a different patient.

Due to such procedure, transmission range became less important: the devices' memory would store a measurement if this was made out of the transmission range.

Conclusion

The system is currently in test phase in real conditions. A target group of patients has been chosen in order to carry out the first trials. Even if potential rejection to the system was a major concern during the design phase, it has had a promising welcome among both patients and clinicians at the nursing home. The system requires minimal interaction and allows the clinicians to focus on prevention, diagnose and follow-up tasks. A patient historical database is under construction and first results about the performance of the tool set up at the nursing home are expected soon. Signal processing tasks to automatically extract signal features and detect abnormalities are to be started at a latter time.

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Chapter 3

eHealth in Support of Routine Medical Practice

Adoption of eHealth Applications: A Model to Investigate the Technology Acceptance within Healthcare Professionals

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Abstract: The aim of this study is to provide the adoption determinants in eHealth applications and to propose a model for investigations about implementation criteria and readiness priorities. In this paper, first the factors influencing adoption of various applications of eHealth which are tested in published articles, with different models, are extracted and/or merged according to their significances and similarities. Eventually, with the help of a panel of experts, it is tried to determine the most significant factors in health sector and to derive a useful model from the extracted factors with combination of the reviewed models and also some barriers to accepting IT applications. This model may be used by IT and healthcare professionals in order to assess their readiness and also to prioritize their e-health implementation strategy.

Introduction

eHealth, as Eysenbach [1] stated, is a broad term that targets 10 e's including Efficiency, Enhancing quality, empowerment, Enabling, etc... . With its exponentially growth in various applications including telemedicine, E-consultation, electronic health records and E-learning [2], eHealth seeks these benefits in healthcare industry with developing health information infrastructures, standards and policies for ensuring interoperability and data security, and many other efforts [3]. However, preparing these requirements does not guaranty the successful implementation of these applications as there have seen some barriers [4] and the technology acceptance factors influencing it.

This paper outlines the significant determinants on healthcare professionals' adoption to eHealth applications which are tested in different models. A panel of experts in healthcare professionals involved in academic or executive fields of eHealth activities is interviewed according to the Delphi method to determine the most significant factors. Finally a model is

formed to represent these adoption determinants and their relationships resulting in the acceptance of eHealth applications.

Background

Emerging IT cannot deliver improved organizational effectiveness if it is not accepted and used by potential users [5]. Models assessing technology acceptance, introduce socio-technological constructs affecting intention of users and predict their actual usage of that technology in future. Some of these models which have been used frequently in healthcare industry include: Davis' technology acceptance model (TAM) and its extended models [6-8]; the theory of planned behavior (TPB) [9]; the theory of interpersonal behavior [10]; an integrated model of TAM & TPB by Chau and Hu [6] and the Unified Theory of Acceptance and Use of Technology (UTAUT) and its combined models [11, 12]. Furthermore there are some studies declaring variables which have been detected to be important in this field without sticking to any special models [4, 13, 14].

The factors currently detected as the adoption determinants in health sector

The important factors influencing on Behavioral Intention, individual's motivation regarding the performance of a given behavior [10], are:

- Attitude: The positive or negative evaluative affect about using the technology [6], has been both significant [6, 7, 10] and insignificant [10, 12].
- Compatibility: The degree to which an innovation is perceived as being consistent with the existing practices, values, needs and experiences of the health care professional [12], significant in [12].
- Computer anxiety: Evoking anxious or emotional reactions when it comes to using a computer [11], have had a significant affect [7, 12].
- Computer self-efficacy: Judgment of one's ability to use a computer to accomplish a particular job or task [11], significant in [7, 12].
- Moderators: Factors including organizational context, user experience, and demographic characteristics to account for dynamic influences [11], significant in [11, 12].
- Normative factors: The degree to which an individual perceives that important others believe he or she should use a technology [12], significant in [10, 13] which consider social roles as well, and insignificant in [6, 10, 12].
- Perceived behavioral control: The availability of proper training, technology access, and in-house technology expertise perceived by users [10], significant in [6, 10].

- Perceived ease of use: The degree to which a person believes that using a particular system would be free of effort [8], significant in [8, 12], insignificant in [6].
- Perceived usefulness: The degree to which a person believes that using a particular system would enhance his or her job performance [8], significant in [6-8, 13], insignificant in [12].
- Self identity: The degree of congruence between the individual's perception of himself or herself and the characteristics he or she associates with the realization of the behavior [10], significant in [10].
- Trust: Is concerned with balancing needed between access to data and privacy [14], has been significant [7, 14].

All these constructs directly or indirectly influence on the Actual Usage of a system in eHealth field.

Research methodology

In order to validate, complete and to assess the significance of the technology acceptance factors derived from literature, a panel of experts including 10 healthcare professionals who were qualified and experienced in eHealth applications by academic research (50%) and/or executive work (70%), participated in an interview with Delphi method and were asked to rate their degree of agreement/disagreement on significance of each factors by a Likert-type scale. They also could add their new factors to be investigated in next rounds. Seventy percent of experts were men. In the first round of Delphi method, the rates for previously known factors were assessed to determine the most significant ones (median \geq 4) and Kendall's W test was used to indicate the level of agreement among raters.

Results

The medians calculated for each factor are displayed in table 1. The results show that perceived usefulness is the most significant factor and supports the previous works [6-8, 13], and also trust and self-identity are comparably insignificant constructs. Fig. 1 proposes a model based on

Factors	ATT	COM	ANX	SE	MOD	NF	BC	EOU	PU	SI	TR
Medians	4	4	4	4.5	4	4	4.5	4	5	3.5	3

Notes: ATT: Attitude, COM: compatibility, ANX: computer anxiety, SE: computer self-efficacy, MOD: moderators, NF: normative factors, BC: perceived behavioral control, EOU: perceived ease of use, PU: perceived usefulness, SI: self identity, TR: trust

observed

Table 1: Measurements for significance of factors (5 points Likert-type scale)

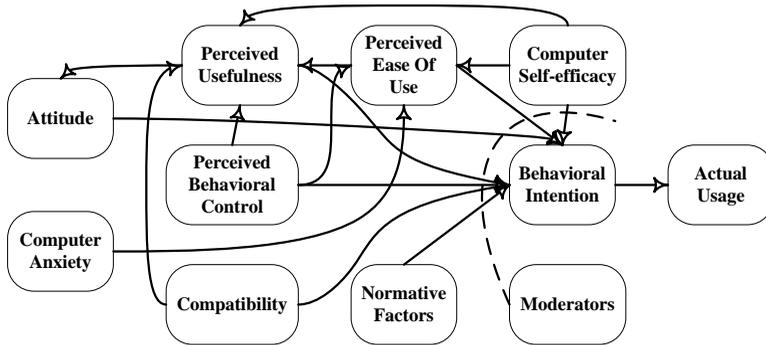


Figure 4: Proposed model

results and the emergent directions of reviewed models. As the degree of consensus among the raters (Kendall's $W = 0.242$) is not satisfying, next rounds should be conducted to reach the acceptable ranks and factors.

Conclusion

Among different factors affecting healthcare professionals' intention to use eHealth applications, trust and self identity have shown lower significance. To obtain a consensus on ranking the factors and preparing the model for validation with a questionnaire, next Delphi rounds are also envisaged in this research.

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RIGHT System as a Support in Diagnosis

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Abstract: RIGHT System, as a real time intelligent electronic system, is supposed to make up the support for health care experts in the range of the quality and pertinence of medical diagnosis and treatment for new Member States of the EU. Its aim is to be reached, for Lower Silesia, through the implementation of the computer system which helps doctors with electronic documentation, in the process of diagnosing and treatment. It is very important to understand the principles of data interpretation. Information skills are basic to good medical practice. The RIGHT system integrates all information needed for the health services. Furthermore, this System will become the platform which will enable consultation and experts' discussion in each given medical field. The dynamics of communication is altered when the way of communication moves from the face-to-face interaction to the telephone, e-mail, voicemail or video one. In order to provide proper actions, there should be introduced such solutions, among others, which will consider changes connected with the aging process of the society.

New technologies used in this System support its logical foundations of the diagnostic process, and the management of uncertainty in clinical knowledge. The problem-oriented medical record is just an information instrument, and clinicians need to know when it is appropriate, and when indeed other formulations might be better choices. Medical data gathered in the Electronic Health Record (eHR) will be stored in the central or local medical database using special software based on the newest achievements within the range of semantics and artificial intelligence for the analysis of described cases. The results of such analysis, based on eHR, will be automatically made available for doctors. In this range, the RIGHT project is based on the co-operation with the e-Health program, one of the main

programs in the EU, which aims to improve the quality of access to health services also for people residing outside the academic centers

Introduction

The risk is always connected with uncertainty but the reverse statement is not true. This is not an absolutely bad things and it appears in every aspect of our life. Few people think that the risk is a positive element, especially when human health or life is involved. If it did not exist, such organisations as, for example, stock exchanges or insurance institutions would not be able to exist. Obtaining of additional benefits is often possible only, if there is a possibility of risk. Risk means that we are not able to anticipate the outcome of our actions. Risk management seeks answers to this question – would not we prefer to avoid this problem? Risk and uncertainty are concepts used in economic terminology, although colloquially they are often used alternatively.

According to the opinion of K. J. Arrow: "Uncertainty means that we do not have a full description of the world that we would regard as completely true. However, the world exists in one or another set of conditions. Each condition of the world is a description which is complete for some purposes involved. Our uncertainty occurs when we do not know which of the conditions is true" [1], and uncertainty may in fact concern any aspect of the change process.

The occurrence of risk in health care

The concept of information asymmetry ("Arrow's theorem") applies both to the doctor and the patient. Due to enormous transactional costs and sometimes also an urgent situation, the patient cannot familiarize himself with all parameters of health services or make the right choice. In addition, patients are not able to assess the value of advice given by medical personnel or even verify their qualifications [2]. A. Wilson defines health service as one which should improve the condition of the service receiver and reduce the level of his uncertainty [3]. Medical services belong to the group of human-based services [4], hence the important role of medical personnel in building trust. Advanced medical technology provides support in such situations. There are even scientists who claim that due to a rapid progress in medical researchers, it is difficult to find a healthy person nowadays. However, problems with accurate diagnosis remain. Possible decision making situations supposed to be consider along with the continuum of certainty - risk – uncertainty. Certainty means that we know what will happen in the future, risk means that we know the probability of occurrence for each possible result, and under uncertainty we not only do

not know these probabilities, but we also may not know what possibilities exist [5].

Risk management is used particularly in medical care where there is not any guarantee of the therapy's effect despite the full commitment of both parties in the service relationship based on the concept of "the promise".

Confidence as a tool reducing uncertainty in health care - Outline of the problem

These days nobody is surprised any more that health care is considered in economic categories. One definition regards it even as : "the business as a part of which the attempts are made to fulfill specific needs of the man, that is health needs, using limited means (material means and labor)" [6]. Risk or uncertainty may concern two main areas: failure of the business and/or wrong diagnosis or fulfillment of health needs. Market reforms which have been introduced in Poland after 1989 consist also in implementation of market solutions for the health care sector (internal markets, freedom in choosing service providers or competition). In spite of this, we cannot talk about market in the classic meaning of this word. This is more a market with limited market mechanisms or a quasi-market. It results from what is called market failure. However, the effect of applying these solutions is change in the functioning of health care centers. Health care units more and more often make use of marketing actions or buy these services from professional agencies. Even such reports as, for example, „How to get the patient?" of On Board PR Agency [7] are developed. However, they are not too optimistic for public organizations. The report mentioned above indicates that the only area in which private and public units are evaluated in the same way is „knowledge and competence of the doctors". Hence this is the factor that public health care organizations should emphasize to attract patients. However, this is neither an easy nor a short process.

The quality of the communication process is dependent on factors lying on both sides of the service relationship. It is affected by: the trust and confidence of the patient, arousing hope and reducing the fear and doubts of the patient regarding the doctor, empathy, personal contact and care for the patient, personality disorders [8].

Currently, advanced IT technologies or technology in general (similarly to: financial resources, following the principles of social responsibility by enterprises, integrated environment management) may be the source of competitive advantage. IT systems are able to collect data quickly and effectively, including not only text data but also pictures and graphics. They modify the practical side of health care centre functioning, if this is necessary, and then prove the value of implemented changes by the strength

achieved as a consequence. Units not using such systems in their activities increase their risk [9].

New technologies supporting the structured information in diagnosis usage

In Poland the general practitioner is a relatively young specialization, still “without experience”. During working hours and beyond this the general practitioner deals directly with his patients and should organise support for any persons in need, in cooperation with other service providers. An average general practitioner does not spend a minimum of half an hour interviewing a patient but receives 6 patients per hour spending from 5 to 15 minutes with the patient. Coming to a correct diagnosis requires more time and should involve completion of a series of additional tests. This situation needs additional support by new technologies provided with RIGHT System [10] being implemented by Lower Silesia Voivodeship in Poland.

RIGHT develops a semantic infrastructure for health information that can integrate information and internet services. It is designed to fulfill two main functions: semantic information retrieval and support for accurate diagnostic decisions. This infrastructure will for each patient provide doctors with necessary details from disease history, appropriate therapeutic tips, proper and updated test results, and information about available medical services, techniques and medications and their effects and side-effects, and possibly also experience from similar cases and advice from specialists. RIGHT in its basis, as an intelligent, electronic real time system, should provide support for health care specialists in order to ensure quality and accuracy of medical diagnosis and treatment for new EU Member States. This goal could be achieved by implementation of an IT system which will help doctors in the diagnosing and treatment process by providing structured electronic documentation. Based on ontology selection allows the doctors to get needed information for proper diagnosis and treatment. The whole information is structurally divided and relations are established. As it is shown in Table 1 there are main groups of relations based on key words.

Table I Main groups of relations for structured information

Relation type based on key words	Selected example
is	is a medical cause of
may	may appear as complication of
can be	can be classified as
has	has clinical features
identifies	identifies clinical type

RIGHT will analyze the described cases using such tools as semantics and artificial intelligence. The results of such analysis will automatically be made available to the doctors.

Conclusions

The possibility of communication as a factor supporting the doctors' work: As a result of more extensive usage of ICT, the scope of medical services has been growing considerably. Development of modern telecommunication technologies is aimed at future "smart environment" services and should be based on good practice. In the future, it will combine a series of opportunities connected with the rendering of services. The new technologies should help to improve quality and efficiency of health care – diagnosis and treatment. According to existing trends, new technologies appear supporting human navigation. In the RIGHT system new services appear enabling the creation of virtual communities and communication between doctors is used for diagnosis. This is possible in two ways. Doctors may communicate by means of an instant messenger service or by a discussion forum. Thanks to the modular structure of RIGHT, further development is possible through the creation of additional telecommunication modules using mobile and wireless technologies. RIGHT is consistent with the e-Health program which is one of the main programs in the EU.

Using the medical data collected in the form of the Electronic Health Record (EHR), the RIGHT project will reinforce the knowledge of medical service professionals and will contribute to increased efficiency and effectiveness. Data located in a central or local medical database, using special software based on the latest achievements, will also have an indirect influence on the capacity of the entire health care structure.

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Telecommunications Infrastructure Readiness for Practicing Telehealth in Philippine Remote Rural Areas

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Abstract: The Philippine health care system is crippled by massive health worker migration and inequitable distribution of manpower resources, and appropriate use of information and communications technology (ICT) in health is seen as a tool for bridging the gap created by this situation. One such appropriate use of ICT in health is Telehealth, which is defined as “the integration of telecommunication systems into the practice of protecting and promoting health”. The present research is an ICT needs assessment of a select group of rural health physicians in the Philippines called Doctors-to-the-Barrios (DTTB), and employs the self-administered questionnaire approach in gathering data. Most of the responses were described qualitatively. Results suggest that while mobile phones and personal computers have made considerable incursion into remote communities, this is not paralleled by landline telephone infrastructure and the Internet, with adverse consequences on DTTBs' ability for making distance referrals. Furthermore, it is felt that much still needs to be done by the government in terms of developing ICT for delivering health care in the country.

Introduction

The Alliance of Health Workers reported the growing number of undermanned community health centers and district hospitals either shut down or in danger of closing down, all because of lack of doctors and nurses [1]. This was echoed by the Secretary of Health who said that the situation had particularly taken its toll on hospitals in the provinces, with a

number of vacant plantilla positions for doctors and nurses incurred by hospitals in the countryside [2]. This situation is by no means unique to the Philippines [3].

The 57th World Health Assembly urged member-states to, among others, “develop strategies to mitigate the adverse effects of migration of health personnel and minimize its negative impact on health systems” [4]. For its part, the Philippines established the Doctors-to-the-Barrios (DTTB) Program in 1993, recruiting rural health physicians (RHP) who would serve as acting municipal health officers (MHO) for two years in 271 remote towns identified at the time as being doctorless. It has since been institutionalized and the country's Department of Health (DOH) now allocates 25 plantilla items twice a year for their DTTBs.

However, given the archipelagic feature of the geography of the Philippines with its 7,107 islands, appropriate use of information and communications technology (ICT) in health seems to be one alternative strategy that is fitting. It can be a way to bridge the gap in health care delivery in remote and geographically isolated communities of the country created by the scarcity of doctors and nurses. One such appropriate use of ICT in health is Telehealth, which is variously defined as “the integration of telecommunication systems into the practice of protecting and promoting health” and as a more encompassing term that covers curative medicine as well [5].

The present research aims to identify existing ICT needs of rural health physicians in the Philippines, specifically batch 21 DTTBs, thereby providing baseline data for pursuing future action in terms of building Telehealth capacities in remote rural communities. Such ICT needs assessment studies have been tried previously for determining the feasibility of using ICT in primary health care work in a country in Western Africa [6].

Method

A self-administered questionnaire is used in gathering data. The questionnaire was patterned after that used for assessing the ICT needs of a farmers group in Uganda [7]. Nineteen out of twenty (19/20) members (95%) of batch 21 of the DTTB Program were able to take part in the present study.

Discussion and Conclusion

It appears from the results that mobile phone technology has made considerable inroads in remote communities in the Philippines even as much of these areas continue to be deprived of landline telephone infrastructure. The ubiquitous nature of cellular phones (19 out of 19

respondents) is mirrored closely by the PC as a considerable majority of the respondents (16/19) have access to one in their offices. A smaller majority (11/16) have access to devices for capturing and digitizing images, which are useful for making referrals in so-called “visual” specialties like dermatology and even radiology. Also, only very few (6/19) have Internet access, either in their offices themselves or within a walking distance from them, a situation that does not bode well for those wanting to make online referrals to specialists.

It is ironic that a majority of the respondents (11/16) feel the government is not doing enough to develop ICT for delivering health care in the country when a greater majority of them (16/19) have consulted another doctor remotely using ICT. The respondents, in fact, are unanimous in expressing wish for ICT to be utilized more by their offices.

Equally ironic is the idea that it is the developed countries, with presumably more advanced transportation facilities and therefore better means for transporting patients, which would appear to see better the need for remote health care delivery via ICT. For example, Australia, which, like the Philippines, is beset by geographical barriers but of a different nature, being one huge landmass, for one, acknowledges that governments must have the will and fiscal objective to put up the necessary telecommunications infrastructure for the benefit of their citizens in rural and remote areas [8]. In line with this, Telehealth has already been projected in this only country in the world that is an entire continent in itself as an innovative and effective means of uplifting the quality of health of people in remote rural areas by facilitating access to specialist care [9].

A Philippine project connecting all government agencies via a national broadband network would have been a significant move by the country towards demonstrating this “will and fiscal objective”, had it not been suspended [10]. It should ultimately have paved the way also for other projects specifically delivering health care services via the Internet.

Limitations and Recommendations

The DTTBs make up only a small proportion of all RHPs and MHOs in the country. Batch 21 DTTBs, moreover, is just a segment of all DTTBs. It might be worthwhile, therefore, to do further investigations that get the sentiment of a more representative sample of Philippine RHPs and MHOs.

The high cost of installing and maintaining telecommunications infrastructure necessary for facilitating Telehealth in geographically isolated areas may be mitigated by investing in establishing ICT kiosks like the ones called Remote Communities Services Telecenters in Canada. These are shared-use facilities that can be utilized for providing various services to

communities. [11] Hence, cost can be shared as well among various agencies in the community. Similar establishments called Community e-Centers have already been set-up in the Philippines [12] and may be tapped for this purpose.

On the matter of physically deploying doctors to rural and remote communities and keeping them there, the “need for professional growth” and “loneliness” factors on the part of DTTBs that preclude their absorption into their areas of assignment after their tour of duty [13] may also be addressed through Telehealth. A study in Quebec, Canada found that Telehealth could improve physician recruitment and retention in remote rural communities by increasing quality of life at work, supporting professional practice, giving access to high technology, increasing access to continuing medical education and increasing feelings of security [14].

Acknowledgment

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The Innovative Searching Engine “YTPO”

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Abstract: This paper introduces specialized metasearch engine machine for medical terminology. Medicine and healthcare are probably the most popular information overloaded scientific spheres. This is due to the following facts:

- A rapidly increasing rate of new information being produced;
- The ease of duplication and transmission of medical data across the Internet;
- An increase in the available channels of incoming information;
- A lack of a method for comparing different kinds of information;
- Contradictions and inaccuracies in available medical information in the web.

A search engine is an information retrieval system designed to help find information on the Internet stored on a computer system. The method for finding this information is usually done by maintaining an index of web resources that can be queried for the keywords or concepts entered by the user. The presented here crawler is developed on PHP in combination with MySQL. It carries the name <http://ytpo.net>. The web site is divided into three parts – medical references with 36 indexed medical specialties, medical library and Internet survey with tests, analyzed and extracted results. At the current moment the medical library in YTPO posses 2000 indexed books.

Introduction

The web crawler (also known as a web spider or web robot) is a program or automated script which browses the World Wide Web in a methodical, automated manner. This process is called web crawling or spidering. Many sites, in particular search engines, use spidering as a means of providing up-to-date data. Web crawlers are mainly used to create a copy of all the visited pages for later processing by a search engine that will index the downloaded pages to provide fast searches.

The behavior of a web crawler is the outcome of a combination of policies:

- A *selection policy* that states which pages to download;
- A *re-visit policy* that states when to check for changes to the pages;
- A *politeness policy* that states how to avoid overloading websites;

- A *parallelization policy* that states how to coordinate distributed web crawlers.

One of the most important steps is processing of the requests – where the crawler searches in its own index. A representative example is the Google machine – if the user searches without breaks the “Suffer from Osteoporosis” – 150 000, in comparison with breaks where the results are much precise - 27 000 results.

Search engine optimization is the process of improving the volume and quality of traffic to a web site from search engines via "natural" search results for targeted keywords. Usually, the earlier a site is presented in the search results or the higher it "ranks", the more searchers will visit that site.

Other, more noticeable efforts may include adding unique content to a site, ensuring that content is easily indexed by search engine robots, and making the site more appealing to users.

The crawler that is subject of this paper is developed according to the world requirements and optimization factors. We can afford to claim that for Bulgarian medical medium this is a unique and quite new product. Searching in Google in Bulgarian language for medical searching machine – there are only 3 results – two of which, points “YTPO”. In comparison with English versions – there are 257 000 results for "medical search engine".

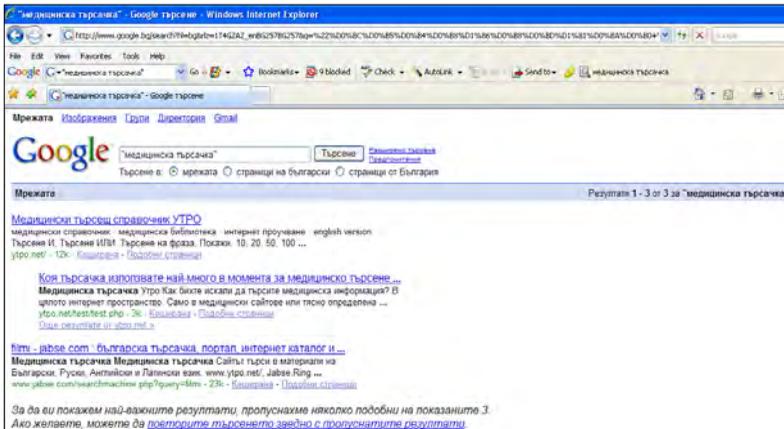


Fig.1. Searching in Bulgarian language for “medical search engine”

The medical searching engine YTPO is localized on <http://ytpo.net>. The server is with stable and free operation system FreeBSD with Apache web Server. The web site is written in PHP and uses MySQL database. It contains 36 medical specialties, searching box, indexed collection of medical literature – 2000 books up to the current moment, request form with 7 questions for the users, statistics and results from. It searches in websites in English, Russian, Bulgarian and Latin languages.

The authors used and led discussions with medical experts from all the 36 specialties to determine and include specific websites, that are considered to be most useful and at the same time trusted.

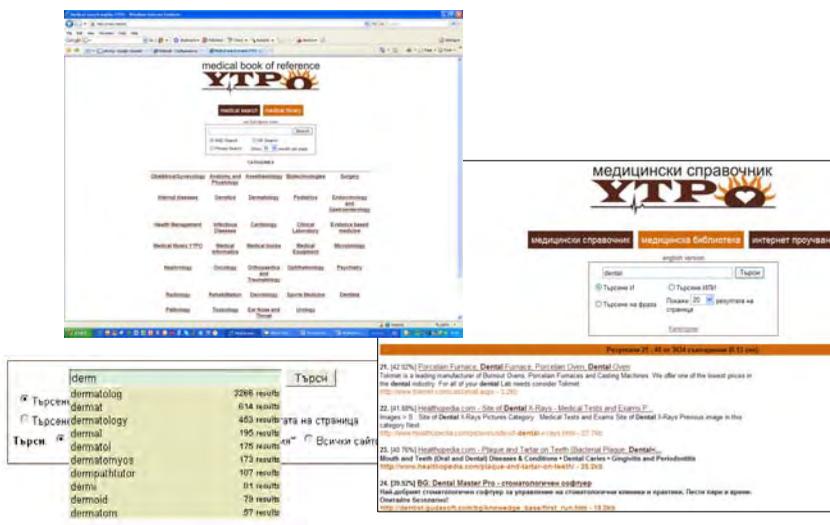


Fig. 2. Screens from “YTPO”

One of the main advantages of “YTPO” is the searching inside the indexed medical library of books. It is based on the same principles of the crawler, but for security reasons the fails are situated out of the Apache directory and downloading is slowed and requires code entrance. These functions prevent from downloading all the books at the same moment and overloading of the server.

In the interview the authors look for the following information:

1. Occupation and Specialty;

2. Which searching engine does the interviewed user most frequently use?
3. How and where the user would like to find the requested information
4. Whether the found information corresponds to the searched information;
5. How many languages does the user use to search for any information
6. Whether the user is a medical specialist?
7. Whether the user finds the key words and grammar corrector useful?

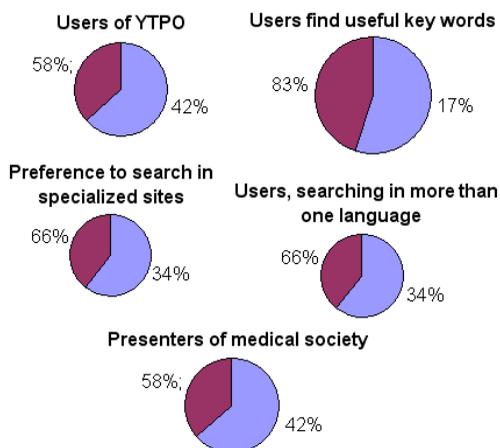


Fig. 3. Interview results

Conclusion

Twenty percent of existing web pages are related to medical and health; some are of high quality and some are junky. Our goal is to provide the Bulgarian society an intelligent tool and a useful service to find the quality health and medical information on the web. The engine “YTPO” needs time to be exploited, improved and widened, but what is more important – the major action is already done – there is a product to work on.

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Chapter 4

Health Informatics and Patient Safety

Bidirectional Voice Interaction with Dental Electronic Health Record

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Abstract. The EuroMISE Center focuses on new approaches in the field of an electronic health record (EHR). Among others, the structured health documentation in dentistry in the form of an EHR is being systematically studied. This paper describes the evolution of the EHR system developed at the EuroMISE Center named MUDRLite and its graphical component for dentists called DentCross. The summary of the features of the DentCross component is followed by a brief description of automatic speech recognition (ASR) module. The problems with data insertion into an EHR during examination of a dental patient leads us to further research in the area of the automatic speech recognition in medical practice. Cooperation of engineers, scientists and dental physicians resulted in an application called DentVoice that is a successful application of the ASR module and the DentCross component of the MUDRLite EHR. The synergy of the voice control and graphical representation of dental arch makes hand-busy activities in the dental praxis easier, quicker and more comfortable. This will result in a better quality of the data stored in a structured form in the dental EHR, thus enabling better decision-making and use of decision support systems.

Keywords: automatic speech recognition, electronic health record, dentistry

Introduction

International standard ISO/DTR 20514:2004 defines the electronic health record (EHR) as a repository of information regarding to the health of a subject of care in computer processable form, stored and transmitted

securely and accessible by multiple authorized users [1]. The EHR contains all the patient medical information acquired from multiple sources. Main goal of the electronic health record is to support continuous, efficient and high-quality integrated healthcare by sharing patient health information between authorized users. The EuroMISE Centre developed an electronic health record application called MUDRLite [2]. MUDRLite operates as a commands' interpreter; it processes the instructions encoded in the so called MLL (MUDRLite Language) based on XML and manipulates the database layer as well as the visual aspects and behavior of the MUDRLite user interface. The pilot application was prepared for dentistry [3]. To produce user friendly program, the system was enhanced with the automatic speech recognition module.

Methods

The MUDRLite architecture is two layered. The first layer comprises from a relational database. Currently, MS SQL server versions 7 and 2000 are supported. The second layer is a MUDRLite User Interface running on a Windows-based operating system.

To gain MUDRLite's user-acceptance in the field of dentistry, a highly advanced component — the interactive dental cross, which is a graphic part of dental documentation [4] — has been developed. The DentCross component is implemented as a stand-alone library DentCross.dll, completely developed for the .NET Framework platform using the Microsoft Visual Studio.NET 2003 development tool.

A user-defined component is inserted by the custom element of the MLL with the following mandatory attributes: "dll" specifying the name of the assembly the component is implemented in, and "class" specifying the name of the main class of the included component.

This component is fully interactive.

A dentist can choose among about 60 different actions, treatment



Fig. 1. Interactive DentCross

procedures or tooth parameters that are displayed graphically and in a well-organized manner.

The automatic speech recognition (ASR) engine was implemented by the Department of Cybernetics, University of West Bohemia in Pilsen [5]. The module was implemented as a standalone application, running in the server-mode in the background.

The server communication protocol is proprietary, running on the top of TCP/IP stack. The communication protocol enables the startup and the shutdown of the recognition process, the run-time configuration of the recognition task and also receiving the recognized phrases by a client.

The ASR system is speaker-independent and is based on a statistical approach. The ASR module scheme can be seen on **Error! Reference source not found.**

The speech signal is digitized at 8 kHz sample rate. Then, the pre-emphasized acoustic waveform is segmented into 25 milliseconds frames with 15 ms overlap. The acoustic model is based on modeling of triphones. Each individual triphone is represented by a three-state left-right HMM (Hidden Markov Model) with a continuous output probability density function assigned to each state. The decoder uses a Viterbi search technique together combined together with an efficient beam pruning algorithm [6].

The DentVoice prototype binds DentCross component and TCP/IP client of the ASR server with a voice commands definition file. The ASR client uses a DentCrossHandler class that implements all the functionality of the DentCross component.

The speech recognition is activated immediately after DentCross component start-up. The recognition process can be paused or stopped by a special voice command or using the user interface. Voice commands can be divided in two groups: global manipulating commands and context dependent commands.

Global commands are designed to manipulate the recognition process e.g. pause, resume, stop etc. and to close message boxes opened by the application to alert the user.

Context dependent commands rely on the current state of the DentCross

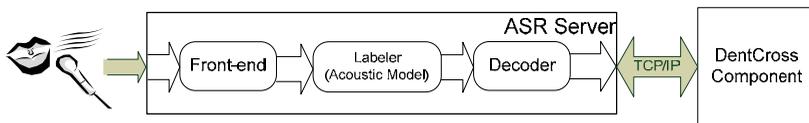


Fig. 1. Automatic Speech Recognition functionality

component and can be further divided into 33 command groups

corresponding to the 33 states (e.g. tooth treatment, caries placement, caries type, root canal treatment material).

Discussion

Electronic health records supports continuing, efficient and high-quality integrated healthcare by providing comprehensive information about the individual. They not only keep the data on the individual's current and historical health, medical conditions, tests, treatments or medications, but can also provide more advanced processing of these data and decision support functionality.

The MUDRLite EHR with interactive DentCross component brings a transparent health record on the whole dentition and accomplished examinations of a patient in a concentrated form. The dental information recorded in a common graphical structure accelerates dentist's decision-making and brings a more complex view on gathered information.

Voice commands usage has been examined since 1990's [7] as a convenient replacement of computer control using keyboard and mouse. Necessity of using human voice to control a computer or other device arose in typical hands-busy environments such as surgery or dentistry. DentVoice application makes the data insertion and update easier and faster.

Forthcoming development will address the usage of a computer synthesized speech. The DentCross will read the actual status of the patient's teeth stored in the database and the dentist will just check if the information corresponds with reality.

DentVoice (a voice controlled version of the DentCross) component is currently being tested in the process of dental data capture and evaluation.

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Mapping Clinical Databases to the Neuroweb Ontology: Lessons Learned

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Abstract: The paper gives an architectural overview of the Neuroweb neurological information system with an emphasis on the implementation problems of mapping clinical data structures to semantically disparate medical concepts.

Introduction

Integrated medical knowledge and data bases have big potentials for improving healthcare quality and supporting scientific research on larger patient cohorts. The goal of the Neuroweb system is to federate and share medical information in the neurological domain [1]. The system is based on the clinical databases of the participating 4 clinics (in Italy, Greece, Netherlands and Hungary), combined with public and local genomic data and other information sources like PubMed. The architecture contains a set of engines that provide various clinical services, which include searching for phenotypes and genotype-phenotype associations, verifying treatments and diagnoses, checking therapeutic options, etc. An important service is the specification of a phenotype by the user and the search for matching patient records in the clinical databases, called a “clinical query”. The paper details our experiences with the implementation of clinical queries.

Flow of Information in Neuroweb

The flow of information from the high level phenotype definition to the clinical database is shown in Fig. 1. In order to support the medical user in using medical concepts, our experts compiled a set of high level, structured phenotypes (like “Atherosclerotic Ischemic Stroke”) in the form of a Reference Ontology (on the left). Top-level phenotypes are related to parts of the body, lower level phenotypes and evidences, down to the actual clinical data (like “Body Mass Index”). The structure and theory of the Reference Ontology is further detailed in [2]. The ontology contains references to the Core Dataset (CDS), a set of 400 exactly defined (mostly coded) data fields, organized in a hierarchical structure, that are required in each longitudinal patient record. The CDS was also assembled by

consortium experts following international medical standards. The main CDS sections are Personal Data, Clinical Data, Brain Imaging Studies, Heart/Vessel/Laboratory Studies, Follow-up information and medication at months 1, 3, 6, 12, and Classification.

When a user selects and optionally restricts/combines a top-level phenotype in a clinical query, the Clinical Engine can translate it into a CDS-level query, which will be executed on the selected clinical databases.

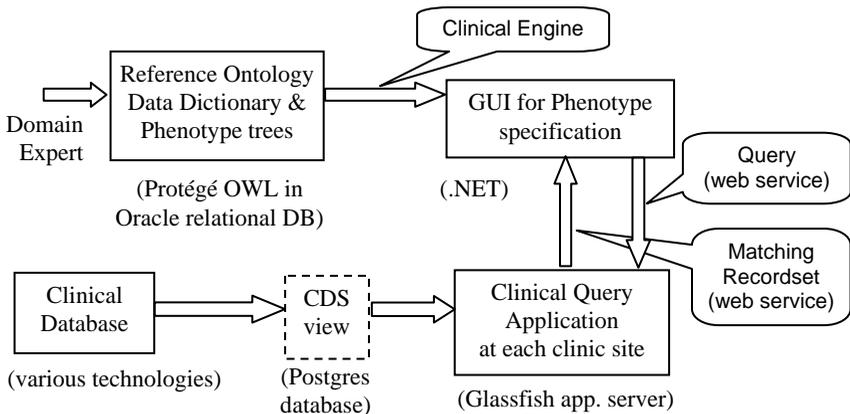


Fig. 1 Clinical Query Workflow Overview. The applied technology is shown in parentheses

The Clinical Query Application

The clinical query is answered by the Clinical Query Application instances running at the clinics. We expect that as the project expands, new clinical databases will be connected to the system, forming a “Neuroweb Knowledge Club”, so clinics are loosely coupled to the centre by web service calls. As security is an important aspect of the project, the communication between the center and the clinics takes place on a safe VPN connection. The Clinical Query Application is implemented in a free but safe technology, Java servlets on a Glassfish application server. The servlet processes and executes the query locally and wraps the results.

The parameters passed to the servlet include parameters for local database access and input parameters of the service related to the query (field names required in the response, query string). Query related parameters are compiled by the user each time a query is made.

The Mapping to CDS Fields

The query created by the Clinical Query Application uses CDS codes which must be mapped to the local database structures as precisely as possible. Existing databases at clinics can not be modified in order to comply. The present technology for this mapping is a database view. The fields of this view must be assembled in close cooperation of a database programmer and a medical expert who actually uses the database in daily practice. The mapping means to define each CDS field as a combination of the available database fields. Since the quality of the mapping determines the overall usability of the system [3], we took special care to overcome various practical and modeling issues.

Data Cleaning

The four clinics use heterogeneous data structures, and even within a single database, we first had to scan the records to identify and remove duplicates and eliminate spaces and accents from field names. We also checked numerical data values for credibility (e.g. a systolic blood pressure must be between 50 and 280). In some cases, the software application used by the medical staff to enter data at the clinic inserted special, erroneous values for unknown data fields. Date formats were also inconsistent in some cases, which could have produced a mapping error without a correction (e.g. 17, as an integer, for specifying a time data vs. '17:00'). The connection layer to the clinical databases also caused some minor problems in field values containing accented characters.

Semantic Gaps and Partial Mapping

The general procedure for mapping a CDS field was to first understand the content of the CDS definition, identify the database fields that carry any related information, and then depending on the missing information (the "semantic gap") decide whether the field is supported. As an example, "A.01.02.02.06.01.00" is the CDS code for "ECG rhythm on admission" with 5 possible coded options: 1: normal, 2: atrial fibrillation, 3: atrial flutter, 4: A-V block, 5: sick sinus. The clinical database contained information only about the presence or absence of atrial fibrillation, thus the mapping had to specify "unknown" values for all records where atrial fibrillation was not present—although we actually knew that option 2 cannot occur.

Another form of a hard-to-bridge semantic gap is missing, but required specialization. For example, the CDS differentiates evidence obtained by a CT scan from one obtained by an MR scan. The clinical database, however,

did not contain the source of the diagnoses, but it was obvious that we could not skip all diagnostics data just because their origin was unknown. So we had to report the diagnosis as a result of a CT *and* an MR, one of which may clearly not be true.

Unknown and unsupported values

The proper handling of unknown values is a cornerstone of any medical information system. There are obviously two cases for any data element in a record to be missing after the mapping:

- The field is not supported (no information was collected in the database)
- The field is empty for the specific patient.

In the first case it is a logical error to query the unsupported field, and the user should be advised about it. We have introduced special codes to mark unknown values. The central GUI keeps track of the unsupported fields at each clinical site to ensure that the user is allowed to enter only “meaningful” queries.

Conclusions and Future Work

The paper presented our experiences in implementing the CDS mapping layer of the Neuroweb system. According to our plans, the whole system will be fully functional by April 2008. We also plan to develop a local ontology, based on the central Reference Ontology, to support the semantic mapping of the clinical database fields to the CDS.

Acknowledgment

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Medical Diagnosis Using Artificial Intelligence Technology

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Abstract: Artificial Intelligence (AI) is devoted to create computer software and hardware that imitates the human mind. Expert systems are considered one of the subfields of AI and can be aid in solving problems and consultation purposes. This talk discusses the role of AI technology in medical diagnoses. Current research of developing expert systems for diagnosis of cancer and heart diseases at Ain Shams University, Egypt are discussed as well.

Introduction

The main goal of AI technology is to make computers smarter by creating software that will allow a computer to mimic some of the functions of the human brain in selected applications. Applications of AI technology include; general problem solving, expert systems, natural language processing, computer vision, robotics, and education. All of these applications employ knowledge base and inferencing techniques to solve problems or help make decisions in specific domains. Expert systems are applied to the following tasks of clinical medicine, generating alerts and reminders, diagnostic assistant, therapy critiquing, medical learning, training and education [1].

Expert system (ES) is an AI-Based system that contains the knowledge and experience of one or more experts in a specific domain that anyone can tap as an aid in solving problems [2]. In rule-based ES the knowledge base is structured in a *if-then* organization. The most difficult and time consuming part of the developing a rule-based ES is the extraction of knowledge from the head of an expert (or a group of experts) and then transforming it into a form acceptable to the ES's knowledge-base structure.

The new generation of ES uses the case-based reasoning (CBR) technique for inference and knowledge representation. CBR is an analogical reasoning method provides both a methodology for problem solving and a cognitive model of people. CBR means reasoning from experiences or "old cases" in an effort to solve problems, critique solutions, and explain anomalous

situations [3, 4]. The technology of CBR directly addresses the problems found in rule-based technology, namely; knowledge acquisition, performance, adaptive solutions, and maintaining. In this paper we focus our discussion around the usage of expert system technology in developing two expert systems for diagnosis of cancer and heart diseases.

Expert system for diagnosis of cancer disease

Cancer is a group of more than 200 different diseases; it occurs when cells become abnormal and keep dividing and forming either benign or malignant tumors. Cancer has initial signs or symptoms if any is observed, the patient should perform complete blood count and other clinical examinations. Then to specify cancer type, patient needs to perform special lab-tests. This section presents briefly a hybrid expert system prototype for the diagnosis of cancer diseases [5]. The system's knowledge base is diverse and linked through a number of indices, frames and relationships. The bulk of this knowledge consists of actual case histories and includes 70 cancer patient cases; some are real Egyptian cases and some from virtual hospitals on the internet. The system uses the case-based reasoning strategy to record and retrieve its knowledge. The initial diagnostic process is done through firing of rules in the rule-based inference. These rules encode information about patient's symptoms and pathological examinations.

The main purpose of the system is to serve as a doctor diagnostic assistant and to aid the young physicians to check the diagnosis. It consists of three main modules; user interface, case base reasoning model and computational model all are interacted with the main environment of cancer diseases. The user is cancer expert doctor, the interaction is through menus and dialogues that simulate the patient text sheet contain symptoms and lab examinations. 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 (nearest neighbor matching). The system's knowledge base uses *if-then* rules and semantic networks for representation of cancer diseases. Frames technique is used [6] for patient case indexing, storage and retrieval. The patient case includes; age, sex, weight, temperature, pathologic, medical history, family history, physical exams and treatments. The system is implemented using Visual Prolog for Windows.

Expert system for diagnosis of heart diseases

Heart disease is a vital health care problem affecting millions of people. Heart disease are of 25 different ones; e.g. left-sided heart failure, right-sided heart failure, angina pectoris, myocardial infraction and essential

hypertension. We have developed two versions of the expert system. The first one uses the rule-based reasoning methodology while the second one uses case-based reasoning. The first system [7] is composed of three components: knowledge base, user interface and computational model. The knowledge was gathered from expert doctors in EL-Maadi Military Egyptian hospital, Egyptian Health Insurance Institute and medical books. Due to the presence of similar symptoms in heart diseases, clustering techniques for both symptoms and signs were applied. *if-then* rules were used for representation of knowledge, where certainly factors are used with both the role premise and conclusion portions. We have built the system's knowledge base for the 24 heart diseases and it is composed of 24 facts and 65 rules. The system is implemented in Visual Prolog. The system has been tested for 13 real experiments (patients). The experimental results have shown 76.9% accuracy in estimating the right conclusion.

The Second system uses case-based reasoning methodology [6]. We have represented the knowledge in the form of frames and built the case memory for 4 heart diseases namely; mistral stenosis, left-sided heart failure, left-sided heart failure, stable angina pectoris and essential hypertension. For the case retrieval, we have developed two algorithms namely; nearest-neighbor algorithm and induction algorithm so that we can measure the system performance in both cases. The system searches for the most adequate cases for the current case, a similarity value between each retrieved case and the current case is calculated and the retrieved cases are ranked according to these values. The system has been implemented in visual prolog for Windows and 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 experimental results have shown 94% accuracy in estimating the correct results for using nearest neighbor algorithm and this percentage is dropped to 53.8% in case of using the induction algorithm.

Conclusion

Artificial intelligence technology offers students more sophisticated tools that can act as "intelligent" collaborates allowing student to develop richer inquiry skills, which may be transferable across learning situations. This paper describes the usage of expert systems technology in developing two diagnostic systems, under research, for cancer and heart diseases. The systems are very useful in the management of the problem, and are helpful for the young physicians to check their diagnosis.

From technical point of view, knowledge representation techniques offer potentially powerful tools for the development of intelligent medical expert systems systems. The variety of such techniques enables the design of robust intelligent learning/educational systems. CBR systems use an extensive case-based of exercises and examples to teach students. The case-based ESs solves new problems by adapting solutions that were used for previous and similar problems. For future work, we plan to develop an intelligent tutoring/learning system has the following characteristics; (a) compose lessons at various levels of knowledge by following the curriculum, (b) solve and generate problems, and (c) generate teaching material.

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Near Field Communication (NFC) Technology – An Enabler of the Internet of (Medical) Things

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Abstract: Powerful computing capabilities and the ability to access web-based systems render the mobile phone applicable to act as patient terminal for home monitoring applications. It enables patients suffering from chronic diseases to acquire and transmit their key measurements on a daily basis. The aim of this paper is to present a new solution for mobile phone-based data acquisition based on a short range wireless communication technology. This technology called near field communication has the potential to act as an intuitive interface between patients and the technical infrastructure of a home monitoring system.

Introduction

Changes in demographics and lifestyle as well as better treatment of acute diseases lead to an ever increasing number of patients suffering from chronic diseases like hypertension, diabetes mellitus or heart failure. Since there are not enough resources to deal with this situation in a conventional way, we have to switch to an advanced strategy based on patient centred telemedicine. This concept virtually connects the patient to his/her physician that finally allows for moving the information about the patient's health status instead of the patient himself. This information is the key to an individualised and optimised therapy for patients suffering from chronic diseases. So we need to leverage information and communication technology as much as possible to acquire, transport and process this information.

A promising approach to establish an interactive link between patients and their caregiver is the utilization of mobile phones, because of their absolute mobility and ubiquitous availability [1]. Powerful computing capabilities and the ability to access web-based systems render them applicable to act as patient terminal to transmit health status information and to receive feedback, alerts, and reminders [2].

Considering the limited usability of handling the mobile phone for manual data entry we have been searching for a new solution that provides high usability at high security. The idea was to utilize mobile phones

enabled with Near Field Communication (NFC) technology that could simplify the way of providing mobile health care services [3].

Near Field Communication technology

NFC is a wireless connectivity technology evolving from a combination of contactless identification and networking technologies, that enables convenient short-range communication between electronic devices. Since NFC is the further development from Radio Frequency Identification (RFID) technology, it is compatible to certain parts of the existing RFID infrastructure. NFC is based on magnetic inductive coupling and works in the unlicensed frequency band of 13.56 MHz. It reaches a data transmission rate of up to 424 Kbit/s within a short range of typically 5 to 20 centimetres [4]. This short range is the major advantage of this technology because it offers the ultimate in convenience for connecting devices and enables rapid and easy communications just by bringing them close together. Therefore, NFC is appropriate to be integrated in various types of consumer devices predominantly in handheld devices like the mobile phone.

Materials and Methods

To research into the potential of NFC with respect to eHealth, we developed and implemented a platform for an easy-to-use mobile phone-based data acquisition solution. This platform contains the following three components:

- NFC module to extend measurement devices
- NFC-enabled mobile phone with an especial JAVA application
- Web platform to receive, store and process health parameters

NFC module

To enable various types of medical measurement devices with NFC capability, we developed a versatile NFC module based on the transceiver chip PN531 from NXP (NXP Semiconductors, Gratkorn, Austria) and a microcontroller type MSP430F123 by Texas Instruments (Texas Instruments, Dallas, TX).

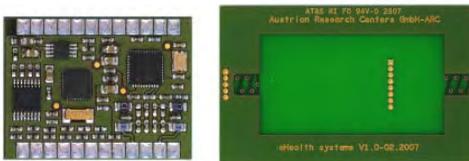


Figure 5: NFC module and separate antenna

This module provides a range of interfaces like

UART, digital I/Os and analogue inputs. The antenna of the module was implemented separately to assemble both components (figure 1) at their best places within a device body. A medical device, enabled with this module is able to communicate with other NFC-enabled devices just by bringing them close together.

NFC-enabled mobile phone

To exchange data with NFC-enabled medical measurement devices we configured the mobile phones Nokia 3220 NFC and Nokia 6131 NFC (Nokia Corporation, Helsinki, Finland) by developing a special software application. These two mobile phones provide an NFC interface that can be addressed from a JAVA application running on the mobile phone.

This software application is able to be launched automatically after bringing the mobile phone close to an NFC-enabled device. Afterwards it automatically receives the data from the NFC module, processes them and transmits them to a Web-based database. Since NFC is compatible to RFID the application behaves analogue after touching an RFID tag or contactless smartcard. This feature supports the recording of non-measurable parameters like intake of medication, physical activity, and wellbeing just by reading the static content from passive RFID tags.

Web platform

The web-based telemonitoring platform is the third component of this system. It has been set up as a three tier architecture containing a web server, an application server and a database. Various services are running on this platform to receive the data from the mobile client, process and store them persistently, manage users, generate and deliver alerts and reminders, and provide the information to authorised users via a web browser.

Results

Based on this platform we implemented various working prototypes by extending different off-the-shelf available medical measurement devices with our NFC module.

The selected devices (to be seen in figure 2) are a blood pressure meter (a), a body weight scale (b), a blood glucose meter (c) and a high sophisticated hemodynamic monitor (d).

Several test users have transmitted quite a number of measurement parameters to the web platform just by touching the devices with an NFC-enabled mobile phone. A comparison of this intuitive method with other

mobile phone-based solutions for data acquisition revealed significant advantages of NFC technology, most of all usability [3].



Figure 2: NFC-enabled devices; blood pressure meter (a), body weight scale (b), blood glucose meter (c), hemodynamic monitor device (d)

Discussion

The intuitive and touch-based NFC technology in combination with the mobile phone's features enhances this handheld device to a powerful eHealth toolbox. The NFC-enabled mobile phone acts as an intuitive and secure gateway between the patients' surrounding and the connected world. Just by touching NFC enabled medical devices or RFID tagged items all of the patient's relevant health parameters can be acquired and relayed without the need of further user interaction.

Conclusion

Initial results indicate that this NFC-based data acquisition concept is able to provide an intuitive and easy-to-use method for patients to collect their health related data. In information technology terms, NFC is the enabling technology in establishing a sensor network for the patient. NFC technology, therefore, allows connecting to the "Internet of (Medical) Things" and brings us closer to advanced healthcare: anytime, anywhere, including anything!

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New Paradigm for Telemedical Collaboration: Design of Intelligent Agent Functions

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Introduction

In development of telemedicine systems the new paradigm based on concept of the multi-agent has appeared (Della Mea, 2001). The agent is autonomous, social, reactive proactive software entity, being sometimes also mobile. Each agent has some purposes, to be fulfilled either by operating alone or together with other agents. The overall behaviour of multi-agent system is determined by the resulting complex interaction among agents.

The telemedicine seems suitable environment for multi-agent systems: it consists of complex systems with heterogeneous components, operates the distributed data and resources, and often requires integration with existing systems (information systems of hospital/laboratory). Set of telemedicine facilities may be described using the multi-agent paradigm, which can then be embraced for its analysis and implementation. This is particularly true for mobile telemedicine systems, which introduce further complexity and dynamism.

In (Della Mea, 2001) was developed a prototype telemedical agent TOMAS through KQML-based (Knowledge Query and Manipulating Language) Internet agents, which are organized in federation, each of which provides special service to other agents. TOMAS has two generic features: an agenda for managing appointments, and methods for access to patient records. Our aim was to add the intelligent feature to TOMAS, namely to develop a method of the complete description of a situation in which intelligent agent can work. The description of a situation will be complete at a full set of parameters describing this situation. For the account of set of the essential factors representing through a set of initial data, parameters are broken into groups each of them combine the parameters, forming rather autonomous semantic group. The problem of a situation evaluation is broken into a number of sub problems. The conclusions made by sub problems, make up parameters of higher degree of generalization which

serve as the initial data for sub problems of the following level of hierarchy, etc. Such process of the solution allows withdrawing the conclusions on separate aspects and the general conclusion about the conformity of a current situation to the control goal in multi-agent environment. Any of the sub problems we formalize as a hill-climbing problem of grouping a set of parameters on factors; the procedures of feature extraction and detection of factors are realized as parallel computing (E. Braverman, I. Muchnik, 1983).

Methods

In order to solve a problem of factors revealing, it is necessary to have the model specifying how values of measured parameters are connected to factors. In this case revealing of factors can be realized as two-level procedure: first to separate out groups with the help of any variation or heuristic algorithms, and then, using one of methods of the factor analysis (for example, the bi-factor analysis) to construct the factor for each group of parameters. The groups built optimum do not guarantee that the factor too will be optimum. Therefore the method of an extreme grouping of parameters where task of groups of attributes separation and the factors detection are solved simultaneously has been developed; this procedure realizes as process of parallel computing.

The initial information is the matrix of correlation $\|a_{ij}\| = \|(x_i, x_j)\|$, representing a matrix of scalar multiplication of vector -columns of an initial matrix "object - attribute" when all columns are centered and normalized. The problem of parameters grouping is reduced to a problem of extremalization of special functionals. It is necessary to note one important thing. In this case factors are formed of other reasons, rather than factors of classical models of the factor analysis where they were used for the best approximation of initial parameters.

Let the set of parameters x^1, \dots, x^n is broken on L groups, - G_1, \dots, G_L and besides it is entered L factors f^1, \dots, f^L such, that $(f^1, f^1) = (f^2, f^2) = \dots (f^L, f^L) = N$

Let's enter functional J_1 :

$$J_1 = \frac{1}{N^2} \sum_{i \in G_1} (x^i, f^1)^2 + \frac{1}{N^2} \sum_{i \in G_2} (x^i, f^2)^2 + \dots + \frac{1}{N^2} \sum_{i \in G_L} (x^i, f^L)^2 =$$

$$\sum_{i \in G_1} \bar{\rho}^2 x^i, f^1 + \sum_{i \in G_2} \bar{\rho}^2 x^i, f^2 + \dots + \sum_{i \in G_L} \bar{\rho}^2 x^i, f^L \quad (1)$$

Where $\bar{\rho} x^i, f^L$ - factor of correlation between parameter $x_i (x_i \in G_L)$ and the factor f^L of this group.

Functional J_1 it is chosen so that its maximization was carried out together in the process of groups of parameters G_1, \dots, G_L formation and selection of factors f^1, \dots, f^L so that "closer" groups turned out and the factors "strongly connected" to these groups were formed. How to determine the factor?

If groups G_1, \dots, G_L are fixed, then it is possible to provide a maximum of functional J_1 , if each factor f^k to choose independently as the solution of a corresponding sub problem:

$$\sum_{i \in G_k} (x_i, f^k)^2 = \max (f^k, f^k) = N \quad k = \overline{1, L}; \quad (2)$$

Expression (2) is a task on a conditional extremum.

Lagrangian of this task will be $F(f^1, \lambda_1) = \sum_{i \in G_k} (x_i, f^1)^2 - \lambda_1 (f^1, f^1)$, so some vector f^k should satisfy to system of the equations which we shall write down as the vector equation:

$$f^k = \frac{N}{\lambda_1^k} \sum_{i \in G_k} \alpha_{1i}^k x^i$$

Where λ_1^k and vector $\{\alpha_{1i}^k, i \in G_k\}$ accordingly are first largest eigenvalue and first eigenvector of a sub matrix of correlation R_k . We shall make two remarks:

1. Eigenvector of a matrix is defined to within constant multiplier;
2. The task is solved not on all parameters n, and only on those from them which belong to group (G_k) .

Meaning a condition of normalization of a vector f^k , we shall receive:

$$f^k = \sqrt{N} \frac{\sum_{i \in G_k} \alpha_{1i}^k x^i}{\sqrt{\sum_{i,j \in G_k} \alpha_{1i}^k \alpha_{1j}^k \bar{\rho} x^i, x^j}} \quad (3)$$

If factors satisfy (3), for calculation $\bar{\rho} x^p, f^k$ and together for check of a condition

$$\bar{\rho}^2 x^p, f^k < \bar{\rho}^2 x^p, f^l \quad (k \neq l) \quad (4)$$

It is not necessary to know the factor f^k (i.e. it is not necessary to know values of vector f^k components on objects). It is enough to know eigenvector $\{\alpha_{1i}^k, i \in G_k\}$ and a sub matrix R_k of coefficients of correlation between the parameters x^i belonging to group G_k . From (3) follows, that:

$$\bar{\rho} x^p, f^k = \frac{1}{N} (x^p, f^k) = \frac{\sum_{i \in G_k} \alpha_{1i}^k \bar{\rho} x^i, x^p}{\sqrt{\sum_{i,j \in G_k} \alpha_{1i}^k \alpha_{1j}^k \bar{\rho} x^i, x^j}}; \quad (5)$$

Algorithm. Let to the given step of algorithm the some partition of parameters into groups G_1, \dots, G_L are constructed and first eigenvectors $\{\alpha_{1i}^k, i \in G_k\}$ of a sub matrix R_k $k = \bar{1}, \bar{L}$ are counted up.

On the given step all parameters x^1, \dots, x^n are looked through, and for each parameter x^p such index l , that is defined

$$\bar{\rho}^2 x^p, f^l = \max_{k=1, \dots, L} \bar{\rho}^2 x^p, f^k \quad (6)$$

If for parameter x^p there are some indexes, satisfying a condition (6), these indexes should be found, using the formula (5). Thus it is necessary to mean, that as groups G_k involved in this formula it is necessary to take the

groups generated on the previous step of algorithm. The parameter x^p is located in group G_i (or in any of groups if to a condition (6) satisfy some groups). Hence, the given step finishes by the formation of new groups G_1, \dots, G_L . For these groups first eigenvectors $\{\alpha_{i^k}, i \in G_k\} k = \overline{1, L}$ corresponding to them are counted up.

If on some step does not occur transition parameters from one group in another, - the algorithm stops.

Let's note two properties of algorithm:

1. During algorithm's operation there can not be two identical partitions of parameters (strictly at transition of parameters).

2. Number of possible partitions finitely, therefore the algorithm converges for finite number of steps.

As initial partition it is possible to take any partition, however it is necessary to take the partition received by any simple algorithm. Though each such (simple) algorithm gives it's own partition, as a rule, these partitions are rather close.

Results

The proposed algorithm was tested on two problems from psychology and neurology. First one is known as K.Holzinger problem (K.Holzinger,1939). The matrix of correlations of psychological tests, which were conducted on 145 schoolboys, was investigated.

Psychological tests have consisted of 5 groups.

1. The group of spatial perception contained tests on: visual perception, - cubes, the form of a flat figure, tags.

2. Group of verbal perception: the general perception of the information, understanding of sense read, drawing up of the sentence, classification of words, understanding of sense of words.

3. Speed of thinking: summation, decoding, calculation of number of points, the analysis of letters geometry.

4. Memory: recognition of words, numbers, figures, and following pairs word - number, a number - figure, a figure - word.

5. Tests for mathematical abilities: deduction, numerical puzzles, the decision of practical tasks, drawing up of numerical series, arithmetic tasks.

Feature of this material was sharp semantic distinction between tests. At the same time correlation matrix for all 24 tests turned up "fuzzy" matrix. The described circumstances were the reason of that the matrix of

correlation between 24 tests is considered as "complex" for research of proposed algorithms. The number of iterations was 8, specificity and sensitivity of the algorithm were 95% and 75% accordingly. The results of computing are shown in Table 1.

Initial partition	Value of functional J_1		Results of classification \Leftrightarrow True classification
	Initial value	Final value	
P ₁	13.803	18.08 2	GROUP 1 - 2 4 10 \Leftrightarrow 1 2 3 4 GROUP 2 - 5 6 7 8 9 \Leftrightarrow 5 6 7 8 9 GROUP 3 - 3 11 15 \Leftrightarrow 10 11 12 13 GROUP 4 - 14 16 17 18 19 \Leftrightarrow 14 15 16 17 18 19 GROUP 5 - 1 12 13 20 21 22 23 24 \Leftrightarrow 20 21 22 23 24

Table 1. Results of classification in K.Holzinger task

The problem of V.Nebilitsin (V.Nebilitsin, 1966) is more simple and consists in investigation of cause-effect relation of nervous processes dynamics and forces of nervous system with so-called effect of imposing of a rhythm. The effect consists of , that at presentation to the examinee light or sound stimulus (or their combinations) on the determinate frequency, in electroencephalogram (EEG) of the examinee characteristics of this frequency components sharply vary. The big distinctions in force of effect along all spectrums of produced frequencies allow putting forward a hypothesis that the effect of a rhythm fastening in different areas of frequencies is caused by impact of different mechanisms.

During experiment to each examinee was produced the stimulus of frequency. First three frequencies were from area θ of a rhythm, the following four both were frequencies from area of α rhythm and last four, - from area of β rhythm; the power characteristic (index) of component of this frequency on electroencephalogram was measured. Thus, in a result there were 11 indexes for each of 25 examinees; on this matrix 11x25 the matrix of correlation for 11 frequencies has been computed. Results of V.Nebilitsin task's solution presented in Table 2. Specificity and sensitivity of the algorithm were about 100%, because no one error was detected.

	<i>Value of functional J_1</i>		<i>Results of classification \Leftrightarrow True classification</i>
<i>Initial partition</i>	<i>Initial value</i>	<i>Final value</i>	
P_{IN}	8.062 4	10.2 95	GROUP 1 - 1 2 3 \Leftrightarrow 1 2 3 GROUP 2 - 4 5 \Leftrightarrow 4 5 GROUP 3 - 6 7 \Leftrightarrow 6 7 GROUP 4 - 8 9 10 11 \Leftrightarrow 8 9 10 11

Table 2. Results of classification in V. Nebilitsin task

Conclusion

The theoretical background of proposed method is very perspective in future formation of intelligent agents communities and realization their real activities in telemedicine environment. The features of agents are aimed at distributing the task of solving problems, by allowing different software components to cooperate, each one with its own expertise. There is also a huge potential for inter-linking decentralized telemedicine networks into a loose grid of networks allowing transparent information exchange and inter-connectivity at all levels. Considering that multi-agent systems theory has been developed in direction of intelligent agent creation, it can be forecasted that common area of grid, multi-agent system and telemedicine will be one of the challenging areas for research in telemedicine, which will be of high impact also for its application in developing country.

Acknowledgments

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Procedures Based on the Dialog Semantics for Emergency and Teleconsulting Call Centers

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Abstract: This paper addresses a sensitive issue in practice of real-time (synchronous) telemedicine: the medical information extracting and interpretation during the teleconsulting sessions. The problem approached is relevant for the current tasks running in the call centers, where the dispatcher should act according with the precise procedures. The procedure of conversation with the dispatcher and semantic construe of patient-physician dialog are the key issues in teleconsulting and emergency calls driving. Basically, the critical issue is the correct understanding of the orally messages often delivered in layman's terms by the peoples in suffering. The paper presents some relevant cases defining the groups of situations on the medical risk guiding the medical staff towards the corect decisions in case of the call.

Introduction

One of the important middleware components of the telemedicine systems is the application named *call center*. It plays an important role as interface that guides the dispatcher or medical staff according to the specific and precise procedural tasks flowing. The main task of the call center is to provide a real-time, correct evaluation of the cases in order to establish the priorities, ranking the interventions and providing the suitable immediate advises and medical expertise. This process is subject of responsibility into the centers of telemedicine driving the current medical routine there.

This research aims to improve the reliability in medical practice when the consultations are provided remotely. The problem approached is relevant for the current tasks running in the call centers, where the dispatcher should act according with the precise procedures. In our opinion, the decisions are made gradually on a multi-level procedural scale towards the more and more competent staff in order to evaluate correctly the risk of the patient and making the correct medical decision each time.

Problem statement

The medical staff in telemedical call centers must be trained to work according to specific regulations in order to avoid the *malpraxis*. This issue becomes critical because of the medical staff are not face to face with the patient, and the available medical data can distort the diagnostic while the decision could be inappropriate.

For example, in all countries the emergency stations are guided by the procedures for effective call reception and promptly intervention. It is mandatory for any efficient telemedical dispatcher to be in connection with an emergency service. Usually, in telemedical networks the patients are known while the data about their health condition are available via telemonitoring, the dispatcher can manage the cases fusing the new vital signs and symptoms with those already known. There are two distinct situations of the patient that lead the tasks of the medical staff in a call center. When the patient is cooperative, the doctor can provide remotely the best medical decision on the correct diagnostic. On the contrary, if the patient is unconscious, fall down, that is an emergency situation, and then data come only from the monitoring devices, including possibly the position of the patient. Considering the medical situations frequently meet in the telecenters by practitioners [2], [3], we distinguish both: (1) The patient is *conscious*, and (2) The patient is *unconscious*. The decision is gradually inferred if the patient is conscious, while it is clearly asserted as “emergency”, if the patient is unconscious. If the caller is conscious, few relevant situations can be taken into consideration starting from the premise the most of the patients are chronics and elders. The frequently meet cases in this category are followings: cardio-vascular disorders, respiratory disorders, immobilized patients, postoperative disorders. A large class of situations includes the hypertensive patient, BP monitored, with possible foreseen complications. Thus, the reference BP value is the key parameter that imposes the procedure guiding the dialog with the patient.

Guide for emergency situations

Some typical cases in this situation are given in the examples followings:

Case 1.

Caller: patient hypertensive claims *head ache* or *vertigo* or *nausea with throws up*.

Dispatcher: Learn about BP value (asking for/accessing the current records). If BP is high decides supplementary drug administration. If BP is still high, then **call the emergency service**.

Case 2.

Caller: patient hypertensive plus coronary disease claims <i>precordial pain</i> .
Dispatcher: Learn about BP value plus EKG (accessing the current records). (a) If BP is normal and EKG is normal recommends: 1. Take an analgesic and 2. Continue monitoring (for possible EKG deviations). (b) If EKG exhibits abnormal deviations and <i>intense pain</i> is present (for more than 20 minutes, even under the Nytroglicerine!): call the emergency service.
Note: If patient is diabetic the precordial pain could miss!

Case 3.

Caller: patient hypertensive plus <i>heart rate disorders</i> .
Dispatcher: Monitorise BP value plus EKG (accessing the current records). <ul style="list-style-type: none"> • If EKG exhibits fibrillation or flutter call the emergency service. • If EKG is interpreted as <i>non dangerous</i> for life of the patient, guide him or her to the cardiologist.

In case of the *unconscious patient* the possible causes are various: stroke, drop attack, fall down with possible syncope, dementia, etc. The procedure states definitely: *emergency alert*.

Guide for teleconsult procedures

The teleconsult is a specific real time procedure for diagnosis and treatment administration. The dialog between doctor and patient has a crucial role for relevant information extraction in terms of the real disease of the patient. A relevant case [1] for a session of teleconsultation is presented in the following example. It could be considered an example of good practice.

Case 4.

A patient female, 40 years old call the telecenter declaring the symptom of <i>diplopic</i> .
First, the doctor approaches both: <i>ophthalmology</i> and <i>neurology</i> disorders but she does not hesitate to put some <i>key questions</i> learning the followings: - The patient has been lost 3Kg in weight in the last 2 weeks, although her appetite is kept up. - The patient has asthenia and restlessness after a psycho trauma. - The diplopic is persisting from one week.
<i>The recent medical records of the patient point out the ophthalmologic exam and neurology exam, including cerebral tomography were normal.</i>
The monitoring devices provide a <i>tachycardia</i> of 98 beats per minute at rest.
The doctor decides on a possible <i>endocrine disorder</i> and <i>guides the patient to the endocrinologist</i> .
The subsequent paraclinic exam reveals hormonal disorder of thyroid, in fact a hyperfunction. The patient is diagnosed with Basedow disease.

Conclusions

The aspects presented in this paper aims to improve the best practices in telemedicine networks as follows: (a)- defining the groups of situations related on the medical risk and suitable actions to do in case of the call; (b)- methodically organizing of the information in terms of the medical language based on the semantic construe of the patient-physician dialog (including the set of mandatory questions to ask in different situations); (c)- extracting the data need for intervention flow arrangeing.

The first step towards developing of the software application for the call centers with optimized capabilities to manage the medical cases during the remotely provided consultation. Definitely, the doctors should be included in the software development team to provide their valuable expertise on the various cases. The authors are conscious this is a very sensitive issue and the results will have a relevant impact for improving the medical decisions in telemedicine services. It is a question of high responsibility to make a medical decision remotely behind the display screens.

Acknowledgment

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RESIST: A Platform to Support Medical Web-Services: A Case Study

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Abstract: This paper describes the contribution of RESIST project to improve the interoperability of eHealth systems in Luxemburg. The general propose is the definition of a platform that supports developments of medical web-services. Based on concepts from Software Engineering our works intend to identify needs of healthcare professionals and to describe it in the design and analysis layer of MDE (Model Driven Engineering) taking into account SOA (Service Oriented Architecture) concepts.

Introduction

In a digital society, the concept of services evolves and words like e-service and web-service enforce their place in the market. With the aim of catalyzing this process, several governments are creating e-portals [1], [2], that allow hospitals and caregivers to have direct interaction with public administrators. They are also improving the curricula of graduate and undergraduate courses [3] in order to educate students to use new technologies. We are entering in the era of eHealth.

This transition is an inevitable outcome and also a challenge. Luxembourg is contributing with e-health studies throughout many projects in related domains. In this paper we present some results from RESIST project. Launched in 2006, it contributes to the development of eHealth solutions applying concepts from Software Engineering to improve the interoperability of medical web-services. The idea is to guide engineers to design and analyze e-health web-services and propose to them a platform where they can test and validate their services. The case study that we are working on is the remote monitoring of patient's vital signs, as illustrated by Figure 6. This application was chosen due to the impact of cardiovascular diseases in industrialized nations and to the experience of our work team in this subject. Developed in collaboration with the national research center Henri Tudor (CRP-HT), RESIST uses in-home and open

source technologies as well as MoniCard, a device developed at CRP-HT for LuHF project (Luxembourg Heart Failure).

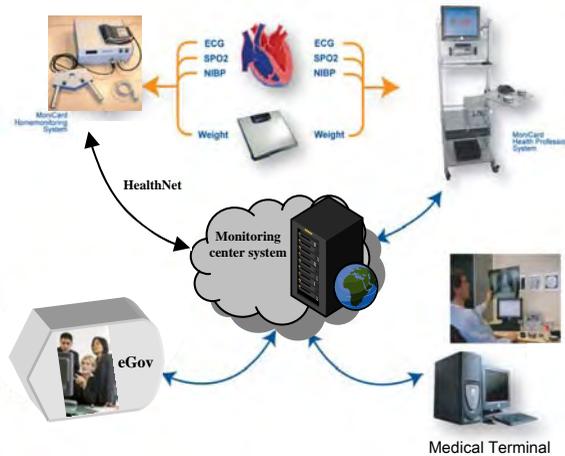


Figure 6: RESIST platform

The RESIST current infrastructure is composed of three systems: a *home monitoring system (HMS)*, used by the patients to remotely measure his vital signs; a *monitoring center system* (normally the hospital ICT) that communicates with the other components via a secure channel (in our case, the HealthNet); and the *medical terminal* that are access points to the other systems, used by H-professional (physicians, nurses, etc.) through specialized applications. Each system has one or more servers that offer a predefined set of basic web-services (from now on called only as services). These services can collaborate to perform more complex tasks. Without an appropriated organization, this structure can easily generate very complex relations between services and drive the system to chaos.

RESIST project proposes a hierarchical organization, illustrated by Figure 7, founded on the concepts of Service-Oriented Architecture (SOA). The components are grouped into two different layers: Business and Application Layers. Each layer has a specific set of components located in different levels of abstraction. The components enclose models that define autonomous services. The *Business service models* specify the services offered to the final user and take into account environmental policies. The *Control service models* represent the different ways to implement the business models and give the variability of services.

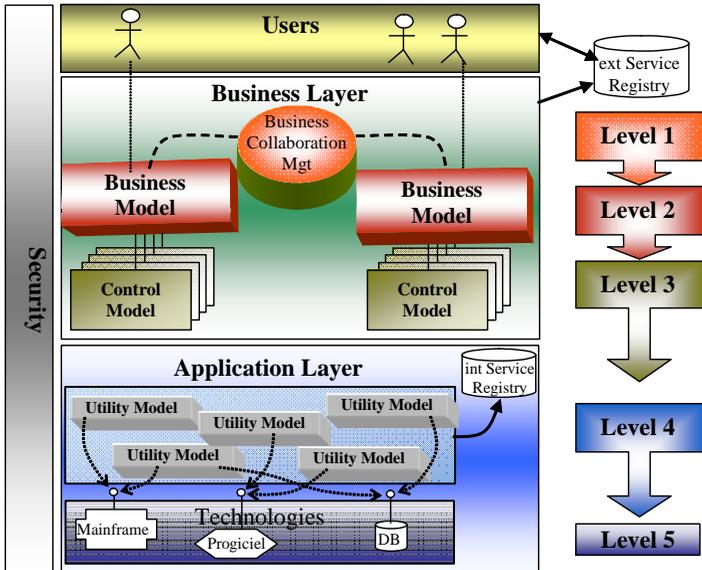


Figure 7: Architectural approach of RESIST project

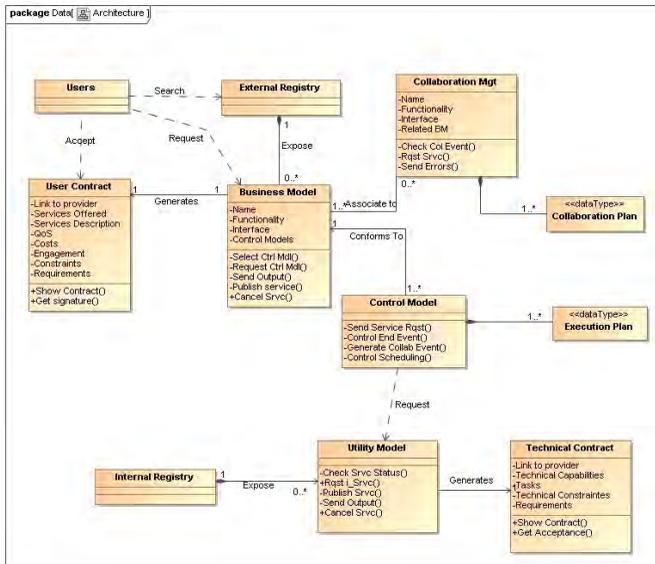


Figure 8: UML model of the RESIST Architectural

The *Utility service models* define services offered by the platform to support the control models. Collaborations are defined in a special component named *Business Collaboration Mgt*. In the right side of Figure 7

are indicated different levels. We differentiate layers from levels to facilitate the explanation of the architecture. Brief, one layer can contain one or more levels. The components of the system are grouped into five levels of abstraction where level 1 regroups the collaboration strategies and level 5 regroups the technologies. The control-flow respects a top-down flow, where the start level is level 2. Level 1 is used only to manage collaborations. Then, the requests are propagated through components that are in the adjacent-inferior level until be completely executed. This principle intends to avoid complex connections and dependences between components. The service specification process is supported by a set of UML models (e.g. in **Figure 8**). It intends to reduce the time consumed to design services, guide engineers and allow them to re-use the models to define domain-specific services.

Current works have studied a way to formalize the description of policies and the coordination of utilities services.

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SAPHIRE-Intelligent Healthcare Monitoring Based on Semantic Interoperability Platform

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Abstract: The SAPHIRE project has developed an intelligent healthcare monitoring and decision support system to address the problem of an ever-increasing workload in medical fields due to the increasing percentage of elderly people in Europe's population. In the SAPHIRE project, the patient monitoring is achieved by using agent technology where the "agent behaviour" is supported by intelligent decision support systems based on clinical practice guidelines. In SAPHIRE system, patient history stored in medical information systems is accessed through an Integrating the Healthcare Enterprise XDS (Cross Enterprise Document Sharing) based architecture to tackle the interoperability problem. In this way, not only the observations received from wireless medical sensors but also the patient medical history is used in the reasoning process.

Introduction

Clinical Decision Support Systems (CDSS) broadly refer to providing clinicians or patients intelligently filtered and processed clinical knowledge and patient-related information in order to enhance patient care. Recently, there has been an explosion in basic and clinical research on disease pathophysiology and treatment. Coupled with increased demands on healthcare delivery systems, this rapid growth has made the practice of medicine increasingly complex. The response of healthcare community to this growing complexity has been to develop clinical practice guidelines to simplify and improve healthcare delivery. Despite the widespread publication of clinical standards and practice guidelines, however, healthcare professionals have difficulties in understanding and applying these guidelines in the clinical care setting. This necessitates computerized decision support systems automating clinical guidelines to support the health professionals. One of the major challenges in developing computerized decision support systems executing these guidelines is accessing the many disparate data sources needed to retrieve patient-specific information. The SAPHIRE Project [1] has made use of semantically enriched Web service architecture and semantic mediation mechanisms to tackle this problem.

The SAPHIRE system aims to continuously monitor the patients through dedicated agents and to support the healthcare professionals through intelligent decision support system. Additionally, it generates and sends notifications and alerts to the related people.

System Architecture

When used at the point of clinical care, automated, computer-based CDSSs can improve healthcare professional compliance with specific treatment guidelines. However, the challenge is in providing timely and complete access to the many disparate data sources to retrieve patient-specific information. In the SAPHIRE system, patient vital signs are received through Web services from the sensor devices from the Gateway computer, and patient history stored in medical information systems is accessed through Integrating the Healthcare Enterprise (IHE) [2] Cross Enterprise Document Sharing (XDS) Registry/Repository to tackle the interoperability problem. In this way, not only the observations received from biosensors but also the patient medical history is used in the reasoning process in the clinical decision support system. This is an essential component, because in clinical guidelines, the physiological signs received from wireless medical sensors, the patient care plan and the medical history retrieved from Electronic Healthcare Records (EHRs) (such as previous diagnosis, medication list, allergy/adverse drug reactions) all affect the clinical path to be followed.

In Figure 9, the overall architecture of SAPHIRE system is illustrated. The SAPHIRE system is based on an agent based network which has been implemented as Java Agent Development Framework (JADE) [3] Agents. Each main module of the SAPHIRE is modelled as an agent which handles and abstracts the communication of the modules for enabling the flexibility of the whole system. The main modules of the SAPHIRE system are provided briefly in the subsections below. For the details of the architecture please refer to [4]. The medical processes for diagnosis, treatment and observation of the patient, on the other hand, have been modelled as clinical guidelines using Guideline Interchange Format (GLIF) [5] by complying with the latest European Cardiology Guidelines [6].

Agent Factory

Agent Factory is the primary agent which controls all other agents in the system. When the Agent Factory is launched, first it registers itself to the “Main-Container” of JADE then it launches several other agents listed below:

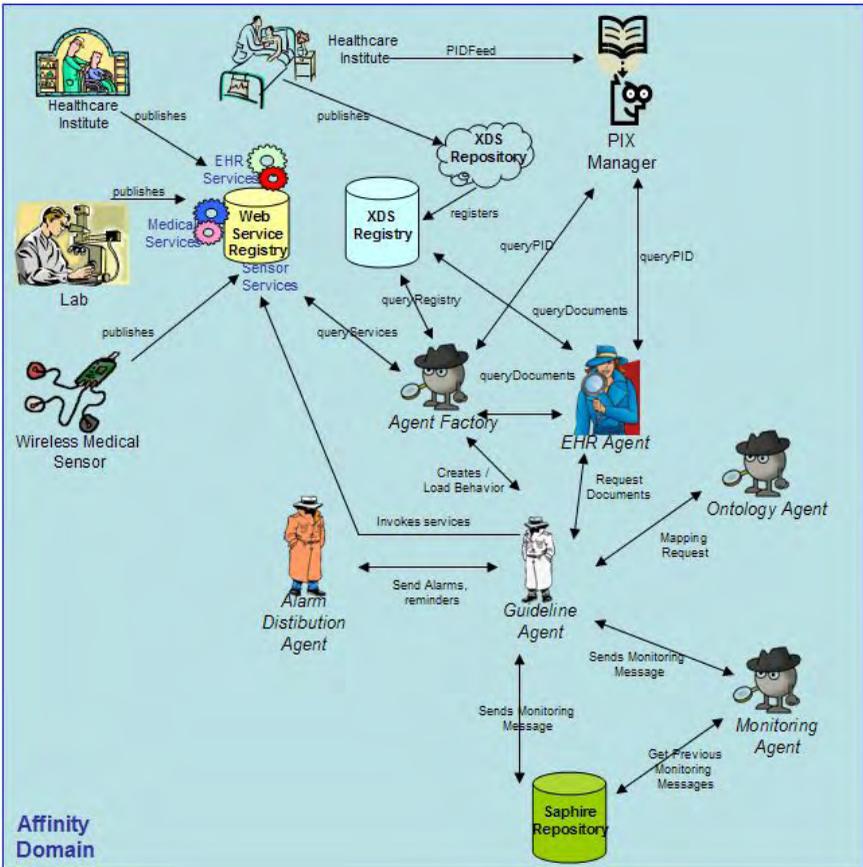


Figure 9 Overall Architecture of the SAPHIRE Initial Prototype

EHR Agent: This is the first agent that Agent Factory Agent creates. EHR Agent is responsible of querying and retrieving the patient electronic healthcare record documents in that clinical affinity domain. There exists one EHR Agent in each affinity domain. In SAPHIRE, EHR Agent queries and retrieves the EHRs in Health Level 7 (HL7) [7] Clinical Document Architecture (CDA) format from IHE XDS Registry/Repository.

Alarm Distribution Agent: This agent is responsible of delivering the alarm entities, which are generated during the execution of the guideline, to the related healthcare people such as doctors, nurses, patient relatives, etc. Alarm Distribution Agent acts as a bridge between the SAPHIRE Intelligent

Clinical Decision Support System and the communication layer of the Alarm Component.

Ontology Agent: Ontology Agent is responsible for the mappings of inputs and outputs of both medical and sensor Web services to data entities of GLIF. For conversions, besides ontology mapping, also XSLT mapping ability has been included.

Guideline Agent

In SAPHIRE system, the computerized clinical guidelines which have been tailored for specific patients are executed through Guideline Agent. The starting of the guideline execution process is triggered by the execution request coming from a Monitoring Agent, which reveals the list of available patient-guideline assignments to the healthcare user. The Guideline Agent functions with the operations of handler classes. Clinical guidelines consist of different building blocks. In SAPHIRE, separate handlers are implemented for each type of the building blocks in the guideline specifications. The Guideline Agent creates the handlers when needed and calls the handling methods providing the necessary parameters which may depend on the characteristic of the guideline section.

The guideline model used by Guideline Agent has a number of building blocks. One of the building blocks is the Eligibility Criteria. The longitudinal records and sensor data related to a patient has to be eligible in order to perform the guideline execution. Another important building block is the tracing the steps of guideline algorithm. The algorithm itself is composed of several ActionSteps, BranchSteps, DecisionSteps, PatientStateSteps and SynchroniationSteps. For the details of the guideline agent building blocks please refer to [8].

During the guideline execution, according to previously defined instances of AlarmMessage class, Guideline Agent creates alarm messages and reminders to be sent to doctors, nurses or healthcare relatives and passes the content of Alarm Messages to Alarm Distribution Agent. Alarm Distribution Agent is responsible of delivering these alarm messages to the communication layer of the Alarm Component in order to be delivered to related people according to rules by means of email, SMS or instant messaging.

Guideline Agent also interacts with Ontology Agent for mapping the input/output structure of Web services while it is accessing the EHR documents, Medical and Sensor Web services. This way, the interoperability is achieved.

Monitoring GUI

The Monitoring GUI is the user interface provided to the doctors and it is responsible from displaying any events, latest status and the detailed history related with the guideline execution. It sits on top of the Monitoring Agent which interacts with Guideline Agent and gathers all the monitoring messages.

When created, the Monitoring GUI first parses and displays the flowchart of guideline in GLIF format. Each guideline step defined in GLIF is drawn with a different shape and colour. During execution, Monitoring Agent user interface also provides a live history of what happened until that moment. The messages are kept in XML format but they are visualized in a more tabular format. Besides data retrieval from sensors and EHR records of the patient, sometimes it is necessary to get information from directly doctors. These information requests are defined with consult actions in the guideline definition which waits input from the practitioner. For handling this property, the Monitoring GUI has a consult panel which is used for getting input from the practitioner.

Using Monitoring GUI, doctors can also monitor guidelines that have already been executed and finished. During execution each completed step is saved to SAPHIRE repository. When the doctors want to see a previously executed guideline, the selected guideline execution is simulated as if it is running at that moment.

Hospital Pilot Application

After the development and integration of the SAPHIRE project is finalized, the system has been deployed to The Internal Medicine and Cardiology Department of the Emergency Hospital of Bucharest (SCUB) in Romania for testing and evaluation of the system [9]. With this pilot application, the SAPHIRE platform will be evaluated using the real data from the real patients having myocardial infarction.

For the prototype, four clinical guidelines have been defined and modelled which are for management of myocardial infarction with non ST-segment elevation and management of myocardial infarction with ST-segment elevation.

In the pilot application, all the patients sign an informed consent admitting to use SAPHIRE system. Then, the sensors developed within the scope of the SAPHIRE are placed on the patient, the necessary configuration is performed and the patient is started to be monitored by the automatic guideline execution. As the guideline execution continues,

appropriate recommendations and prescriptions are suggested and alarms are sent to the related people in the hospital whenever necessary.

Conclusion

The SAPHIRE Project aimed to develop an intelligent healthcare monitoring and Decision Support System (DSS) for reducing the ever-increasing workload in medical fields due to the increasing percentage of chronic diseases. This system which is based on agent framework has been designed to continuously monitor the patients and to deliver recommendations, prescriptions and alarms to the medical personnel as needed. The system also enables the remote monitoring of the patient since the continuous monitoring is achieved with extensive support for timely and complete data retrieval from different sources (from EHRs, sensors and medical people).

At the moment, the SAPHIRE System is being validated by two pilot applications; a hospital application and a homecare application. With the Hospital Pilot Application, it is expected to be demonstrated that the SAPHIRE system can provide bedside intelligent monitoring wirelessly and provide patient-specific clinical decisions in accordance to the European Cardiology Guidelines. The pilot application also tests the safety and the accuracy of the sensor data, the Alerts System, the accuracy of the history data from the EHRs and the recommendations generated by the system by correct interpretation and implementation of the guidelines.

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Security Considerations for Integrated Telecare Systems

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Absatract: The paper presents specific security problems and solutions of a complete telecare system that will be applied within a Romanian medical telecare system – TELEASIS, developed as a part of research programs financed by Ministry of Research of Romania. The telecare system will contain hardware and software components that implement specific medical flows for the provided services. One of the main factors when design and develop a telecare system is the data confidentiality that leads to a set of aspects concerning data transmission and security.

Introduction

TELEASIS project main purpose is to design and implement a home telecare system especially for people over 60 years old. It will also define general architecture and guides for implementing telecare services in Romania. One of the main concerns is to assure high security and confidentiality information. This paper presents issues of concern and solutions for security layer for TELEASIS project. By system integrity we understand the prevention for external factors to interfere unauthorized with the telecare system. Therefore we divide the security based on the structure at the following levels: ***Patient security level:*** contains software security aspects related to telemonitoring devices located in the patients homes; ***Service provider security:*** contains security solutions related to data transmission from patient home to a telecare service provider; ***Telecare center security:*** contains security implementation from the network architecture and software point of view inside a telecare center; ***Mobile medical staff security:*** contains a security approach of mobile medical participants that interact with the telecare system.

Patient Security Level

This security level refers to solutions concerning the equipments used at patient home and the data transmission between them. The patient will have two kinds of equipments that are part of the telecare system: data acquisition equipments that are used for collecting raw information from the sensors and reporting equipment that communicate with telecenter and transmit collected information.

The chosen solution for sensors is called Wireless Body Area Network (WBAN) and consists of a set of sensors that are using ZigBee (IEEE 802-15) technology to communicate with the storage equipment. The WBAN solution has in our context the following advantages that recommend it as a secure solution: the transmission frequencies used by equipments are medical dedicated and is of a low frequency; the sensors power consuming is very low, therefore the equipments produced are very small and can be attached directly on the human body; the data transmission is quite resistant to interferences. Data storage equipment will receive raw sensors data and will send them to the home main transmission equipment. The best approach found was to use Bluetooth that helps in creating a better security. Also protocol is supported by a wide set of equipments and implements a good security in data transmission.

In this project we approach two types of data transmission equipments. If the home user has its own computer he will be able to use a Windows application that collects and processes the sensors data before transmitting them to the telecenter. In this case an Internet connection will be used through dial-up or permanent connection (like DSL). The second approach is dedicated equipment that will have either Embedded Linux or Windows operating system that will be used to collect the data, process the information and transmit them to the telecenter. In this case this equipment will be utilized with mobile communication for sending the information.

Related to transmissions security there are two important points to outline:

1. The sensors transmit raw data that sometimes can be compressed and processed. The transmission equipment will also implement base algorithms for processing the data and transmit only telecenter relevant information. This will lower the used bandwidth and also optimize transmission duration.
2. The standard method for transmission will be the conjunction use of the following technologies: Virtual Private Network (VPN) – that assures a tunnel point-to-point communication; IPsec – is a suite of protocols for securing Internet Protocol (IP) communications by authenticating and/or

encrypting each IP packet in a data stream; RSA 2048 certificates that assure authenticity between home and telecenter equipments.

Service Provider Security

The telecare service provider has to implement a strong security related to telecenter patient data security and external attacks to servers from telecenters. Most of data security and integrity point can be assured by the following methods: **Redundancy** - A redundant topology eliminates the single point of failure that assures high availability of the telecenter for existing customers; **Data backup** – all system data should be backup-ed in separate storage for safety; **Disaster Recovery** – represents a process of restoring critical telecenter services that includes data structure from backup and communications to increase the service availability.

Related to external attacks we will concentrate on the possible vulnerabilities of data transmissions between patient and telecare center. As stated above for communication we will use VPN with IPSec technologies. One of the most dangerous attack types for such a data transmission is called “man in the middle attack”. The following procedures are implemented in order to minimize this possibility: **Public key infrastructure**: the system will use RSA 2048 bits certificates specific to telecenter and patient home equipments; **Mutual authentication**: both telecenter server and patient equipment will authenticate in both directions; **Passwords**: both equipments will use internal passwords when starting communication.

Telecare Center Security

From security point of view we will define 2 level accesses for the system inside the telecare center.

Level 1 consists of personnel that interact directly with the patient. For them, the access to the system is password based. In this context: the passwords will be delivered by a certified authority in the telecare system; lost passwords are reset and regenerated; passwords are changed automatically on a configurable amount of time; passwords are not kept in clear text and are encrypted with a one way method in the database (like md5 algorithm) that will make impossible reversing them into clear text; entering bad passwords for 3 consecutive times will disable the account. The password issuer authority will be able to reactivate it upon an internal procedure. Telecare center application for operators includes an inactivity protection. Therefore when an operator is not using the application for a configurable amount of time it will automatically require reentering the password.

Level 2 consists of medical personnel that work together with Level 1 for assuring all telecenter services. This level has more permission inside the telecenter application therefore more security measurements have to be taken comparing to level 1. Beside password protection policy and presence mechanism we will implement a token authentication system, composed by token equipment that generates random numbers based on a PIN code. The generated token is changing in time creating a high security level. Tokens might be used for authentication when performing sensitive operations on the database level for certain patients.

Mobile Medical Staff Security

Telecare center has also a notification system for medical personnel. This means that a doctor can create events for his patient and be alerted if certain conditions are met. The alert system works through mobile communication and is using SMS system. Mainly the content of the messages received is not sensitive content and requires for medical staff to login to the main application. Therefore for this kind of situations we will rely on the mobile communication provider security.

Conclusions

The paper points out several security techniques that are used in a telecare system using a 4 level approach. In a medical application, security is one of the main concerns and all the possible vulnerable points have to be covered and well protected. Combining hardware, software, security policies and procedures will assure high availability of the system together with a high security level.

Acknowledgment

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The Formulation of a Scientific Problems and Its Practical Solution Using “The Symbiosis of Telemedicine and Neural Networks”

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Abstract: This material contains ideas about the Symbiosis of Telemedicine and Neural Networks.

Introduction

The purpose of this study is the substantiation of theory "symbiosis of telemedicine and neuron networks". We believe that the success in the use of artificial neuronal networks in medicine and biology depends mainly on the problems formulation. Unclear criteria and wrongly formulated medical problems often lead to failures in neural networks learning.

The ethical approach in the use of neural networks in medicine, providing more intensive education of a physician, can also be reinforced by economical considerations. The conception «Symbiosis of telemedicine and neural networks» is an illustration of a strict approach toward decision making. Let us call such an approach «Division of labor in problem formulation and solution». Each step of the solution is to be assigned to a certain group of specialists.

The presence of the bases of medical data, created with the aid of the electronic communication channels (for example - base of data iPath of Basel University, Switzerland; the base of data of Caroline university, Sweden and etc) is the main the prerequisites of the conception.

The main idea of the conception «Symbiosis of telemedicine and neural networks» consists of the following:

I. Creation of medical databases using certain criteria.

I.1. Principles of medical databases creation.

Medical databases are to be created using the criteria of evidence-based medicine. The second opinion of medical experts is required for database creation.

Databases are to be created according to the criteria of mathematic (cybernetic), «neural-networks» processing.

I.2. Databases classification and systematization:

- a) According to the type of diseases
- b) According to the type of medical information for each diseases using qualitative and quantitative principles.

II. Processing of database information in medicine:

II.1. The conditions for creation of neural networks;

II.1.1. Correct problem formulation (from the point of view of medicine and theory of artificial intelligence) for neural network learning;

II.1.2. The specialists in neural networks have to be charged with selection of the software able to work in various fields of medicine;

II.2. Creation of the learned neural networks for various fields of medicine.

III. Teaching physicians using the means of telemedicine:

III.1. Principles of teaching:

a) Using the results of data processed by neural networks for teaching the students both in universities and at home.

b) Using the results of data processed by neural networks for continuing medical education of physicians directly at their workplaces, using electronic communication channels.

Example of the Neural Nets

Formulation of the problem:

“Can be complication in the form of the fatal thrombosis of pulmonary artery or its branches in this sick with myocardial infarction?”

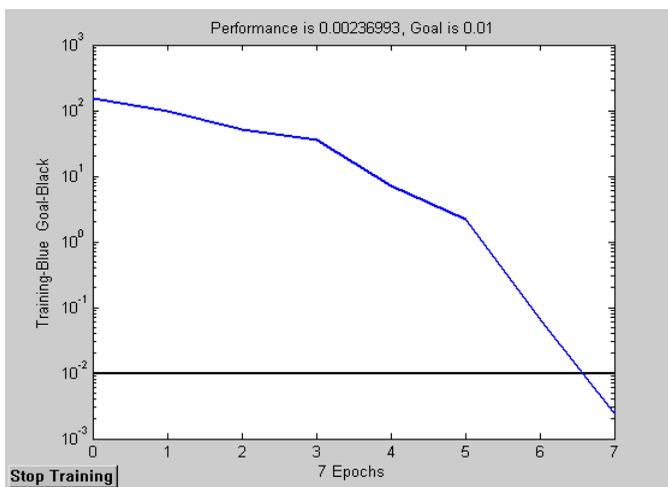
A - The group of patients with the Cordial Ischemic Disease - myocardial infarctions without the risk of the developed thrombosis of pulmonary artery (n=16).

B - The group of patients with the Ischemic Heart Disease - myocardial infarctions with the risk of the development of the fatal thrombosis of pulmonary artery (n=17).

The groups of patients are selected on the criteria conventional for the sharp myocardial infarction. They are compared on the sex, the age and the associated diseases. Diagnosis in the second group of (B) of patients is identified posthumous according to the data of pathologist studies.

In this work it is proposed to use Neural Networks approach for evaluating the probability of the occurrence of this terrible complication of sharp myocardial infarction as the thrombosis of pulmonary artery or its branch. Solution of this prognostic problem is based on the use of a base of data of patients, whose this complication appeared, and those, which it not had. Analysis is constructed on the use of a collection of the analyses of the blood standard with this disease. Given indices can contain information

about the probability of the occurrence of thrombosis. However, this information is not obvious and to practicing doctor on the basis of numerous indices to frequently difficultly estimate the degree of the concealed pathology and to appoint adequate therapy. The collection of the training examples consists of two groups of patients of the age from 42 to 78 years. Data of patients with the thrombosis compose the first group. In all are examined 17 realizations for 10 indices of the analyses of the blood, and also is considered floor, age and localization of infarction. Last three indices are coded by significant figures. Into the second group 16 realizations of analogous indices for the patients with the uncomplicated myocardial infarction enter. The accumulated data base was subjected to preprocessor to processing for bringing the values of the elements of the vectors of entrance to the normal distribution with the zero average and the dispersion, equal to 1. The trainer and the control room of set is formed from the initial sample. For the solution of the set diagnostic problem in system MATLAB



6.5 with the use of expansion Neural Network Toolbox is realized the three-layered network of reverse propagation, which includes 13 neurons in the input layer (according to the number of components of input vector) with the transfer function logsig, 3 neurons in the second (concealed) layer with the transfer function logsig and 2 neurons in the output layer (according to

the number of components of output vector) with the transfer function purelin. In this case as the training algorithm the algorithm Levenberg-Marquardt (trainlm) is selected.

The process of instruction is illustrated by the graph of the dependence of the estimation of error in the functioning on the number of the cycle of instruction.

Testing the obtained neuron network showed that it successfully manages this diagnostic task and number of erroneously classified cases does not exceed 5%. Thus, the results of this work testify that the indices indicated can contain information about the probability of the occurrence of thrombosis.

The development of the concept of the Symbiosis of Telemedicine and Neural Nets is substantiated by the presence of the scientific achievements of medical, mathematical and other sciences. The medical data bases possibly and must be created on the criteria of the international standards, yearly discussed by international medical societies.

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The Introduction of Electronic Referrals in Norway

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Background

A Regional Health Authority (RHA) is a state enterprise that is responsible for specialist healthcare in Norway. The Norwegian Ministry of Health instructs the RHAs regarding requirements that should be fulfilled annually. One of these requirements is that the RHAs are obliged to provide services for sending and receiving discharge summaries and referrals. Electronic referrals are requests for medical examination and evaluation by a specialist, outpatient clinic or a hospital. The referrals can be sent from a GP, specialist or from one hospital to another. The referral transfers fully or partly the responsibility for further treatment of the patient. The introduction of electronic referrals in Norway started back in 1996, when the first standard for an electronic referral was introduced. There are still problems with implementing the electronic referrals. In September 2007 only 8200 referrals were sent electronically and 6300 of them within the RHA of North Norway. As a comparison, during the same month, 125 000 electronic discharge summaries were sent.

In order to minimize the workload related to ICT at each hospital, the RHAs have established an organization (National ICT or NICT) that provides limited funding for projects and actions that can support all the RHAs. In 2006 NICT initiated a task to identify which problems that had to be solved before electronic referrals could be widely used. The Norwegian Medical Association was given the responsibility for the task. A series of 10 meetings with the RHAs was put through.

Findings from the series of RHA meetings

The organizers for the first meetings were the RHA's representatives in NICT. The RHA's representatives in NICT are top level managers for ICT, and they are members of the RHA's management group. Both technical resource persons and clinicians were present at the meetings, although fewer clinicians were involved requested. A resource-person from the

Norwegian Centre for Telemedicine, with experience from regional referral-projects in North Norway, was also present at some of the meetings in addition to representatives from Norwegian Centre for Health Informatics (KITH) and the Norwegian Medical Association.

Missing strategy at regional level for deploying electronic cooperation

All the RHAs seemed to be well informed about requirements from the Ministry of Health, and they had taken steps both to develop a plan for deploying the messages and communication modules. Still many of the RHAs did not have a strategy for deploying electronic cooperation in general. Even if the management level know the requirements from the Ministry of Health well, many of the people who were supposed to implement the strategy at an operational level, were not familiar with it. It seemed clear that top level commitment is necessary, but still not enough to ensure that the messages were implemented and used. Most of the RHAs also have very tight budgets, and internal activities at the hospitals are highly requested. Activities that support shared care and that do not lead to an obvious economic benefit for the hospital within a short time span, seemed to be given low priority.

Strategies and action plans with relations to the national plans should be developed in cooperation with the end users, but also the IT-workers who are going to implement plans and strategies. The RHAs must allocate sufficient resources, and the work must be given priority according to the requirements from the Ministry of Health.

Responsibility for deploying the solutions is shared among many actors

Especially within RHAs with many large hospitals, the responsibility for implementation of the communication strategy is assigned to several people at a hospital level. The background for this is partly historical, because many of the larger hospitals have a long tradition for selecting and/or developing their own ICT-solutions.

One person should be given the overall responsibility for implementing the communication strategy within each RHA. A team with members from the hospitals, representatives from GPs and community care should be established to support the process. The team-members should preferably have mixed competence regarding the different information systems, eg. EHR, laboratory systems and PACS/RIS. Clinicians should also be included in the team.

Workprocesses should be improved

The introduction of electronic referrals in a large organization as a hospital can be a major challenge. Today the hospitals have routines to

handle the referrals that are sent by paper from GPs, specialist and other hospitals. These routines are fairly good, but it will sometimes take weeks before the actor who sent the referral will get information about the patients scheduled appointment in secondary care. Quite often additional information about the patient's health status and previous treatments will be requested by phone or mail before a decision can be made about further treatment. Sometimes the referrals also get delayed because they are sent to the wrong address: The requested doctor could be on leave, or the GP could have misunderstood which ward the referral should be sent to.

Some hospitals can probably benefit from establishing a reception service where referrals are handled before they are sent to a specialist who gets the responsibility for further treatment of the patient. The reception service can request missing information from the GP, make sure that the referral is sent to a specialist with adequate competence for the task that needs to be performed, and follow up that information about scheduled appointment is sent back to the GP and patient.

It is likely to suppose that the limited number of electronic referrals compared to the number of electronic discharge summaries can be linked to the complexity of the cooperation process between the GP and the specialist to establish a "good" referral. Further steps should be taken to address this issue, and hopefully suggestions to how this process can be improved, can be given.

Practice consultants should be used

There were complaints from the RHAs about referrals from the GPs that included too much information. The referrals also did not satisfy the specialist's needs at the hospital.

Many hospitals already benefit from the use of practice consultants to improve cooperation. The practice consultants are GPs who are employed in part-time positions at the hospitals. They try to improve procedures to support the work processes for both GPs and specialists. A typical task would be look at the procedures for production of electronic referrals and discharge summaries, and initiate processes to come to an agreement about the structure and content of these documents. The GPs needs for information in the discharge summary would for example often differ from the hospital doctors needs; The GP needs the document to make sure that he or she can provide the patient with a proper treatment plan. The specialists at the hospital on the other hand, find the discharge summary useful as a means to get access to summarized information when the patient is readmitted to the hospital.

Automatic production of discharge summaries from existing EHR-documentation is also possible from some EHR-systems. If this is not done with care, the result can be documentation that is too voluminous for the next caretaker in the treatment chain. This can be seen as a parallel to the specialist's complaints about voluminous referrals. In both cases a common understanding of each others needs is necessary in order to agree on a recommendation for how much information should be included.

Knowledge should be shared and used

During the meetings, people from the hospitals had the possibility to ask questions directly to those who had been involved in other implementation projects, contact with the vendors and testing and development of the standards. Knowledge from the resource person could be shared with those who were initiating new projects.

The Norwegian Centre for Telemedicine (NST) has had the project management for two regional electronic referral projects. They have gained valuable experience and have knowledge that should be shared with other projects. There have also been several other referral projects ongoing, and it would be useful for other projects to get to now more about their experiences. It should be considered to establish meeting arenas for ongoing and planned referral projects. Web-pages with easily reached information and communication channels to resource person should also be provided. Currently KITH has an information service available for those who implement standardized messages, and NST has also been instructed by the Ministry of Health to assist in implementation projects, but this is not sufficient.

Technical issues should be sorted out and solved

There were complaints about the Norwegian Health Net. Some of these complaints seemed to be due to lack of understanding of healthnets role and responsibility. The Norwegian Health Net mainly provides an infrastructure and some basic services. The customers have to provide content to the net and this is also a responsibility for the RHAs. Complaints also indicated that Norwegian Health Net did not satisfy the customer's expectations regarding response time for handling requests and downtime.

The Norwegian Healthnet should provide better and more easily reached information about their services. This includes both their Webpages and direct contact with the RHAs. In addition to that, technical problems need to be solved more quickly.

Testing and Approval Service should be extended

The national Testing and Approval Service has so far been used to test the vendor's implementation of message standards. The RHAs experience is that even if the implementation of the standard is tested separately at the endpoints, it does not necessarily mean that communication in the treatment chain with many actors will run smoothly. A table that is included in message by a specialist at the hospital might as an example be unreadable when it is shown in the EHR-system at the GPs office.

The Testing and Approval Service should be extended to include the whole cooperation chain. It must be evaluated how this can be done, but regional test environments at the RHAs might be used in cooperation with vendors test sites, the test-server at KITH and the testing facility at the Norwegian EHR Research Centre (NSEP).

Outdated EHR-system versions should be replaced

The RHAs claimed that outdated versions of the EHR-systems at GPs office were a problem. The GPs EHR-systems have been tested through the National Testing and Approval service, but if the GPs do not install the newest version of the software, there will still be problems with the communication. The number of offices that used outdated versions was not quantified, but it was claimed that this was a significant.

A means to help solve this problem can be contracts between the hospitals and GPs. The GPs would then have to commit themselves to upgrading to new versions if they want to communicate with the hospital. Some of the hospitals are on the other hand reluctant to do this, because the fear that the can loose customers to competing companies, as private laboratories.

Conclusion

There are many elements that need to be in place before communication between the hospitals and the GP's-EHR-systems can run smoothly:

- The RHAs must have a strategy for deploying solutions for electronic cooperation. The responsibility for implementing the strategy must be given to one person, and a supporting team should be established.
- Technical issues regarding availability to the Norwegian Health Net, EHR-system version and testing need to be solved.
- More attention should be paid to the fact that the number of electronic referrals is so much lower than the number of discharge summaries.
- Organizational issues must be addressed, and the GPs must be included in planning organizational change. Practice consultants can be used. New solutions for electronic referrals should also be

used to support enhanced workprocesses, and joint reception for referrals should be considered at larger hospitals.

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Towards Pervasive ICT Solutions in the Healthcare Sector: An Integrated Technology Approach to Safer and Efficient Clinical Processes in Organizations

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Abstract: The Italian National Cancer Institute in Milan is moving towards advanced applications in support of clinical operations, applying a coherent methodological approach to technological and organizational evolution. Above all it can be considered a forerunner in the advocacy of RFID solutions, as it is spreading this technology across many clinical areas: blood transfusions, tissue bank operations, management of surgical instruments. This case study shows an innovative use of new technology focusing on the enabling role of IT on process governance instead on the diagnostic aspects of technology (machinery), fostered by the methodological support of Fondazione Politecnico di Milano.

Introduction

Founded in 1925, the Fondazione IRCCS Istituto Nazionale dei Tumori in Milan (Italian National Cancer Institute) is recognised as a Scientific Research and Treatment Institution (IRCCS) and has achieved renowned excellence in the field of pre-clinical and clinical oncology. The Foundation also managed the development of the Lombardy Cancer Pathology Network (ROL).

This paper will mainly focus on the first project being set up for granting safer transfusion in the Institute. Some other key projects will be presented, underlining how they are bound by a coherent strategy and a shared approach to technological and organizational evolution.

RFID fits an integrated RFID strategy at the Italian National Cancer Institute

The Istituto has consolidated expertise regarding the impacts of new technologies on knowledge transfer from research to clinical practice and on tools for granting enhanced process safety, transparency in critical areas. This both because of the clear CIO's strategy and of the state-of-the-art methodological framework adopted to lead project activities, necessary to face change management issues in such a challenging context like public healthcare institutions, leading to a common infrastructure enabling the spread of IT tools in the Institute. This not for buying new machinery, but for exploiting the real potential of ICT in supporting day-by-day operations, organizational evolution, information exchange for scientific and clinical purposes, in realizing new services for citizens. Setting aside specific ambitions, we can say any technology shows incremental stages of application in a scale about process reengineering: the higher the depth of the change brought out on activities, the higher the potential exploited and the organizational impact. An integrated and systemic approach to technological and organizational evolution like the Business Process Reengineering Framework [1] is essential to fully realize this potential, because it enables an all-round process and management review following a new viewpoint.

Focusing on RFID technology, potential benefits in the clinical area are well known especially in terms of safety, process governance and workflow management, automation of information flows and efficiency of day-by-day operations. For all, the application of this technology is still at an early stage, where systems are still characterized by a reduced number of functionalities, narrow process coverage, low pervasiveness. This is quite peculiar, if we consider that the healthcare sector is mainly demanding quite complex functionalities, including sensing, active tracking, high safety standards and multiple combined person-items cross matches [2].

The Istituto takes its place far beyond this scenario, aiming at developing a common platform being an integral part of the existing IT application portfolio. The Istituto believes that, if adequately designed, RFID solutions can be a strong means to reconcile a high degree of safety with a technology that is non-invasive neither for patients nor for staff, and which is also easy to deal with, because it has to be used by all the health personnel involved. Moreover, RFID applications are demonstrating to support the information flow all over processes, creating a link between applications that were completely none communicating and enabling process control.

Safe transfusions and total blood traceability in the ward thanks to RFID

The first experience has been a project in 2005-6 on transfusion safety. The transfusion office did not have instant access to all the necessary information and, for some procedures, operators only have access to hard-copy aids. As we know, the main risk of transfusion adverse events is mainly process-related rather than infectious: using RFID, the Istituto can now achieve a greater capacity for controlling and monitoring at item-level the transfusion process, with the aim of enhancing safety, transparency and quality. RFID tags are stucked on blood bags and patient wristbands. Staff is provided with RFID identification cards and PDAs (with an application developed by the project team) and thus enabled to register patients at their arrival, verify the patient-to-blood match, recognize any time patients and transfusion units. Each event is automatically traced by the system and sent to the Transfusion Centre, providing an essential informative feedback which was not available before. In accordance with best practices in management theory, the project team has established a complete KPI (Key Performance Indicators) panel for process monitoring and ROI evaluation. The System Usage Rate is a particularly meaningful indicator among those recorded: the mean rate has shown above 90% from the fourth month of testing, drawing near to 98.4%, thus having a remarkable impact on the prevention of errors.

This initiative has been awarded international prizes [3,4] and the Istituto is now extending it, developing a metamodel of general value of the transfusion process, also assessing the effects of project activities in terms of Clinical Risk Management. On these bases, a modular parametrical application will be developed and deployed to other hospitals of the district of the North Milan Area for blood management and transfusion medicine, which the Regional Government is pushing to adopt the same model. This will include e.g. addressing critical issues related to the use of WiFi systems in critical environments, tools for haemovigilance reporting and process monitoring.

The Tissue Bank Project and others: active monitoring through RFID

Moreover, the achieved experience is being exploited to another project about total traceability the Oncological Tissue Bank over time- and temperature-sensitive surgical specimens, used to investigate pathogenic mechanisms, classify tumors and assess disease prognosis and treatments efficacy (the Istituto counts more than 30 specific research projects in this field). Thus, it is of primary relevance to trace and monitor the path of each item from patient sampling in the operating theatre to analysis in the Department of pathology and deep-freeze storage in the biobank, in order to become aware of potential biases of results due to inappropriate handling

(measurements of gene expression are based on the assumption that RNA samples closely represent *in vivo* conditions). Answering these and other needs, this new extension of the RFID application platform aims focuses on:

- The exact identification of specimen;
- Investigating on quality control procedures for tissue processing and storing, implementing of reviewed high quality standards for processing and storing biobank samples, also investing on new hardware;
- Tracing the process and transport lead times, monitoring the specimen condition by tracing at item-level environmental conditions via active/semi active sensors;
- Developing a shared scientific data-base where to collect all the relevant information to support diagnosis and scientific research.

Project activities started in fall 2007 and will end in 2009.

The Istituto is also evaluating the extension of the RFID platform for tracking of surgical instruments, starting with internal management of surgical kits and single item checks before and after surgical operations.

Conclusions

Starting from a basic level of ICT support, the Italian National Cancer Institute in Milan established a new strategy aiming at enabling the spread of applications to support pervasively clinical and research processes in the context of oncology care. An area of applied research regards RFID technology, that has proved fitting exactly into this context. Potential benefits of RFID technology in the healthcare sector are well known especially in terms of safety and efficiency of day-by-day operations (e.g. internal logistics, transfusion process,..). Nevertheless, to exploit this potential an integrated and systemic approach to technological and organizational evolution is essential, as always in case of process innovation connected to Information and Communication Technology. At the Istituto we can see how in this context, a pilot project run under clear objectives and methodology has proved leading to sustainable and measurable results. Furthermore, the pilot application is now evolving and expanding its pervasiveness and process coverage, being extended and implemented in other contexts (e.g. the challenge of developing a comprehensive application standard model for transfusion management and which can be diffused at a regional scale). Moreover, the same system is being developed in order to support other critical clinical processes in oncology care.

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Chapter 5

Telehealth and Supporting Self Care in 21st Century

A Mobile Telemedicine Solution Offering More Comfort and Privacy in Stress Urinary Incontinence Treatment

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***Abstract:* Stress Urinary Incontinence (SUI) is an involuntary loss of urine that occurs during physical activity, such as coughing, sneezing, laughing, or doing exercises. In alternative to surgery or medication, SUI can often be treated by training the pelvic floor muscles. This paper introduces a system based on a training device with biofeedback and a mobile phone. The solution proposed allows patients to perform pelvic floor muscle exercises and to receive feedback on their progress in complete comfort and in a familiar environment.**

Introduction

According to estimations, almost half of the women with symptoms of incontinence present Stress Urinary Incontinence [1]. Although surgery can be of value in many cases, the conservative management of this condition can also be an effective option. In fact, pelvic floor muscle exercises (PFME) can strengthen the support of the pelvic organs and may therefore restore the urethral closing mechanism [2].

However, to become effective, this treatment should be followed for at least 3 months. This normally requires the patient to frequently visit a clinic to perform the PFME under the assistance of a specialized nurse. This obviously presents some inconveniences for the patient and it requires resources from the clinic.

Methods

Previous studies have proved that PFME are more effective when associated with biofeedback [3]. Mega Electronics FemiScan™ Multi Trainer, the device used in this study, utilizes surface EMG-biofeedback to measure the pelvic floor muscle activity and it uses a voice guidance to assist patients during their PFME. During the exercises the EMG signal is continuously registered to provide an automatic record of each training session.

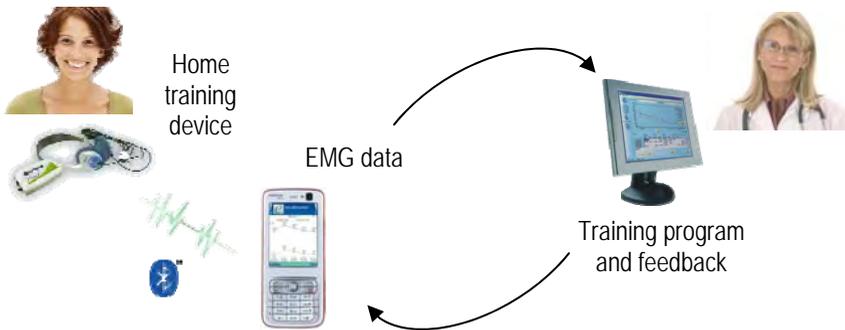


Figure 1 Remote training and continuous follow up

The training device has been used in combination with eHIT's Health Gateway mobile solution to wirelessly transfer the registered information to the patient mobile phone and to seamlessly forward it to the health care provider by using mobile networks [4].

The health care personnel analyze the data registered during each training sessions and according to the results, may decide to make some changes to the training program. The bidirectional capability of the Health Gateway makes also possible a remote update of the training program. The new exercise programs are transferred from the health care provider to the patient's mobile phone and wirelessly uploaded to the training device. At the same time, patients can also receive some feedback from the physician/nurse directly to the display of their mobile device.

The results of each training session together with related feedback information are stored in the mobile phone to help patients in following up their progresses.

Results

To verify the effectiveness of home training in comparison with traditional PFME, two groups of randomly selected patients have been under a trial for one an half year and results have been compared.

Both test groups received their FemiScanTM devices and practiced their PFME at home. The reference group has been regularly visiting the clinic for follow up during the treatment and to receive new training programs. The second group received a mobile phone equipped with the application program and after following a brief instruction session never returned to the clinic until the end of the treatment three months later.

The results of the trial have been more than promising. Patients using the mobile solution achieved equal or slightly better results than patients regularly visiting the clinic. The health care personnel received the results

of each training sessions directly on their computer system and patients received feedback and the new training program on their mobile phones.

In addition to making the treatment more comfortable, the mobile alternative showed to bring approximately 100 euro savings per treatment to the clinic. Furthermore patients saved time and travelling expenses.

Insurance companies also can benefit from this mobile solution, which potentially reduces direct and indirect costs such those related to absence from work. It is significant to notice that, according to the Confederation of Finnish Industries, one day of absence from work represents a 250 – 400 euro cost.

Conclusion

By combining the use of a training device with biofeedback and mobile technology, patients are free to do their PFME at home or when travelling, at their own pace and still be constantly followed by health care specialists.

FemiScan™ gives the patient the possibility of performing her training session at home in a private environment. Health Gateway brings this concept further, allowing the patient to exchange information with the caring personnel and even to update the training program, without the need of travelling to the clinic.

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Comparison of Usability Evaluation Methods for Telecare Applications

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Abstract: In order to evaluate the usability of telecare applications, different methods are available. This paper gives a comparison of four methods and a logical framework for selecting a usability evaluation method to apply to elderly persons.

Introduction

During the performance of several usability tests we found that elderly persons did not only have problems with the tested applications but with some aspects of the used evaluation method as well. Therefore, we performed a comparative study [1] on four well known methods for usability evaluation and their suitability for elderly persons. The methods chosen are the Pluralistic Walkthrough [2], the User Walkthrough, the Thinking Aloud method [3] and the Questionnaire method.

Method

First, seventeen human characteristics were defined that influence the way a test person performs a test. Special attention was paid to the fact that the characteristics must match with the evaluation method and not with the use of the tested interface, since we want to compare methods and not present a set of usability standards for elderly persons. An overview of the 17 characteristics is shown in the table below.

Being able to communicate by reading and writing	
Cognition	1. Ability to solve problems
	2. Ability to imagine an unknown concept
	3. Ability to imagine a situation for another person or case
	4. Learnability
	5. Short term memory
	6. Concentration
	7. Ability to switch between tasks
Mood	8. Self confidence

	9. Stress resistance
Physical condition	10. Ability to hear
	11. Ability to see
	12. Mobility
Skills	13. Ability to communicate by reading and writing
	14. Social behavior in formal relations
	15. Social behavior in informal relations
	16. Ability to express oneself
	17. Co-operation

Table I

For each characteristic three levels were defined: low, average and high (for some only low and average). Each level was well described. Table II presents a description of the three levels for the characteristic “Ability to communicate by reading and writing”.

Ability to communicate by reading and writing	
Low level	The method doesn't use reading and writing in the communication with the test person;
Average level	The methods only uses reading as a way of communicating and not writing;
High level	The method uses reading (test script) and writing (e.g. to answers questions).

Table II

Secondly, the four evaluation methods were described based on knowledge in literature and for each method the minimum level on the 17 characteristics was given (i.e. the level that is minimally asked of the test person). The matching results are shown in Table III for the characteristic “Ability to communicate by reading and writing.”

	<i>Pluralistic Walkthrough</i>	<i>User Walkthrough</i>	<i>Thinking Aloud</i>	<i>Questionnaire</i>
Ability to communicate by reading and writing				
<i>Low level</i>			x	
<i>Average level</i>		x		
<i>High level</i>	x			x

Table III

Finally, the level of each of the 17 characteristics for a certain focus group was defined. We chose two groups of elderly persons. One with an age around 65 and one with an age around 80. We ranked their level for each characteristic based on our experience with elderly persons. This yield a framework to make it possible to select suitable methods and to name their weaknesses.

Results

The four methods will be briefly described and some findings will be presented.

Pluralistic Walkthrough

With this inspection method representative users, product designers and usability experts evaluate each screen of a user interface as a group. Before discussing a certain screen each participant writes down his own findings [2]. The user that represents the focus group is considered to be the test person in our comparative study.

Around the age of 65, test persons might have small problems with remembering what others said in the group discussion and where their own notations where about. Besides that, the switching between different kind of tasks and the asked confidence level, might give some problems. Also the level of stress resistance, the ability to hear and to express oneself might give problems around this age.

Around the age of 80, many more problems could be expected. To represent the group of elderly, a high level of imagination in the situation of another person is asked and many people of this age could find this difficult. Remembering what others said in the group discussion and understanding their own notations will often show more problems than in the younger group. Besides that, big problems might occur when often switching between different tasks is needed (inspecting, thinking, writing, listening and speaking). Also, the asked level of self confidence is high. The asked level of stress resistance, of being able to hear/see and of being able to communicate by reading and writing might give trouble as well. Also the formal setting, not being mobile enough to come (the group discussion can often only take place in another location) and the asked ability to express oneself might cause problems.

User Walkthrough

According to the User Walkthrough the test person gets a test script with exercises and cases. Without any help (except for questions about the script itself or when the person got stuck) he performs the test script while a test supervisor observes the human-computer interaction.

Around the age of 65, test persons would probably not have many problems with the used method. Little problems that might occur have to do with concentration issues and the fact that it could be hard to switch between tasks.

Around the age of 80, two big problems and some small problems might come up. The asked level of imagining the situation of a case might give big problems. Also often switching between reading, asking questions and interacting with the interface could give big problems. Some small problems that might arise have to do with the small term memory of elderly, concentration issues, self confidence and the asked level of stress resistance. Also the asked level for hearing/seeing, for communication by reading and for expressing oneself, might be too high.

Thinking Aloud

In literature, different variations of the Thinking Aloud method were found. We define the method as followed: the test supervisor asks a test person questions about the interface and to do exercises. While performing these exercises the test person is asked to think out loud [3].

With test persons around the age of 65, there probably will not be many problems with this testing method. Perhaps small problems due to their level of self confidence and their level of being able to express themselves might occur.

For people around the age of 80, their lower level on these two characteristics will probably cause bigger problems. Beside that, the switching between talking, listening, thinking out loud and interacting with the interface might give big problems, especially because of having to think out loud while performing certain tasks. Also small problems might occur because of the asked level of being able to image a certain case and the asked level of short term memory, stress resistance and ability to hear.

Questionnaire method

In addition to a usability test the test person is often asked to give his opinion about the interface by filling in a questionnaire with multiple choice answers and some fields to give suggestions.

Test persons in the age of 65 will probably not have many problems with this testing method. Only concentration issues and the ability to express oneself might play a role in this.

Persons in the age of 80 might have some more problems. One could find it difficult to switch between the tasks of reading, writing and inspecting the interface. Also their ability to see, level of concentration and the ability to express themselves could play a role. A big problem could occur with reading the questions and writing down their answers.

This seems to be a very attractive method to apply on elderly, but the downside is that it won't test how they actually use the interface. Only their opinion about it.

Discussion

Usability testing of telecare applications for elderly people is complicated by social, physical and psychological factors. The test design must be such that first the best representation of the user group is selected. Secondly, the method that best matches with the characteristics of the test group should be chosen. These two should never be switched, for then the selected group might not be representative anymore. The presented framework is an instrument to select a method. In general, there is no best suitable evaluation method known to apply to all elderly persons. Each method has its weaknesses, as the framework shows. Based on a certain group of elderly people with defined characteristics, different well suitable methods can be chosen and their weaknesses can be mineralized by some adjustments.

An example of such adjustments is a variation of the Thinking Aloud method, named Constructive Interaction [3]. In stead of thinking out loud while interacting with an interface individually, this variation lets two persons interact with the interface in co-operation. This way, the test persons won't have to think out loud, but can communicate with each other. With elderly people who might have problems with thinking out loud while performing a task, this variation might be an alternative by which the test supervisor can still hear thought, but in a more natural way.

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Economics and Marketing of Modern Telemedicine for Developing Regions and Countries

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Abstract: The task for the nearest future is to expand the use of telemedicine technologies by physicians in developing countries. The article gives basic guidelines for economic analysis of introduction of innovative videoconference technologies as a tool of telemedicine.

Introduction

Long-term experience of adoption and development of telemedicine technologies in Health Service practice of Russia with its vast territories that have different level of development and organizational resources of qualified health care delivery gives the opportunity to suggest appropriate tools for economic and marketing analyses for intensive promotion of telemedicine technologies in rural regions and developing countries.

Solution

Economic analysis of introduction of innovative videoconference technologies as a tool of telemedicine services and organization of tele-education of medical staff is based on the abovementioned specifics of this "integrated information technology" trend, including:

- Transmission of digital video images with controlled quality level, including studio level;
- Maintenance of steady visual contact between the participants of the session;
- Maintenance of high-quality two-way exchange of audio information (live dialogue) between the participants of the session;
- Availability of high-speed e-mail allowing to transmit additional data in the course of the consulting (lecture);
- Linking of videoconference facilities to any source of av data to demonstrate the extensive illustrative material during the session or follow-up research;
- Capacity for multi-party use of the "blackboard", meaning that participants are able to enter and display information simultaneously,

via several communication lines at a time, in a special generic space, with identical playback of two or more video materials on the screens thousand miles apart;

- Availability of quality software/hardware data protection against unauthorized access.

Therefore, one may claim that a videoconference session involves the use of a whole package of available data display methods, which all participants may access during the tele-consulting, tele-lectures, as well as skill building sessions and practicum.

Also it should be noted that advocates of ISDN and IP-phone communication channels successfully settled their disputes over the last few years thereby enabling all modern videoconference systems to use effectively both interfacing protocols. This brought to an end all discussions regarding the risk of potential losses resulting from shutdown of a regional communication system for whatever reason. The user of modern systems is free to choose the operator, securing the investments in equipment from potential change of operator caused by the market conditions. It also promotes the efficiency of investments in telemedicine.

Right from the start of the telemedicine project we endeavored to make it most economically efficient, seeking to reach economic factors giving it the competitive edge and making it attractive for investors, thereby allowing this project to develop without any budgetary and/or any other “shareware” resources.

As a methodological basis for the economic analysis, we used classic approaches to planning and assessment of efficiency of investments published and recommended by international organizations, such as the World Bank (WB) and the United Nations Industrial Development Organization (UNIDO).

The research aimed to acquire such economic indices of the telemedicine project, which would help reasonably balance the minimum permissible cost of the rendered service and attractiveness of investments in this particular project.

To solve this problem, we analyzed the structure of costs on creation of a telemedicine network, including:

- Rent of premises (at least 20 sq. M. For tele-consulting; at least 40 sq. M. – for tele-lecturing, except for individual public lectures for over 50 persons at a time);
- Installation of service lines;
- Acquisition of videoconferencing hardware;

- Acquisition of digital equipment for data visualization (video imager, video camera, scanner, vcr, personal computer);
- Acquisition of networking equipment and ups.

At the moment, the combined minimum seed capital required for the creation of one telemedicine unit (TMU) in Russia on the basis of videoconference systems varies from USD 15,000 to USD 30,000, depending on the scope of the current tasks.

Analyzing the efficiency of telemedicine service system, we referred to the increasing tendency of liquidation of tax exemptions or considerable limitation thereof in Russia. Therefore, we endeavored to consider the majority of taxes, which the project managers will be required to pay (at least until their projects have acquired the priority status on a state (regional) level).

We also considered other factors affecting the economic indices of the project, such as: terms of payment, delayed payments, discounts and price markup, opportunity to render non-core services (video communication sessions for businessmen, tele-lectures by order, etc.).

Analysis of the tele-consulting (tele-lecture) cost structure allowed identifying the following basic components:

- Costs on data compilation for the tele-training session;
- Amortization of the cost of the tmu equipment engaged in the session;
- Fees of the consultants (lecturers);
- Payment of the data traffic within communication channel;
- Isdn or IP channels rental fee;
- Fees of technical experts.

The assessment considered the prices in Russia, which tend to drift toward the level of the world market prices.

Since the state has grown seriously interested in telemedicine technologies only recently, the economic analysis was based on a non-state structure of the TMU network formalized as a group of small-business entities, which made this structure flexible and capable of responding to the market demands promptly.

Specifically, the project envisages a multipurpose use of the TMU personnel at the sites and in the center for the solution of technical, organizational and marketing tasks.

Determination of principles and levels of payment to personnel was based on combination of the average flat rates for the administrative and technical personnel and surplus on the paid scope of services, which encourages all personnel to seek more opportunities for utilization of the TMU facilities and reception of auxiliary income.

The outcome of economic analysis of the TMU network operation was the set of guidelines on determination of relationship between the price of just on telemedicine services, gross volume of services rendered within the specific period, demand for credit resources for the creation of TMU, payback period and the net present value (NPV). In other words, we identified the conditions for development of a new segment of a socially-oriented business, which would serve to implement the tasks of telemedicine depending on the regional demand structure for this kind of services whenever the price of a telemedicine service is more competitive than any other method of qualified help to the patients (Supplement, Fig. 1). According to the estimates of East Siberian physicians, the patient paid approximately 80 times smaller fee for the telemedicine consulting service rendered by a Moscow expert, than it would have taken to make a trip to Moscow to consult this same expert, without detriment to the quality of this service.

This allowed us to determine the sequence of creation of the new TMU based on the results of marketing research in a specific region and the predicted demand for each service rendered by the new telemedicine unit.

With this in mind, further development of telemedicine for a country with a huge territory like Russia requires adequate instruments for the analysis of the external environment, and market methods for the promotion of this product to the regional market of medical services.

Speaking of the market, one should point out the need to objectively assess the demand for this particular service and availability of adequate payment sources.

It all indicates the advisability of modern marketing instruments as means of balancing the demand and the offer of the commodity (service).

Based on a decade of experience in development of telemedicine projects in Russia, the authors emphatically point out the intermediate position of telemedicine as a rather unique service [2, 3]. Under certain conditions, telemedicine belongs to the marketing category “human needs”, i.e. has to do with a pressing need to satisfy one’s basic needs, when a human life is hanging in the balance and a minute delay may cause irreversible damage. However, when a human is in a fairly stable condition, telemedicine transforms into a category of need — as specific form of satisfying human needs shaping the demand, which is not so much a desire to receive a service, as it is an ability to acquire it. Therefore, in the process of creation of a telemedicine consulting network one shall consider not only the number of individuals who may want to receive tele-consulting, but rather (which is even more substantial) those who may want to purchase it and may well afford to satisfy this need [1].

Based on the detected economic limitations, we suggest the approach to formation of the regional telemedicine marketing strategy, which rests upon the understanding that "...Marketing is a social and administrative process aiming to meet the needs and demands of each individual and a group of individuals equally by creating, offering and exchanging the commodities".

It means that creation of a regional telemedicine unit (TMU) shall be accompanied not only by the analysis of the region's demand for medical consulting, but by the extensive analysis of potential demands of the residents, enterprises and organizations of the region for the services, which can be rendered using the whole package of data exchange equipment forming the basis of the created TMU. According to practical experience, in some instances expenses on equipment, redundant in terms of telemedicine, ensure high demand for the TMU services in other spheres, which allows receiving the auxiliary funds, remarkably vital for implementation of the social component of the project and further development of the latter without waiting for the government funding.

We believe that marketing strategy of the regional telemedicine based on the objective analysis of the local market's demands and opportunities allows pursuing aggressive policy, which serves to form the demand for the TMU services. In the course of creation of the regional TMUs, one should make provision for the financial resources on organization of modern advertising and PR-campaigns ensuring the steady development of the project even in conditions of the increasingly competitive regional market. In doing so, one shall be thinking of advertising actions adequate to the quality of services offered by the TMU, which belong to the 'high-tech' package and require appropriate solutions, including advertising in the Internet.

Summing up, we would point out that experience of economic analysis of telemedicine projects can be successfully used in the process of creation of the all-world network of E-clinics on a district level. And, especially, in the course of implementation of those particular projects, which envisaged not only creation of a telemedicine unit within the existing clinic, but a comprehensive technical upgrading as well, equipping the medical facility with the cutting edge diagnostic units interfacing with videoconference equipment.

Summary

Decade of development of telemedicine projects in rural regions allows for a number of optimistic conclusions, including the one that Russia has laid foundation for its national telemedicine network based on innovative

technologies, which will define economic, scientific and engineering development of any country caring for health of its citizens.

Within framework of the national telemedicine network based on innovative technologies, Russian specialists has developed theoretical basis and implemented economic and marketing solutions, which ensure proper functioning of each element of the network.

The task for the nearest future is to expand the use of telemedicine technologies by physicians in all regions and countries without exception, as well as to support the emergency medicine personnel, render assistance to residents of remote settlements and detached communities (vessels, offshore drilling rigs, etc.).

Experience of the national telemedicine may be vastly used in the course of profound technical upgrading of medical institutions in the regions and communities, as well as during the creation of integrated system to ensure quality medical assistance to the citizens of each country, based on the approved innovative telemedicine technologies. This will ensure substantially more efficient and economically feasible use of budgetary assets.

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Our Experience and Achievements in Mobile Telemedicine for Rural
Regions e-Clinics in Developing Countries



Sample: Return on investment (ROI) diagram for small clinics` tele-consulting unit.

(ROI is one of more than 20 indexes used for telemedicine project economic analysis)

Finding out What Elderly Think of the E-Health Homecare Project Zorggemak

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Abstract: TNO explored the success and failure factors for the Dutch e-Health homecare (telecare) project “ZorgGemak” (freely translated: “care made easy”). This homecare concept aims to support healthcare possible from a distance, by the use of the Internet

Background

Eventually the ZorgGemak concept aims to make it possible for elderly or patients with chronic illnesses to check their own health and medication status. And in case of an emergency or when patients have questions about their own health condition they can make video contact with a health service desk. Video communication with another healthcare professional will also be possible via the health service desk. The concept also facilitates searching health information or getting a digital health advice. The purpose of ZorgGemak is to bring efficient healthcare to elderly persons and patients with chronic illnesses by delivering services from a distance. This gives a care consumer the ability to manage his own care and to have sufficient information about his condition or preventive actions that can be taken. The ultimate goal for the project is to empower healthcare consumers who can stay much longer in their own homes with their own social living surrounding and with an efficient consultation of care professionals.

Objective

Our goal is to explore the success and failure factors of the ZorgGemak concept and especially find out what elderly in the age from 60 think of the e-health homecare project ZorgGemak.

Method

Prototypes of the ZorgGemak concept have been developed in order to examine the impact of the concept on care professionals and care consumers and to find out the success and failure factors when implementing the concept in real situations.

The development process of the concept consisted of defining the required functionality and requirements based on Use Cases. The concept of ZorgGemak has been designed into three steps. During each step the designers conducted focus group interviews and did usability tests with care consumers and care professionals in order to detect problems (failure factors), potential risks and the fitting of the functionality on the competence of the user. After each step the design was updated based on the latest results. In the first step of the designing process the concept was presented in PowerPoint and in step two and three the concept was presented as a partly working prototype with a video environment, a health information template and a daily personal care book in an internet environment.

The test group for the focus interviews consisted of 11 elderly persons who were involved in every step of the design process. Usability tests were carried out with three elderly in their own living environment.

In step three a test script was written with several tasks based on cases they had to carry out. Tests were carried out developing knowledge for the designers about how elderly persons will use the end product and if the functionality of the product will fit on the competence of elderly in their own home situation.

We used the 'User Walkthrough Method' [1] with a test script available on paper to study the interaction of the test persons with the prototype

Results

One of the main failure factors noted by the elderly is their uncertainty about the availability of a 24 hour health services desk with qualified personnel especially in an alarm situation. They still prefer directly contact the alarm service! The interviewed persons also indicated that an ICT-application based on the Internet technology will be too hard to use and they noted to dislike the wires and computer hardware that would be installed in the home.

Another failure factor is the possibility that a patient could become more isolated because they don't have to get out of their home anymore. Also as failure factor mentioned is the video contact that will be seen as a threat to the patient's privacy and the high costs of the service. The interviewed persons are not willing to contribute more than a couple of euros a month for this service.

The possibility to search for general health information is, by some, labelled as a nice addition to the normal healthcare, but never as a complete substitution for classical healthcare. For that, it does not feel safe enough. To answer a large set of questions before ordering a digital advice is seen as

a failure factor. The people would rather call the family doctor's assistant, because that is much faster and it gives them a safer feeling than depending on a computer system. They find a daily personal care book interesting if a care professional would observe this book on a regular basis.

A good instruction in the use of a e-health homecare application is seen as a success factor as well as the social possibilities to (video) communicate with family, friends and especially neighbours. Also to see the other person while speaking is seen as a nice addition to the normal telephony. Additional functionality that the elderly patient mentioned to make them feel more secure is a camera in the hall, direct contact with the police and the possibility for the healthcare organization to open outside doors to let healthcare professionals in.

Healthcare professionals interviewed

Having a successful telecare implementation the focus must be laid on the fit of telecare on the type of care process and on the fit of the competence of the care consumer. Further integrate an integrated electronic health record (medical, medication and care) that can be retrieved from a telecare health services with qualified personnel. But do this in a way that pays most attention to the care process itself with practical care information and answers about care methods available from the health services. The health record is only interesting when it's based on real time information. Integrate the mentioned medical information in such a way that the care consumer can understand the information and is able to contribute his own medical data as blood pressure and findings about wellbeing as well. Visual contact with the care consumer from a distance can provide the professional with information about his physical condition.

Discussion

Having success on a large scale with a care environment as ZorgGemak you have to take care about the mentioned failure factors. We propose introducing systems like ZorgGemak in a very early stage of getting older. Starting with interesting and recreational webbased video services and information services on the base of social contacts, social and health guides and safety, the elderly will accustom themselves on the technical and usability aspects. Probably they are willing to pay for it because it's, primarily, for their own recreational use and safety.

Another investigation, of the Dutch Telemedicine Institute NITEL (www.nitel.nl), reported [2] based on a group interview and in-depth interviews, the conclusions that elderly have a greater need of an easy way to make contact with children and grandchildren rather than tableware tools with a video component. They also conclude with us that video contact via

internet is a way in getting familiar with the technology before there is a need for telecare. But we think if health problems occur when getting older and you have already the skills using technology, you also will use telecare services. Having success later when using the health components of systems like ZorgGemak also attention has to be paid to aspects as personalized information about the health problems in the context of their competence and living surrounding.

Also a professional health service desk (24 hours a day available) with qualified personnel is required. This health service must have the availability of personal health data as recent medical history, recent medication and if necessary information about the care process to be carried out in his home and the results of it. Working on a distance will also require health services to have a good maintained electronic care system and a good identification method in identifying the real patient who is calling. Case of mistaken identity will be a higher risk especially in cases a family member is calling for a patient.

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Virtual Hospitals Promote Improved and Flexible Healthcare at Home

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Abstract: The challenge of healthcare at home is to provide a flexible and efficient mean to implement healthcare at home on a broad scale. By the integration of the various services and platforms Virtual Hospitals will support equal access to healthcare for all, anytime, anywhere (ubiquitous health: u-Health). The Virtual Hospital will provide a strategy to extend healthcare delivery beyond the classical physical hospital structures, extending Virtual Hospitals to include also the field of homecare. Healthcare at home comprises intelligent houses, emergency services, positioning devices, monitoring services, etc.

Introduction

In an aging society, the provision of healthcare at home becomes increasingly challenging, as it requires flexible means for its widespread implementation. Healthcare at home through ICT promises not only benefits for citizens and patients, esp. disabled and those with chronic diseases, but also huge economic potential because it relieves the strained healthcare system [1-2]. For the widest implementation, homecare services must be customizable to the users' needs and should enable patients to stay at their homes and participate in their usual community for as long as possible. Virtualisation of hospitals plays a pivotal role in the interaction of the patient in his home environment and a remote medical specialist. By the integration of medical services and technological platforms Virtual Hospitals (VH) provide a strategy to extend healthcare delivery beyond the classical physical hospital structures, extending the VH to include also the field of homecare.

The Virtual Hospital

The Virtual Hospital (VH) plays a central role in the interaction of the patient in his home environment and the remote medical specialist. The VH aims to facilitate and accelerate the interconnection and interoperability of the various services being developed by different organisations at different

sites through real integration. This integration must take into account the social, human and cultural dimensions and strive towards common approaches but open and respectful of cultural differences: multi-lateral cooperation instead of aid [3-4]. The VH supports a global healthcare for all, anytime, anywhere or u-Health (ubiquitous Health).

The methodologies for the VH are medical-needs- driven instead of technology-driven. Through the integration of different telemedical solutions in one platform many medical services can be supported. The technologies of the VH, like satellite and terrestrial links, Grid technologies, etc., will be implemented as a transparent layer, so that the various user groups can use the services such as expert advice, e-learning, etc. on top of it, not bothering with the technological details and constraints.

Homecare

Future Healthcare at home will become a natural part of intelligent houses in which components like windows, doors, household devices are networked and can be electronically controlled, personal assistants (avatars) capable to communicate with various homecare systems, emergency services offering facilities of rising an alarm in case of a fall or a serious physical problem, positioning devices such as GPS to deliver the position of the person when on an excursion, monitoring services transferring the measured vital parameters of a person to the medical center, body area networks, etc. Personal health monitoring systems will need computerised data monitoring, knowledge-based computer-aided decision making and automatic generation of alerts. The data acquired from the patient must be reliably received and presented to the health professionals in a way that allows quick and accurate assessment. Technically, telecare systems must be intelligent, user-friendly, reliable, fault-tolerant and secure. Typical scenarios for homecare are telerounds, telenursing, telecare by the general practitioner and remote acquisition, analysis and evaluation of medical parameters like blood sugar level, internal eye pressure and pulse frequency.

A clinical study performed by Medway Council [5] revealed that more accurate monitoring of long term conditions and treatment levels leads to a reduction of hospital admissions by 67%. Moreover, 75% of people receiving telemedicine-based treatment did not require a general practitioners visit in a 12 month period. These results highlight the potential for telemedicine to help the pre-assessment process by aiding primary care and decreasing costly hospital care involvement.



Fig. 1. Scenario of telerounds for patients at home

Potential solutions for homecare

To operate the various household devices an average citizen still needs dozens of buttons, switches, remote controls with different menu structures. An integrated system operation consisting of a new software and controls has already been demonstrated [6]. This middleware opens the system for all household devices which can now be controlled by a central PDA or via internet. Moreover inhabitants of intelligent homes can make orders at pharmacies or supermarkets, make appointments etc.

To assist people who live alone a personal monitoring services has been launched in Victoria, Canada [7]. The service includes regularly scheduled automated telephone calls to people who live alone to confirm that they are alright. If the recipient of the call does not acknowledge the call a response protocol is initiated for contacting a designated responsible person who can check on the client.

Robots can support the recovery process and reduce the length of stay of a patient at the hospital. This is the result of a study where additional postoperative robotic telerounds have been performed establishing a robotic telepresence [8]. However, the opinion of professionals on the deployment of nursing robots is still ambiguous [9].

Conclusion

Virtual Hospitals that explicitly integrate homecare components can lead to the development of long term sustainable services. Virtual Hospitals offer low level support to avoid later crises and maintain well being avoiding more costly care. The use of ICT-supported communication shall not completely replace personal contacts in homecare; crucial will be its optimization, rather than its maximization. ICT as enabling factor (eHealth) will enhance the global realisation of access to high-quality healthcare for all, at any time from anywhere: ubiquitous healthcare (uHealth).

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Chapter 6

International Telemedicine and eHealth Initiatives and Developments

Continuous Professional Development: The Role of Telemedicine in Continuous Medical Education in Nigeria

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Abstract: This paper is on the role of telemedicine / eHealth in continuous professional medical education in Nigeria. Telemedicine is the use of electronic communication and information technologies to provide or support clinical care at a distance. eHealth is defined as the use of electronic and telecommunications technologies to support long-distance clinical healthcare, patient and professional health related education, public health and health administration (encompasses telemedicine & the use of remote medical expertise – WHO). eHealth is the use of information and communication technologies for health (WHO). In this context, telemedicine / eHealth will serve as an economical tool in Nigeria for ongoing training of health professionals and offering health sciences courses through eLearning programme for health professionals in training and practice. eLearning tools for continuous professional development that can be deploy in Nigeria includes; distance training for undergraduate / post graduate health sciences student, National Health portals – websites, e-mails, chat rooms, Multimedia format (CDs, DVDs, Tapes), podcasting, video streaming, videoconferencing, Point to multipoint videoconferencing for grand rounds, business/administrative meetings and community/patient education. In a developing country like Nigeria, promotion of telemedicine / eHealth services to play role in continuous professional development requires overall promotion of information communication technologies for continuous medical education, introduced into the curriculum of health care professionals in Nigeria at undergraduate and post graduate training, provide training for all health care workers to improve computer literacy, provide online access to national and international journals in medicine for medical research communities; developing a digital national open archive for scientific research, health research , published in Nigeria and create electronic format of providing health information for the general public through government or agency and accredited health institutions

websites. The constraints in affordable technological access should be minimized through national strategy to reduce the cost of information communications technology infrastructure in the health sector and public/private partnerships should be promoted to achieve the role of telemedicine / eHealth in continuous medical education in Nigeria.

Keywords: Continuous Professional Development, Telemedicine /eHealth, eLearning tools

Introduction

Telemedicine may be describe as a tool that allows health care providers seek second opinion in the management of a case over the telephone, e-mail, SMS, MMS, GPRS or as sophisticated as using satellite technology to provide a platform for exchange of health information & management between providers at different levels of health care. Tele = Greek word for “at a distance” Mederi = Latin word for “healing”= Medicine at a distance. Global interest in telemedicine over the last decade to provide new mode of health care delivery makes it appear that it’s a relatively new use of telecommunications technology. The truth is that telemedicine has been in use in some form or other for over thirty years now. Today, Telemedicine is the use of electronic communication and information technologies to provide or support clinical care at a distance. eHealth is defined as the use of electronic and telecommunications technologies to support long-distance clinical healthcare, patient and professional health related education, public health and health administration (encompasses telemedicine & the use of remote medical expertise – WHO). eHealth is the use of information and communication technologies for health (WHO).

Background

To meet the goals of health related millennium development goals (MDGs); and improve the doctor patient ratio in Nigeria our thinking must tag along with the improvement in the health sector with the telemedicine/eHealth tools. The recent advances in information and communications technology allow a symbiosis between the fields of health care and information communications technology sector. In Nigeria today we have suffered set back in our continuous professional development in the health sciences due to ever increasing migration of health workers abroad that have led to shortages of expertise in various fields of medicine that should have helped in the continuous transfer of knowledge and skills to undergraduate students and ongoing training of medical professionals.

The geographical barrier between our migrant health work force, urban specialist and those providers in the remote areas can be bridged with the platform of information communications technology (ICT). ICT allows easy exchange of information and it is an economical tool for capacity building of our health work force.

Telemedicine/eHealth and Continuous Professional Development

In this context, telemedicine / eHealth will serve as an economical tool in Nigeria for ongoing training of health professionals and offering health sciences courses through eLearning programme for health professionals in training and practice. eLearning tools for continuous professional development that can be deploy in Nigeria includes; distance training for undergraduate / post graduate health sciences student, National Health portals – websites, e-mails, chat rooms, Multimedia format (CDs, DVDs, Tapes), podcasting, video streaming, videoconferencing, point to multipoint videoconferencing for grand rounds, business/administrative meetings and community/patient education. In a developing country like Nigeria, promotion of telemedicine / eHealth services to play role in continuous professional development requires overall promotion of information communication technologies for continuous medical education, introduced into the curriculum of health care professionals in Nigeria at undergraduate and post graduate training, provide training for all health care workers to improve computer literacy, provide online access to national and international journals in medicine for medical research communities; developing a digital national open archive for scientific research, health research , published in Nigeria and create electronic format of providing health information for the general public through government or agency and accredited health institutions websites. This will improve access to medical knowledge-makes the patient to become an educated and informed consumer, effective & economic tool to train and educate medical students / doctors and healthcare professionals with international standard.

Conclusion

Telemedicine/eHealth presents many potential benefits for continuous professional development in our health sector; we need to build our own local skills and infrastructure based on local demand, build competencies for eHealth; find & retained skilled personnel. The constraints in affordable technological access should be minimized through national strategy to reduce the cost of information communications technology infrastructure in the health sector and public/private partnerships should be promoted to

achieve the role of telemedicine / eHealth in continuous medical education in Nigeria

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eHealth – The Effective Application of Information and Communication Technologies

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Abstract: Recent technological advancements and the accompanied performance-price improvement have fostered the development of eHealth significantly. eHealth broadly refers to the use of information technologies to distribute information or expertise necessary for providing or delivering healthcare services among geographically separated participants, including physicians and patients. eHealth has a great potentiality; however there are unfortunately today few examples of large services. The benefits of expanding its use are threefold: it can improve the quality of healthcare services; it allows a better exploitation of limited hospital resources and of expensive medical equipment; and it helps to address the problem of unequal access to healthcare. Throughout the world the number of people requiring special care is increasing as the proportion of elderly people rises, at the same time, in a high-tech age the expectations of the society for a better healthcare are also rising. eHealth offers the opportunity for improving healthcare services and for making healthcare expertise available to underserved locations. The application of information technology for medical purposes is considered as an economical means of development of healthcare sector in countries with middle and low incomes and of achieving national health policy objectives with regards to the improvement and the extension of healthcare. The guidelines and technologies of application of information technology for medical purposes are worked out by developed countries, but developing ones can use them in the most effective degree. Each application is rapidly developed and the tendency of optimization of development of telemedicine solutions in accordance with developing countries' claims should be observed. As a result medical service in the developing world could be turned into a communitarian and safe practice. Virtual health care units and even systems become more and more realistic. They offer new perspectives for medical service and it is envisaged that healthcare professionals, scientists and researchers will use this facility to connect their personal computers to the Internet, forming a network for consultation. But countries with middle and low incomes are often affected by severe limitations in the practice of application of information technology for medical purposes. The result of this efficiency often translates in inappropriate treatment of patients due to

inaccurate diagnosis. The rapidly expanding information technology allows that day after day we are near to closing this gap.

Introduction

eHealth is the practice of medical service at a distance, based on the transmission through telecommunication means of medical data for their corresponding interpretation and diagnosis. Included in these transmissions is information about the patient, clinical history, identification numbers, laboratory data, statistics, etc. In general, the uses of eHealth are for 1) primary diagnosis, 2) second opinion, 3) education /QA (quality assurance). eHealth has left its childhood. Its technical development is mature, and its use for primary and secondary diagnosis has been expanded to a great amount.

Overview

The probability of an incorrect handling of a relevant medical data, still dangerously high, mainly is due to: environmental factors, instinctive factors, emotional factors. As a consequence the probability of a serious error occurrence could be high and the probability of its recognition and correction very low. This frequently causes a repetition of exams in the same time or in different medical units and it slows down the diagnostic process (resources waste) and the proper treatment. So, proper actions for improving the working procedures have to be taken.

The health care systems, and the education of health care personnel, have to be reorganized to systems that function in a cross-border fashion. Prerequisites for this development shall be a specific emphasis on equity of access, interoperability and standardization of systems and protocols, security and legal aspects. There are technical, legal, organizational, and financial problems to be solved.

In spite of the potential which eHealth has as mechanism to support health systems, a number of barriers, at various levels, would need to be overcome for health systems to take full advantage of these opportunities. These barriers are not multidimensional constructed, encompassing technical knowledge, economic viability, organizational support and behavior modification. The three most important barriers to eHealth adoption were identified as: the problem of interoperability (technical, cultural, systematic-financial reimbursement, inter-organizational workflow), acceptance of a “new” health system, and regulatory constraints. This emphasizes that telemedicine and eHealth implementation has to be

accomplished by simultaneously horizontal and vertical multisectorial action.

Interoperability is a key change. This is the fragmentation problem – many pieces of information, in many formats, on many platforms, in many stakeholder environments, and in many geographic locations. The data sets are heterogeneous both physically (stored in different locations) and logically (not organized in the same fashion) accentuating issues of interoperability that are raised by lack of compatibility of systems and equipment. The problem of interoperability is not limited to technical standardization as typically assumed, but encompasses the complex issues of integrating cultural, financial and workflow systems. Ensuring that the ‘ways of working’ of health systems are interoperable is a major challenge.

Acceptance of telemedicine and eHealth presents a particular challenge. It is important to promote the use of automated tailoring of information access and summaries to accommodate variations in culture, language, literacy, and health-related goals, as well as integrated decision-support systems that can proactively foster best practices. Unfortunately, collection and delivery of the necessary epidemiological and patient data on which such systems must be built are problematic. However, once collected, eHealth can be used for timely transfer of data to central services for planning and management purposes. At the organizational level, revolutionary advances in medicine and technology as a whole during the past few decades have resulted in shifts in the boundaries between hospitals, primary health care, and community care. In the future, eHealth is likely to add to this by changing the way in which health services are provided, from clinical messaging (advice, results and referrals), to distributed electronic health records, increased connectivity between health services, patient appliances to assist self-management, and the use of technology to improve communication. These changes need to be sensitive to acceptance concerns related to changing established medical traditions, professional autonomy and loss of control.

The most important and perspective application of telemedicine and eHealth is education of health care professionals at a distance, so called distance education (eLearning). It may be defined as the application of communication technologies to acquire new knowledge or skills across the whole range of areas which will affect health care professionals, and enrich their experience in rendering the best possible care to patients through out the process of medical care. Distance education has the abilities to apply new concepts, and ideas in which the learner becomes an owner of that knowledge, without any respect to distance. As such, eHealth overall, and in

particular eLearning, is significant part of health care revolution, since the event of modern medicine. The addition of technology should not substitute for failed pedagogical process, but technology should allow that educational process and the message to be disseminated, and tailored to individual groups and professionals, by retraining along some of the educational principles of traditional education.

Perspectives

Perspectives and strategies for eHealth are currently evolving, as emerging operative requirements would allow self-sustainable large scale exploitation while recent technological developments are available to support integrated and cost-effective solutions to such requirements. However, as far as we know few eHealth services have proceeded to large scale exploitation, even after successful technological demonstration phases.

eHealth by comparison with the usual medical service introduces added value and a positive impact at social, economic and cultural levels. As a result eHealth is initiating to have an important influence on many aspects of medical service in countries with low and middle incomes. Thus, when implemented well eHealth may allow these countries to leapfrog over their developed neighbors in successful health care delivery.

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Planning Wireless Cities and Regions to Support Telemedicine Applications

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Abstract: Planning guidelines based on the author's experience in wireless city/region projects are presented based on the requirements of telemedicine applications. Currently available and emerging broadband wireless and mobile technologies are considered and case studies are presented.

Introduction

Availability of appropriate telecom infrastructures for telemedicine and e-health applications is often taken for granted. However, it is not at all evident that the public telecom and internet service providers can meet the requirements. Indeed, due to their specific business models, service providers do not provide ubiquitous access within a given territory and often cannot satisfy the quality of service requirements. As a consequence, providing broadband access to citizens, communities, public institutions and developing businesses has become a strategic objective for governments and international organizations worldwide. A large number of initiatives, under the collecting names of *community networks*, *digital cities and regions*, *wireless cities* and the like, have been launched in North America as well as in Europe. By creating telecom infrastructure in underserved regions, local governments can prevent remote communities from digital divide, and are able to create a healthy climate for economic development, help startups grow, bring new businesses into the region.

Community network infrastructures are supposed to provide ubiquitous access, full area coverage, accessibility from a variety of user devices and quality of service, and, therefore, provide the right platform for implementing *telemedicine services* in a given city or region. In fact, telemedicine is often one of the main applications that drive the development of community networks.

Wireless technologies are particularly suitable for building community networks for several reasons, including ease of installation and expandability, affordable costs and the availability of a range of powerful broadband wireless access technologies, starting from the ubiquitous Wi-Fi through WiMAX and beyond-3G mobile.

Requirements of current and emerging telemedicine and telecare applications

A typical telemedicine setting consists of (i) a remote site where the patient and some medical personnel is located, (ii) a referring site, where the specialist is located, (iii) a central database, e.g. a PACS system and (iv) (optionally) a classroom where the remote patient and the diagnostic information used can be presented, in real time, or in stored form, to students and practicing doctors. A telecare setting is similar except that a large number of remote sites (the patients' homes) are involved. Data to be transferred within the telemedicine setting includes biosignals such as blood pressure, temperature, heart rate and ECG, radiology pictures and video, live video and audio used to demonstrate the patient's behaviour and for communication between the personnel at the remote site and at the referring site.

Bandwidth, delay and packet loss requirements of some typical information sources are summarized in Table 1. For a detailed analysis of the telemedicine settings and the characteristics of pictorial information from current medical imaging equipment, see [1].

Data type	Data	Required bandwidth	Delay and jitter limit required?	Packet loss permitted?
Biosignals	Blood pressure	Few kbps	No	No
	Heart rate	Few kbps	No	No
	ECG	~100 kbps	No	No
Audio	Conversational voice	~8-64 kbps	Yes	Yes, few %
	Diagnostic audio	~100 kbps	Yes	Yes, ~1%
Video	Diagnostic video	~1-10 Mbps	Yes	No
	Conversational video	~384-762 kbps	Yes	No
Medical imaging	CT, uncompressed	~ 1 Mbps *	No	No
	Mammography, uncompressed	~ 10 Mbps *	No	No

* For acceptable transfer times, in the order of 10 seconds

Table 1 Bandwidth, delay and packet loss requirements of medical information

Technology selection for wireless community networks

Available technologies

In this section, the two key candidates for wireless telemedicine networks, Wi-Fi mesh and WiMAX, are outlined and compared.

Wi-Fi (Wireless Fidelity) mesh networks are peer-to-peer multi-hop networks, where the nodes cooperate with each other to route information packets through the network. Mesh networks, being of “organic” nature, have some attractive features: nodes may be added and deleted freely; there is an inherent fault tolerance, too. A disadvantage results from the fact that nodes need to forward other nodes’ traffic which decreases the access throughput of a given node. In spite of this shortcoming, the majority of wireless community networks are currently based on Wi-Fi mesh. Current products feature dual and multiple radios to significantly compensate the throughput decrease, and comprise also WiMAX capabilities to use the latter technology as a backbone.

WiMAX’s (Worldwide Interoperability for Microwave Access) flexible architecture is based on the family of IEEE 802.16 standards. The area coverage is up to tens of km in LOS (Line Of Sight) environment. An attractive feature is operation in NLOS (Non Line Of Sight) conditions. Quality of service is an inherent feature of WiMAX. The mobile version is based on the IEEE 802.16e standard, approved at the end of the 2005, and products, based on this standard, will be available in 2008. Its deployment is easy, quick and relatively inexpensive. Different spectrum allocation possibilities exist in licensed and license-free frequency bands. A WiMAX-based backbone for Wi-Fi mesh networks seems to be an attractive option.

Technology selection

Key points to be considered in selecting the right technology are as follows:

A) Application requirements

As illustrated in Table 1, different telemedicine applications and information sources need different bandwidth and quality of service.

B) Timeframe

Wi-Fi mesh is available now, however no interoperability exists between different vendors’ mesh products. Fixed WiMAX is on the market, but prices will go down. Mobile WiMAX is not yet on the market.

C) Frequency issue

In many countries or regions, mainly in Europe, it is difficult to obtain licenses required for WiMAX. Using unlicensed ISM band can result in weak QoS and low bandwidth because of disturbance of other devices and providers.

D) Costs

A careful calculation is needed for each individual project. In addition to equipment price, the required density of Wi-Fi mesh nodes should be considered vs. number of WiMAX base stations.

A novel methodology for the design of wireless CNs, based on the application requirements, is described in [2].

Business models

A critical issue is to choose the most suitable business model for the implementation and operation of a CN. The analysis of business models is outside of the scope of this paper, the reader is referred to [1].

Case studies

The author and his colleagues participated in the technology design and business planning of several regional and city-wide community networks.

As an example, we mention here T.Net, a community network project under implementation in Trentino, a province in Northern Italy. It is part of the eSociety project of the local government. Its management model involves publicly controlled companies for the implementation and management of the broadband infrastructure, supplying of transport services, connectivity and IT services for public administration and renting infrastructure to market operators under fair and non-discriminatory conditions. The network consists of a fiber optic backbone and a pre-WiMAX-based wireless access network. The number of backbone nodes will be 78 with the total length of optical cable over 750 km. The network will connect in total 223 municipalities. By the end of 2007, wireless access will be provided for 150 municipalities [3]. The author has analyzed the business models for this network and has shown that, under a realistic set of assumptions, the ROI is as short as 5-6 years [4].

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The Experience of the Development of Tele-Medical Design in Saratov Railway Clinic - Telemedical Centre: The Experience and the Hopes

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Abstract: This article contains ideas about the development of tele-medical design in Saratov Railway Clinic – Telemedical Centre.

Keywords: Saratov Railway Clinic – Telemedical center, Teleconsultation, Tele-education, international clinical trials.

Introduction

Saratov Railway Clinic (SRC) is a leading medical unit in the Volga Region Railway company. This multitype hospital has patient capacity for 534 beds and employs the leading health professionals of the field. The Volga Region railway covers more than 250 thousands km² with the population of more than 6 millions people. The needs of data exchange and medical consulting on such a vast area gave a stimulus to the development of tele-medical technologies in the hospital.

Our Center is a part of the developing net of Russian railway hospitals and it carries out corporative commitments. We also share the humanistic values of the telemedicine that brings people more close to each other and study our colleagues experience in telemedicine.

The advisory and diagnostic center *Telemedicine* has the broadband Internet access and Tandberg MXP990 equipment for video-conferences by the Norwegian producer Tandberg-Telecom.

The tele-medical project dates back to May 2006 when it was brought to life by the needs of the contemporary diagnosis and treatment. The expert level of diagnostic medical equipment in the clinic and the doctors and medical professionals' high level of proficiency contributed to it.

For the past 18 months the Center has worked in the following directions:

1. Tele-education and professional tele-discussions.
2. Tele-consultations via the Internet and video-conferencing.

3. Monitoring patients at home and preventive checking on the cardiology staff.
4. Participation in Russian and international scientific projects.
5. The *Telemedicine and Neural Nets Symbiosis* project.
6. The *Virtual Clinic* project.

One of the first steps of the tele-medical project was the approbation of the automatic information system in the therapeutic department, thanks to which the medical records were documented digitally.

The patients of the clinic have been given possibility to get the second opinion, first of all via IP video-conferencing link.

The central Railway clinics of Moscow and other big cities in Russia and abroad have already been tele-consulting patients via video-conferencing. SRC is working on the possibility to provide clinical services to the local patients of the region.



The Internet technologies - messengers and web-platforms - are used to obtain the expert specialists assessment.

Tele-education is carried out in the form of various disciplines lecture courses. A number of lectures were presented by the leading specialists from Central Railway Clinics of Moscow, as well as other Russian cities and University of Regensburg (Germany).

Another line of investigation represents participation in home and international clinical research, making use of modern technologies carried out according to the world's laws and practices. It concerns mainly clinical experiments on antitumorigenic medication development. This direction preference is explained by the fact that the clinic houses the first oncological department in Russia and therefore it employs better qualified academic personnel, which, in its turn, provides further possibilities for on-going professional development. The clinic co-operates with the Saratov State Medical University, the Saratov State (Classic) University.

At present, having assimilated international norms of medical information communication, we are looking for further ways of enhancing the diagnostic capacities of the clinic and are set to take part in more advanced stages of co-operative research.

With considerable clinical experience of our own supplemented with telemedical experience of our foreign colleagues, we are interested in the prospect of more close symbiosis of the telemedicine and neuronal network. Our view on the further perspective of it concerns of medical data bank organizing and management.

Home monitoring is a slower-growing innovational practice that has embraced cardiological patients so far. The patients can transfer their rhythmogram to their automated case record, and the doctor can communicate his recommendation digitally.

The new project of *Virtual clinic* is a further development of Home monitoring direction. At present we are working on Virtual clinic for the group of railway personnel.

An important aspect of Home monitoring is epileptic patients' management guidelines. The implementation of this project will bring about self-documenting and sending encephalography fragments to the automated case record or directly to the caregiver.

We view the professional on-going education in the sphere of Telemedicine and e-Health as the most important part of telemedical project in the clinic. It is being put into practice through the staff involvement into tele-consulting and tele-lectures discussions. The project allows our personnel to complete a continuing competency course in their home city. A doctor's supplementary education course held in Moscow costs approx. €2000, while an equivalent tele-educational course on the basis of tele-technologies will cost €500, which proves e-education economical benefits.



We strongly believe that any project should stress the human values and therefore we hope that the education in Telemedicine and e-Health will help us to further improve our staff proficiency and will make it possible to be integrated in current medical practices of our colleagues in Russia and abroad.

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The Implementation Process of Electronic Medical Record System in Indian Hospital

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Abstract: IT revolution has not spared any sector and health care system is no exception, however, the degree of ICT infusion in other sectors like banking and transportation is much greater than health sector. Though we are very much aware of advantages and potential benefits of ICT, which is “Better access to health care and access to better health care” the infusion of ICT in Health care is very slow than expected. However, the increasing number of publications in scientific journals indicates the acceptance of EMR system particularly from developed countries. I was enthusiastic to know what is happening in developing world. This enthusiasm leads me to do research in the hospital that is in the process of implementing EMR system, so that I can get answer to the questions like i. what are the visions and expectations of Managers. ii. What are the challenges and problems of the end users are facing while transitioning their practice from paper to pc? iii. What are the strategies adopted by managers to overcome the problems faced by end users? I hope this research gives me a good overview of different issues for future research towards finding solutions for struggling and problems faced by different actors during implementation process of EMR in Indian Hospital setups.

Keywords: Electronic medical/patient records, Hospital Information system, Implementation, developing countries, India

Introduction:

Indian health care system is very complex, for it has to serve more than one billion populations. It has diversity not only in culture and traditions, but likewise in its geographic setting. In India, we have mountains, desert, and thick forest and islands in the Indian Ocean. About more than 70% (700 million) of total population of India are surviving in remote or rural areas. But on the other side, 74 % of health professionals lives in cities and cater 30 % of urban population and 23 % of physicians lives in semi-rural areas and only 2% left for caring huge proportion of poor and remote population.

Moreover, Indian Health care system follows three tier hierarchy starting from, Periphery Health centres (PHC) in remote areas, which provides basic health assistance. However, if the patients need some examination he / she will be referred to District hospital. This is located in every district of a state, and if the case is more complicated that needs some thorough investigations and diagnosis, then patients will be referred to Tertiary hospital that are located in capital cities of each state. This pattern of three tier hierarchies is followed by both public and private sector. With the only difference that, in public sector we have only specified hospital where to go but in private sector there are varieties of choices available depending on paying capacity of the patient.

Important part of this scenario is, there is no network or communication among health providers in both sectors public and private to share or transfer patients information. The only information a physician gets is what a patients carry with him, paper records, many times incomplete, with illegible handwriting, and sometimes patients' carries bills paid for the previous investigation instead of results or reports of investigations done earlier. Unfortunately in India, still we don't have Electronic Medical Record (EMR) systems in our health care setups, each time when patient is admitted in hospital a new patient record is created for same patient, and this creates redundancy of paperwork, repetition of examination done previously and so on. These problems have given me motivation to this study.

Motivation for this study:

IT revolution has not spared any sector and health care system is no exception, however, the degree of ICT infusion in other sectors like banking and transportation is much more then health sector. Though we are very much aware of advantages and potential benefits of ICT, to say in one sentence "Better access to health care and access to better health care" still the infusion is very slow then expected. During my participation in the eHealth India conference in New Delhi, in August 2007, it surprised me that, in spite of highly developed ICT sector in India, utilization of ICT in health sector is lacking behind. Only very few hospitals out of hundreds of tertiary hospitals in India have adopted Electronic Patients Record systems. Though the increasing number of publications in scientific journals indicates the acceptance of EMR system is largely from developed countries. I was enthusiastic to know what is happening in developing world. Since my field of interests are Personal Health Records, Hospital Information System, especially about management and flow of medical information with in and among health care providers. Therefore I got

interested to know the challenges problems of implementation process and usage of EPR system in developing country. To take advantage of my nationality I wanted to conduct study in Indian hospitals. I was in search of the hospital that is in the process of implementation, so that I can get answer to these questions:

Research Questions:

1. What are interests of managers to adopt EMR system, what are their visions and expectations?
2. What are the challenges and problems the end users are facing while transitioning their practice from paper to pc?
3. What are the strategies adopted by managers to over come the problems faced by end users?

Through this study I am attempting to answer the above questions. I hope this research gives me a good over view of different issues for future research towards finding solutions for struggling and problems faced by different actors during implementation process of EMR in Indian Hospital setups.

Method:

I have travelled from Norway to India only for collecting research material and doing observation on site; I stayed in Chennai for 53 days (12th Nov 2007 to 4th Jan 2008) have used various techniques like observation, semi-structured interviews, and informal talks. I have done about 30 hours of observation on site observing how optometrist and consultant accomplish their routine tasks, how they handle paper files and electronic files, what do they do if they face problem with EMR system and I also observed patients reaction when health staff using computers instead of paper file. Apart from observation I conducted semi-structured interviews and done informal talk, details of interviews done are shown in Table 1.

Sl.No	Actor	No. of interviews	Technique used
1	Managers (5)	11	
i.	Chairman	1	Semi-structure interview
ii.	Medical Superintendent	2	Semi-structure interview
iii.	Medical Record Department	3	Semi-structure interview

iv.	IT Director of hospital	2	Semi-structure interview
v.	Head of Optometrist Department	3	Semi-structure interview
2	Consultants (5)	7	Semi-structure interview
3	Optometrist (10)	10	Semi-structure interview
4	Vendor (1)	2	Semi-structure interview
Total	21	31	

Table. 1

31 interviews were conducted from 21 different actors, which include managers, IT staff, Health staff and vendor. Apart from semi-structured interviews, I have done informal talks/chat especially at lunch time or tea break. I have found such informal talks also more informative, because actor is relaxed more open. I hope that I have collected good enough information to highlight the views and experiences of different actors. Although I got answer to all my research questions, in this paper I would like to discuss only one and important question that is the challenges and problems of the end users while transitioning their practice from paper to pc. I have supported my discussion with the quotes given from my informants.

Discussion:

The challenges and problems faced by end users while transitioning health care practice from paper to PC:

Though there are different meanings for these words, in our context, challenge means a call to engage in a contest or mission; problem means any question or matter involving doubt, uncertainty or difficulty. Therefore, in other words challenge is nothing but efforts for achieving a goal. The goal to make EMR system into mainstream of practice; challenges are more or less pertaining to managers. Problems are the difficulties or uncertainty while using EMR system commonly pertaining to end users. In this section I will highlight challenges first and then problems of different actors.

Challenges of the managers:

- Awareness

- Mindset and Attitude
- Understanding between IT and Health Staff
- Organizational aspects
- Ownership of the information
- Training
- Encouragement and Motivation
- Security and Confidentiality

Creating awareness is challenge no.1 for any manager, who wants to bring changes in routine practice. He needs to bring awareness among users, should make it clear about new system and the advantages to them. Managers should explain the power of IT and its benefits. He should make users understand how EMR system will make their work easy, flow of information fast, and advantages of such information data base. Unless users are satisfied with the concept of this new system, managers should not go for it. One of the managers thinks, this is another important challenge to change mindset and attitude, particularly of senior employees. He say's "*It is natural that human being resists changing, as this new system proves itself to be good and beneficial, the resistance will be disappearing slowly and gradually. It takes some time*".

To build understanding between IT staff and Health care staff is very necessary. As the system is going to be developed by IT staff but used by Health staff. One of the manager say's "*I am involved in bringing these parties together. IT staff should know requirements of Health staff and Health staff should know the limitations of the software programmes. At first they created something that looked good on screen, but actually it was useless to doctors. If something need 100 clicks before it can be filled is useless. Doctors need fast and easy system*". Organizational aspects are important challenge for managers to deal with. Implementing new system means re-organizing and giving new shape to the practice. It is management's responsible for all organizational issues, such as distribution of responsibility and work-load. It should be done in a way, that all actors are satisfied, and to satisfy all at a time is not at all an easy task. Organizational aspects are one of the key factors making a project successful or flop. However, if user finds over burden by the work load they simply stop using the new system.

Ownership of information is also a type of challenge for managers to convince patients. Though it is patients own information, it is created by hospital for smooth work flow and research purpose of the hospital. Patient is not an owner of his own information. The manager say's that the patient information created and stored is owned by hospital. However, he say's,

“We give paper summary to all patients at discharge; we give those full details what they want. However we don’t provide access to our data base for the outsiders. Its dangerous and also it’s the question of confidentiality”.

Providing enough training to all users, will be a great task. It is utmost important to make users interested and spare some time in learning the system, getting familiar with different interfaces and templates used in the system. Providing different options of training from management side and giving sufficient time to learn and practice the system from user side can only be the best way to speed up the implementation process. The more the users are well verse the lesser time they need to work with the system. One of the consultant say’s *“At first I was reluctant to learn, it took some time but once I got well versed of the system, it made my work fast, now I can dispose patient sooner then with paper file system”.*

Management should constantly adopt different ways to encourage and motivate users to learn and use the system. I will be discussing about strategies adopted by management of this hospital for encouraging users in next section. Management will be solely responsible for the security and confidentiality of the patient information stored in the server of the hospital. High level security precautions should be taken. Even though the data-base is used for research purpose confidentiality of the patient should be respected and should not be breached. Back up options of the information should be foreseen.

Problems of the end users:

- Time factor
- Technology
- Work load
- Patient-Optometrist relationship
- Integration with other departments
- Changes in the interface
- Converting electronic to paper file

Time is the important factor which is a problem for almost all the users. Users need to give enough time to get training and learn the system. Then they should give some more time to practice it with old paper files, only after getting well versed with the system and its functionality they can practice with patient. In real practice the primary concern of all health staff will be to reduce waiting time of patient. If the practice gets slow due to any reason (technical or incompetence to use EMR) the user has to shift to paper file. Sometimes due to some technical problems the server may go down or very slow again this creates interruption in the practice of health staff, in

such cases health staff has no other choice other than just printing out as much data they have entered and then continue with paper file. As well when ever they need to order investigation, they have to convert electronic file to paper file by printing out, then only they can refer patient to laboratory or radiology department for investigation. However this is a temporary problem can be solved once integration is done with all departments with in the hospital.

In fact health staff needs a system which will help them in their work not add on some extra work. On this one of the optometrist comment's "*We need templates at least of common diseases preloaded, so that we can fill out the field relevant to that disease and rest of the fields should be shown normal by default, but in present system, we have to fill information regarding present disease and in additional to this we have to fill other fields which are not relevant to disease. And typing takes time*". Few optometrists told that they felt some patients were unhappy, when optometrists were entering data while listening to patient. Especially not well educated patient felt that optometrist is busy with her work on computer and not showing attention towards patient. Regarding how to gain confidence from patients, one of the senior optometrist say's, "*Eye to eye contact is very important to make patients feel that we are listening to them and understanding their problems. At the same time we can do entry of the information if we are perfect in typing, we need not look at key board for each letter*".

One of the optometrist told, "*Still little changes have to be done though many changes have been done since EMR system got implemented*". Though almost everyone is satisfied over all with this new system, still some feels it needs some changes. For example some wants templates preloaded, some wants just to click on right word from a given list rather than typing; some wants a space to be provided in order to write remarks. Because one of the optometrist say's, "*When we want to write period we can click only on 1 or 2 (day/month/year), but if a patient says 1.5 months we have to choose from 1 or 2, we want space to be provided so that we can write exact period. In the same way there is list of allergens, still if patient says something new which is not in that list we need to write it manually.*"

Conclusion:

I would like to share the lessons learned during this study. First and foremost managers should be prepared and consider implementation EMR system is long term process, they should have flexible plans and slow and steady approach rather than demanding and fast. Managers should create IT environment in the hospital; they should make health staff to use computers

not only at their work, but also for their personal use, such as checking mails and searching article and practicing EMR system online in their free time. In addition I feel managers should focus on end user needs and try to find out some means for incentives to motivate them. Will power is important from users end; they have to understand the time invested by them will make their work fast and efficient for ever. Health staff should not only get well versed of EMR system, but also get trained in typewriting. Involving health staff in developing team of EMR system will be of great advantageous for both vendor and health staff. Proving technical help desk is very crucial, as in this hospital the technical problems evolved during practice were rectified by IT staff, by just call to them and saying IP address of the PC the health staff is working, the IT staff could take control over that PC and solved the problem within minutes.

At last but not least I urge for further immense research to be done in developing countries to find more sustainable solutions for the organizational and economical issues which are hindering the infusion of the ICT in health care system.

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The Jubilees of Medical Informatics in Bosnia and Herzegovina

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Medical informatics as a separate scientific discipline began to be effective in academic institutions at the end of the 70's by the presentation of actual accomplishments in this area in under and postgraduate education at biomedical faculties. As a specialized discipline, health informatics has its rudiments in Bosnia and Herzegovina (B&H) in the beginning of the past century (20th), when experts, mostly graduates from the Vienna Medical Faculty, began their professional careers in our country. Those who were more involved in the area of health statistics started to be intensely interested in the application of health technologies in health science (1,2).

In 2007, the Health informatics profession in Bosnia and Herzegovina celebrates five jubilees: thirty years from the application of the first automatic medical data manipulation, twenty years from the development of Society for Medical Informatics B&H, fifteen years from the establishment of the Medical informatics journal „Acta Informatica Medica“, fifteen years on from the establishment of the Cathedra for Medical Informatics at Faculty of medicine University of Sarajevo and five years on from the introduction of the new educational method - „Distance learning“ in medical curriculum, based on Bologna declaration of medical teaching process. Let us say a few words about all mentioned events.

Thirty years on from the introduction of the first automatic manipulation of data. In Sarajevo 1977, under the supervision of Fuad Secerbegovic, MD, Chief of the Department for Health Statistics, Republic Institute for Public Health BiH in, the company - “Energoinvest” Ltd. Carried out the first analysis of summary and periodic health data reports about the network, capacities and performance of the healthcare service in Bosnia and Herzegovina, this analysis was previously performed manually in the above Institute. In 1982, in the Regional health station “Visnjik”, Sarajevo for the first time in the history of health within Bosnia and Herzegovina an Information System was tested, this was named the 'Local Health Information System' (LZIS). The creators of LZIS were Izet Masic (the pioneer of Medical informatics in B&H) and Arif Agovic (engineer of

electronics in “Energoinvest” Ltd. in Sarajevo). Health data on services provided to 6000 users of healthcare who were treated by four teams of physicians was analysed in a software package Archive in an original Sinclair QL personal computer.

Twenty years on from the establishment of the Society for Medical Informatics BiH. In October 1987, the above named Society was established by a group of enthusiasts and pioneers of health informatics in BiH (Izet Masic, Irfan Zulic, Arif Agovic, Marijan Dover, Mladen Novak, Zoran Kontic and others). On May 26th 1988, during the 3rd STC Conference of Medical informatics in Zagreb, Croatia, presidents of the similar societies from Croatia (Gjuro Dezelic), Slovenia (Stefan Adamic) and from Serbia (Rajko Vukasinovic) at the meeting held in the School of Public Health “Andrija Stampar” in Zagreb, signed a common memorandum of understanding and established the Association of Societies for Medical Informatics of Yugoslavia, this Association was officially registered and started to work on February 16th 1989, and in 1990 (December 6-8th) organized the First Congress of Medical Informatics in Yugoslavia, which was held in Belgrade. After the dissolution of Yugoslavia, the Association of Societies ceased to exist and in 1992 a BiH Society was registered as the Society for Medical Informatics of Bosnia and Herzegovina.

Fifteen years on from the establishment of the Scientific and Professional Journal of the Society for Medical Informatics of Bosnia and Herzegovina „Acta Informatica Medica“. The first editorial board of this journal comprised of: Izet Masic (editor-in-chief), Zoran Ridjanovic (assistant of editor-in-chief), Amra Redzepovic (secretary), Ljubomir Kravec (technical editor), Georgina Janjic (lector) and Tatjana Prastalo (English translation). The Editorial board members were: Kenan Arnautovic, Meho Basic, Mahmut Djapo, Zoran Hadziahmetovic, Dragan Huml, Mehmed Kantardzic, Mustafa Kulenovic, Nedžad Mehic, Miroslav Polomik, Nikola Rukavina, Borisa Telebak and Irfan Zulic. In 1993, in impossible war conditions, the first issue of the journal was published. So far, approximately 35 issues of „Acta Informatica Medica“ have been published. From this year AIM is indexed in EBSCO data basis.

Fifteen years on from the establishment of the first Cathedra for Medical Informatics on Biomedical Faculties in Bosnia and Herzegovina. In October during the War year of 1992, by decision of the board of cathedra-chiefs in the Medical faculty, University of Sarajevo, and signed by dean Professor Borisa Starovic, the first Cathedra for Medical Informatics was established. Cathedra staff at the time comprised of the following: Asst. Professor Izet Masic, Chief of Cathedra and teaching assistants - Zoran Ridjanovic, MD and engineer Safet Jakupovic, and associates Amra Redzepovic and

Ljubomir Kravec). Later cathedras for medical informatics at medical faculties in Tuzla (1994), Banja Luka (1994), Foca and Mostar (1997) were established. In past years the curriculum was modified and harmonized, but the basic one was the Program of Sarajevo cathedra for medical informatics.

Five years on from the introduction of the method of “Distance learning” in medical curriculum. In December 2002, at the Cathedra for Medical Informatics, Medical Faculty, University of Sarajevo a symposium was organised under the name “Tele-education in Biomedicine” organized to celebrate the ten-year anniversary of the establishment of the above cathedra; participants at the symposium were health informatics experts from both Bosnia and Herzegovina and Croatia. During the symposium, for the first time in the history of the University, an intra-university network was tested, this was prepared by the University Tele-information Centre – UTIC. The leader of this activity was electro-engineer Safet Jakupovic, UTIC manager. On this occasion the tele-lecturing had a duration of 90 minutes. It was the start of the project “Learning from distance in biomedicine”. Izet Masic was the leader of this project at the Medical faculty in Sarajevo, and the project was financed by funds of the cantonal Ministry of Science and Education and the Federal Ministry of Science and Education. Experiences from this project were presented at a number of world and European scientific events.

During last thirty years several activities in the area of health informatics had special importance and gave appropriate contributions to the development of health informatics in Bosnia And Herzegovina. The Society for Medical Informatics of Bosnia and Herzegovina gathered the most eminent experts, mostly medical doctors with various specialties. Society of Medical Informatics of B&H became a member of European Federation of Medical Informatics – EFMI during the war in 1994, and in the same year, a member of the International Medical Informatics Association – IMIA. In 2007 BHSMI become member of International Society for Telemedicine and eHealth.. Also, on EFMI Council meeting held in Athens, Greece, the Society for Medical Informatics of Bosnia and Herzegovina were given the opportunity to organize the 22nd European Congress of Medical Informatics which will be held in Sarajevo in August teh 2009, a prestige event and merit to BiH experts in medical informatics.

The main institution in Bosnia and Herzegovina when development of Medical informatics is in question are Cathedras for Medical informatics at biomedical Universities in Bosnia and Herzegovina. Teaching staff performed a number of surveys analysing current levels among medical students and health professionals. Key activity of the B&H SMI will be to enhance efforts on reconstructing a high education system in the country in

accordance with the Bologna process. There are two areas which the focus of activities needs to be directed: under and postgraduate education and continuous medical education (CME) for health workers, medical doctors as well as nurses (2,3).

Developing perspectives of health informatics, besides further improvement of educational concepts and contents at biomedical faculties in Bosnia and Herzegovina will be in promoting its activities in two directions:

Significantly larger involvement of health informatics experts in the development of health information systems, from the bottom to the top (state level), that is one of the basic objectives and goals of the deep reform and reconstruction health system in Bosnia and Herzegovina in general. Improvement of the existing and building of the computer based Integral health information system which is an inseparable part of the program for the reform and reconstruction health system within the Federation of Bosnia and Herzegovina, Republika Srpska and Brcko District, three separate and organized health systems in BiH, but each of which, in the future, must be based with emphasis on its adaptation to the goals of European regional strategy: "Health for all by 2015". It must be pointed out that the reform and reconstruction of health system in Bosnia and Herzegovina cannot be realized without medical informatics which is an important vector in the forthcoming changes. It is not possible to follow the development of information technologies and information systems in neighbouring countries and wider in Europe without adopting an existing health statistics system and make it comparable with the mentioned systems. So, health informatics in the wider and medical informatics in the shorter meaning must be the object of strategy reconstruction of the existing health system in BiH and in accordance with strategy recommended by WHO. The truth is that actual problems in BiH health system are numerous (mostly methodological nature, informatics infrastructure is insufficient, it is obvious that medical staff has no appropriate training, lack of finance resources, etc.), general ones: problems in data collection and reporting, problems in data analysis, presentation of data and communication, problems in the use of health information, etc. To solve mentioned problems the engagement of decision makers at all levels of healthcare and especially those who were educated in the area of health informatics must be much larger. All the above activities with joint and interfering resolving could justify current state investments in the health sector and to improve population health and allowed fairness in the use of health resources, since the BiH health system can give quality outputs/outcomes only based on reliable and quality information from health information systems from local

to state level. In this regard a more important role must have cantonal and entity ministries of health.

Further promotion of BiH informatics at international level, understood continuation of continuous and successful preparation of appropriate political, scientific and professional structures and associations (governments, ministries, universities, faculties, NGOs) for the organization of the 22nd European Congress of Medical Informatics to be held in August 2009 in Sarajevo.

It should especially be pointed out that the professionals and experts of health informatics in Bosnia and Herzegovina have given important contributions to the promotion of this medical discipline through several studies and projects, from the building and realization of information systems at certain levels of healthcare to introducing modern education models in biomedicine using contemporary information technologies.

The authors of this article is eager to mark the importance of the above mentioned Anniversaries in the development of Health informatics in Bosnia and Herzegovina and have attempted, very briefly, to present the most significant events and persons with essential roles throughout this period.

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Towards An International Telemedicine Training Programme

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***Abstract:* There is need for widespread training of health-workers in telemedicine, particularly in those countries that have been slow adopters of telemedicine. The International Society for Telemedicine and eHealth has established an educational working group to develop a basic telemedicine training programme that can be implemented anywhere in the world. The development and content of a basic introductory training programme in telemedicine is described, and issues that still need to be resolved are discussed.**

Introduction

There is widespread acceptance of the benefits, both perceived and actual, of telemedicine. This is supported by resolution WHA58.28 of the World Health Assembly of 2005 which called on member nations to develop long term eHealth strategic plans, provide necessary telecommunications infrastructure for eHealth and establish national centers of excellence [1]. In addition, the WHO Global Observatory on eHealth notes the need for an international knowledge exchange network to share practical experiences on the application and impact of eHealth initiatives, the use of eLearning programmes and the inclusion of eHealth courses within university curricula [2]. The assumption is made that telemedicine infrastructure and skills are already in place or are planned at national level.

The situation in many developing countries is however somewhat different. Computer literacy is low, connectivity is poor, ICT infrastructure in hospitals and clinics is rudimentary and telemedicine is limited or non-existent. There is both a general lack of awareness and ignorance of telemedicine among health-workers in many countries. Additionally, there is a great need for widespread training in telemedicine in not only developing but also developed countries. The International Society for Telemedicine and eHealth (ISfTeH) has risen to the challenge and established a Telemedicine Education Committee tasked with producing a

basic introductory telemedicine programme for international use in both the developed and developing world.

Training Programme

A draft training programme has been developed which is currently being discussed, tested and refined. The programme is aimed at both health workers who will be using telemedicine as part of their clinical practice and key support personnel working in the field of telehealth. The stated vision of the programme is “To develop a workforce with a practical working knowledge of telemedicine and competence in the ethical use of telemedicine and tele-education” and the mission is, “To develop a basic telemedicine training programme for health-workers and support staff that can be used anywhere in the World.”

Key domains of telemedicine were identified. Essential knowledge and skills required were identified within each domain and lists of educational outcomes were developed. The training strategies required to achieve these outcomes were then proposed for each outcome and the resources required for this were listed. (Fig 1.) In its present form the program is an intensive two day course for those who have computer skills and a three day course for those who are computer illiterate.

Unit	Outcomes	Training Strategies	Resources
Unit 1 Ethics and Law in Telemedicine 1 hour Prerequisite: Unit 1	On completion of the unit participants will be able to: <ul style="list-style-type: none"> List and discuss the key ethical issues in Telemedicine Identify the relevant Health Legislation that governs the practice of Telemedicine Identify issues relating to international practice of telemedicine 	<u>Information Session:</u> 1 hour <ul style="list-style-type: none"> Patient physician relationship Informed Consent Confidentiality and privacy Quality of care Standards - adequacy and quality of data Continuum of care Data security Liability Licensure Record keeping Protocols Tele-medical Law Prescriptions and electronic signatures	PowerPoint Slides Data projector Computer Resource manual Case studies Readings Ethics Legislation

Fig 1. Module template for “Ethics Law and Telemedicine” listing outcomes, training strategies and resources required.

It is intended that the training programme will be flexible and modular, allowing units to be selected and combined depending on the participating target group. This also allows the course to be spread over several sessions if required. It is proposed that course delivery will initially be face to face, with didactic lectures supported by appropriate readings and course materials, and hands on practical exercises with supporting practical manuals.

The proposed eleven modules include: Introduction to Computers (for those who are not computer literate); Introduction to Telemedicine; Ethics and Law in Telemedicine; Setting Up Venues; Basic Telemedicine Skills; Basic Skills – Use of the Internet; Basic Skills – Use of eMail; Basic Skills – digital photography; Practical Use of Store and Forward Telemedicine; Tele-education; Telemedicine and Homecare an Introduction. Key strands such as computer skills and ethics in telemedicine will thread through all the modules. An example of a module template is shown in Fig 1.

It is planned that additional modules will be developed within specialties such as tele-dermatology, tele-traumatology, tele-radiology, tele-ophthalmology and tele-psychiatry and in areas like telemedicine program planning, implementation and evaluation.

Issues to Be Addressed

There are several issues which require further discussion within the ISfTeH, these include assessment, certification, standardization of teaching materials, development of teaching and practical manuals, online teaching and training of skills trainers.

At present there is no assessment, formal or informal, of participants either during, or on completion of the programme. As each module has stated outcomes, development of assessment tools should follow the outcomes. Certification of the programme has been raised by potential participants and developers. The programme has been designed as a basic introductory course which should give participants sufficient insight and skills to participate in a telemedicine programme on completion of which a certificate of attendance or completion could be awarded. The course has not been designed to demonstrate professional competence in the field of telemedicine. It is envisaged that participants would use this course as an introduction to telemedicine and that subsequent training in telemedicine could be gained through existing academic programmes or the through the development of a higher level programme under the auspices of the ISfTeH.

There has been debate over standardization of teaching. Various suggestions include the development of a set of PowerPoint slides for the course that can be used in all settings. While seemingly attractive, this may not take into account regional differences in legislation, local health demands and the availability of infrastructure and human resources. Another approach is to define a core of set points which need to be made in each presentation and allow local presenters to adapt the rest of the presentation to the local situation. The option of developing a set of recorded presentations incorporating PowerPoint and streaming video, showing the presenter, has been investigated as a possible option for the future. This would allow participants the benefit of having leading educators presenting in their own fields and languages and the presentations could be made available on the Web, if sufficient bandwidth is available, or on locally provided CD or DVD. Again the issues of local flavor and relevance need to be considered. Note should be taken of the need to provide the material as free open source learning objects which are SCORM 1.2 compliant, so that they can be used in different commercial and open source learning management environments.

Conclusions

It is hoped that this bold initiative of the ISfTeH will assist countries in providing basic telemedicine training to large numbers of health professionals. More advanced and specific training programmes can be developed to supplement this introductory course as required.

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Chapter 7

eLearning

A Strategy for Health Professionals Learning at Distance: Focus on Brazilian Sentinels Hospitals

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Abstract: This paper describes a Brazilian partnership between the public National Health Surveillance Agency–ANVISA and the private Institute for Teaching and Research Hospital Sírío Libanês–IEP/HSL, to run a strategy of a distance-learning pilot for specific Health Professionals workers in Sentinels Hospitals distributed throughout the country. The initiative has also the purpose to strengthen their networking and brings the evidence-based health concepts and perspectives to their praxes. The strategy was implemented by ANVISA’s political articulation joined to financial, methodological and technological support by IEP/HSL, plus the five-hospital dedication. In 2006, the pilot reached 119 professionals within 5 state capitals of Brazil. In 2007, the second edition underway, with 1762 professionals from 23 Brazilian states out of a total of 27. Additionally, this partnership allowed the creation of a continuing education program called “Sentinels in Action”, to discuss rational use of drugs, techno surveillance and hemotherapy surveillance among many other themes.

Introduction

Brazil is a country with big territorial dimensions and also with huge professional qualification contrasts. The budgetary and logistical restraints on moving people from place to place merely to study stimulated ANVISA -National Health Surveillance Agency- to find a partner IEP/HSL -Institute for Teaching and Research Hospital Sírío Libanês- to provide educational activities, at distance, focused on health services administration, incorporating the concept of evidence based health. This is a report of the experience of using ICT - Information and Communication Technology - to teach health professionals at distance within a networking of Brazilian Sentinels Hospitals. The main objective of ANVISA’s initiative was to run a pilot course to provide a low-cost possibility of good quality education to professionals from many different parts within a huge country such as Brazil, without taking them away from their jobs.

Methodology

The strategy first counted on the political articulation by ANVISA with the Sentinels Hospitals, which were induced to prepare a room with the necessary technological conditions and let the professionals do the course at the job. The technologies used were the ones available at telemedicine service of IEP/HSL such as videoconferencing and video streaming through the Internet associated to live chat interaction and electronic messages. The team of professors was in contact with the professionals every week per 2 hours videoconferencing classes and 2 hours of monitoring and doubt sessions. During the year the participants had to fulfill the asked tasks and produce a final paper work at the end.

Outcomes

Some outcomes we got from this pilot called First Evidence-Based Health Course, which lasted 150 hours from June 2006 to May 2007. The integration of 5 hospitals from the cities of Natal, Fortaleza, Belém, Manaus and Cuiabá to graduate 94 from the 119 initially registered participants. Fig.1.

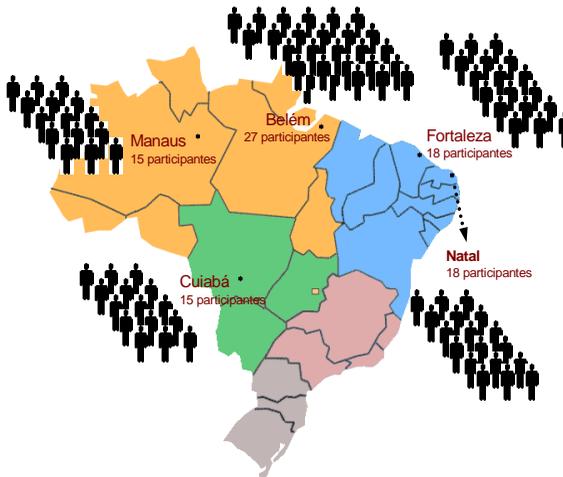


Fig. 1. 2006 Pilot Program

The amount of 27 papers produced. The positive evaluation made by the users during the course, October 2006, and at its end, May 2007. Table 1.

The Program Evaluation

Table 1 – A1. 44 respondents from 94 participants, A2. 65 respondents from 94 participants, Possible grades from 0 – 10

Results Survey A	A1. Oct.2006 Grades	A2. May.2007 Grades
a) evaluation of videoconferencing technology	6.5	6.6
b) evaluation of web casting technology	6.3	6.9
c) evaluation of the training quality	7.5	7.6

The B monitoring evaluation instrument, with 85% of the total participants answering to the multiple-choice question: “Which changes in your professional life has this course provided?”

Table 2 – 80 respondents, multiple answers

Result Survey B	%
New focus on scientific reports reading	100
New care on therapeutic conduct	54
Critical respect on the conducts	89
Meticulous reading and interpreting of the methodology and results of the scientific studies presented	93
Stimulus to studies about health-evidence	98

We consider a final outcome the surprisingly high number of interested people, approximately 2000 professionals for the new edition of the course, launched in August 2007. Fig. 2.

For the 2007 edition we are using the previously described technologies plus a LMS platform, Learning Management System, which is helping us to have individual’s evaluations and place for oriented discussions every week within small groups oriented by active tutors.



Fig. 2. 2007 – 1762 selected people of 23 States of Brazil

Additionally to these 2 formal courses, we also have a weekly program called “Sentinels in Action”. It is also coordinated by ANVISA and executed by IEP/HSL but the difference here is that it is not a course but its mostly a continuing education and it really works like a net because for each lecture we have a different speaker from the networking itself. That particular characteristic makes all the difference because it is a natural space for feedbacks among the members and also motivates the participants to be present to share their experience. In the 2007 program we had 32 transmissions, 128 registered hospitals from 197 possible ones. Having every week approximately 40 hospitals connected to the program to discuss rational use of drugs, techno surveillance and hemotherapy surveillance among many other themes.

Conclusion

Although the description of the usage if ICT could be found not original, we conclude that it is an innovation in eHealth in Brazil because we are dealing with high complexity care, which concentrates high technology, high costs, and potentially high iatrogeny creator. Also because there are very few initiatives of public and private sectors working together in Brazil just as we described, specially the usage of ICT on the Health Sector involving so many different cities and activities at the same time.

Development of a Web Education Module on Endocrine Physiology for Nursing Students

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Introduction

The endocrine system can coordinate and integrate activities from different kinds of cells. Thus, the teaching-learning process on this subject involves complex phenomena.

The resources offered by the *Web*, such as text, static images and animation, permit the creation of educational material that can increase the student's understanding about these phenomena through simultaneous reading and visualization. The best media vary from student to student. Hence, mixing them is more effective to teach students with different learning styles, allowing them to identify the most adequate combination [1].

In view of the above, this study aimed to develop a virtual education module on endocrine physiology, directed at undergraduate Nursing students from a Teaching Diploma program offered at a public university in the interior of São Paulo, Brazil.

Methodology

The methodology used to develop the education module on endocrine physiology followed the cycle for the creation of a distance education course through the web, proposed by Driscoll in 1998. The steps of the cycle are: survey of module objectives, content organization, selection of most adequate media, class creation, module follow-up and assessment and module maintenance.

Results

Survey of module objectives

The survey of the module objectives was based on the program content of the physiology subject offered in the undergraduate teaching diploma program in nursing at a public university in the interior of São Paulo State.

Content organization

The content was organized in succinct classes, using digital media resources like text, static graphs, image and animation to increase the student's motivation and understanding and to explore different senses simultaneously. To construct the content, classical reference works on physiology were used [2, 3, 4].

Selection of most adequate media

The Virtual Learning Environment TelEduc was used, in view of some important characteristics, such as easy use, flexible usage mode and a limited set of functionalities [5].

Class creation

To create the classes, texts were used, associated with links taking the student to static graphs, animations and photographs of endocrine glands. These elements were included in the body of the classes for a greater understanding of the phenomena described in the text.

Animations were elaborated in partnership with informatics professionals, using *Macromedia Flash* and *Blender* animation software.

To obtain the photographs, authorization was requested from the head of the Serviço de Verificação de Óbitos do Interior –SVOI (Death Verification Service for the Interior of the State); this authorization was subject to the requirement that the researcher produced all photographs and that relatives gave their authorization by signing the Free and Informed Consent Term. Therefore, the research project was submitted to the Research Ethics Committee at the Ribeirão Preto College of Nursing, in compliance with resolution 196/96 regarding research involving human beings. Approval was granted on 07/18/2007, after which the SVOI was asked to contact the researcher by phone when deaths occurred. After this contact, the researcher called the family, using the number registered on the patient's referral form. If the family agreed after being informed of the research objectives, the researcher went to their home to have the responsible sign the Free and Informed Consent Term. Thus, photographs of the hypophysis, thyroid, parathyroid, adrenal glands, pancreas, testicles and ovaries could be made.

Module follow-up and assessment

The endocrine physiology module was submitted to four informatics and four physiology experts.

For this assessment, an instrument adapted from Caetano [6] was used, addressing items related to **pedagogical aspects**: content, interaction and activities and **technical aspects**: answer time and quality of the interface. The four experts who assessed the content (100%) found it pertinent, clear, applicable, offered in sufficient quantity and consistent. It favors student-

student, student-computer, student-group, student-teacher, group-teacher interaction. As to the activities, three of the experts (75%) considered they are pertinent, clear, applicable, offered in adequate number and can support educational assessment. Both informatics and physiology experts assessed answering time. Six of them (75%) found that access to and navigation through the module were adequate. As to the quality of the interface, experts were unanimous. All 8 (100%) indicated that the color, screen space, fonts, figures and animations attended to this characteristic.

Module maintenance

For this module, the changes suggested by informatics and physiology specialists were accepted and made. Maintenance will be continuous.

Conclusions

The module developed with the support of Web resources is expected to increase the motivation and learning of Nursing undergraduates with respect to endocrine physiology.

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eDietary Intake Portal for Food Recording, Reporting and Nutrition Education

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Abstract: Diet is closely related to obesity and associated diseases, and patients with chronic diseases are usually requested to keep dietary intake records for diet review. Conventional dietary intake records are troublesome and require a good level of literacy to complete. The accuracy is also highly questionable due to non-real time recording. The eDietary Intake Portal (the Portal) makes use of advances in information technologies and the common use of digital handheld devices. Food photos could be captured by the patients wherever they eat, at home or in a cafeteria. After uploading to the Portal, nutritionists could evaluate the food calories and nutrient profiles, and the data could be stored in the Portal database for ongoing application. Patients could enter the amount of food eaten daily, and by matching their own energy requirements, the Portal could give advice by showing evaluation reports. The energy and nutrient profiles of each food could also act as an education reinforcer. Patients will learn which foods should be eaten less or even avoided. The research team is considering uploading video clips for better serving size assessment by nutritionists.

Background

Diet is closely related to obesity and disease. It is recommended that patients with chronic diseases like diabetes mellitus, hypertension, gout, cardiovascular disease and renal failure follow specific diet guidelines along with their disease management. Dietary review is thus a critical process to evaluate the type and amount of food patients consume in their daily lives. Dieticians, nutritionists and nurses need to understand the eating habits of patients before they provide appropriate interventions and education to the patients.

Typically, the food diary, food frequency questionnaire (FFQ) and 24-hour recall are the tools used to record patients' dietary intake. However, these can be problematic because they are not user-friendly. The major reason is that patients need to write their diet records, so they have to be literate. Patients such as children, old people or those with little or no education have to be interviewed instead. Besides, patients do not remember all the food they have eaten, so the reliability of the dietary intake record is always questionable. Patients also find it troublesome to write the food diary daily, and it is common to receive an incomplete food diary after 2 to 3 days' recording by a patient. The response rate from a previous unpublished study analyzing the diets of school children was 18.6%, which was very low compared with non-diet studies using questionnaires [1]. The alternative tool, the FFQ, seems to provide a simpler, multiple-choice format; the food items ranged from 130 to 350 [2-7], with the latter comprising 50 pages and requiring 1-2 hours for completion by the subjects. The FFQ also requires certain literacy skills, and does not show meal patterns.

Recent Research

Recently, with the advancement in information technologies, digital handheld devices are widely available and the cost of digital transmission is low. Innovative dietary intake methods like photo taking and wireless transmission have been researched [8,9]. Such methods are convenient, time-saving and easy to use. Portable digital devices ensure real-time image capturing to avoid memory lapses, as well as real-time data transmission to record meal patterns. Although direct observation resulted in significantly higher correlations than digital photography in terms of total grams, and slight overestimations resulted [8], the findings have been positively appraised. Spearman rank correlation coefficients ranged from 0.21 to 0.86 between digital photos and the weighted food records in nutrient analysis [9].

eDietary Intake Portal

How to use

This eDietary Intake Portal (the Portal) is part of a portable telehealth system designed to be used in home or community settings. The telehealth system is a convenient tool enabling users to conduct their own health assessment and vital signs monitoring. Since diet records are related to health monitoring, the eDietary Intake Portal would be built as a module to add to the telehealth system. The Portal could also be opened by any internet browser as a single application for diet analysis. Users could

capture food photos using their camera or mobile phone and then, through the internet and the Portal, upload them to the central database (Fig. 1). Patients could fill in the food record by choosing the food they have eaten and selecting the number of servings consumed for each food. There is a combo box beside each food photo for this purpose (Fig. 2).



Name of food	<input type="text"/>
Unit of food	1 serving
Calories (kcal)	<input type="text"/>
Carbohydrate (gram)	<input type="text"/>
Protein (gram)	<input type="text"/>
Total fat (gram)	<input type="text"/>
Saturated fat (gram)	<input type="text"/>
Non-saturated fat(gram)	<input type="text"/>
Fibre (gram)	<input type="text"/>
Calcium (mg)	<input type="text"/>
Potassium (mg)	<input type="text"/>
Sodium (mg)	<input type="text"/>
Cholesterol (mg)	<input type="text"/>

Photo (size less than 100KB
please use English in creating
file name)

Image preview

Fig. 1. User interface for uploading digital photos

How it works

Nutritionists on the other side could evaluate the food ingredients, corresponding serving sizes, cooking methods and sauce added through the uploaded photos. A nutrient analysis could then be made by food analysis software. The energy and nutrient profiles of each food could then be extracted and entered into the Portal by the nutritionists. Based on these data, the Portal could calculate the total intake calories and total amount of

Fig. 2. eForm of daily dietary intake

major nutrients consumed daily. Each patient could build his/her own food database after a period of time.

Each patient will at first have demographic data such as gender, age, body height, body weight, illness and activity level input to the Portal once. Based on these physical parameters, the Portal could calculate the energy requirement for each individual user. After the user has finished entering his/her information into the eDietary Intake Portal, the Portal could calculate the energy and nutrient profiles and give the user two types of reports – a Daily Dietary Intake Report (Fig. 3) and a Daily Dietary Analysis Report (Fig. 4). The former will show the user the energy and major nutrient

profiles (carbohydrate, protein, total fat, saturated fat, unsaturated fat, cholesterol, sugar, sodium, calcium, dietary fibre and vitamin C) categorized by each food they have eaten in one day. The Daily Dietary Analysis Report will show the energy balance analysis by matching the patient's energy requirement and energy input. If the energy input is not within the tolerance limit as compared with the patient's energy requirement, the Portal will show "Fail", and if it is within the tolerance limit, the Portal will show "Pass". This report also gives feedback on whether the patient's diet is nutrient balanced by matching the nutrient profiles based on the Dietary Guidelines for Americans. This report could

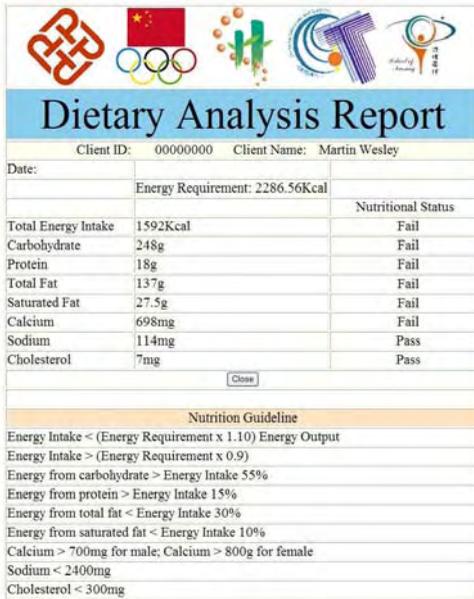


Fig. 4. Daily Dietary Analysis Report

high in dietary fibre and calcium. The Portal could give patients clear targets to work on.

Future Research

In spite of this breakthrough, shortcomings are found in the limitations of the two-dimensional images used, which cannot clearly show the depth, width and length. It is also difficult to distinguish the food type, sauce and cooking methods through a two-dimensional image, thus, it

indicate in a simpler way which nutrient values the patient may need to pay attention to so as to reduce the risks of chronic diseases or to achieve a better state of health.

How it promotes health

Because it is an interactive Portal to enable patients to evaluate their own diet, the user could learn from the report the nutrient content and corresponding values of each food eaten. This report could act to reinforce education, reminding patients to eat less or even avoid unhealthy food and eat more healthy food that is

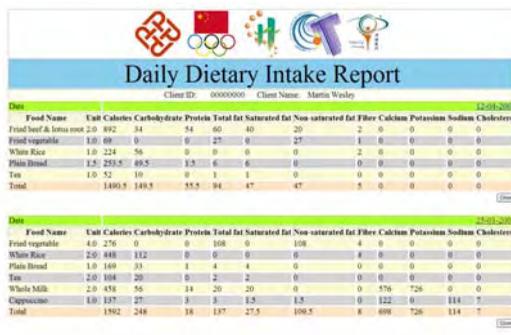


Fig. 3. Daily Dietary Intake Report

would be valuable and should be feasible to evaluate dietary intake through a three-dimensional image. The feasibility of nutrition assessment by video clips is being tested. If nutrition assessment by video clips is found to be more reliable than that by photos, the eDietary Intake Portal could be upgraded to allow patients to upload food video clips instead of food photos. This would help the nutritionists to give more accurate energy and nutrient profiles of food based on more accurate estimation of the serving sizes.

Acknowledgement

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E-Learning and Teleconference in Trauma Education

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Introduction

Medical training requires a balance of teaching theoretical knowledge and providing ample opportunity for practical attainment of manual skills. The acquisition of this knowledge varies with the particular pathology approached and on the skills necessary for its assessment and management. Surgical residents do not always have adequate opportunities during their medical residency to observe, discuss, access and manage the full pathological range related to their specialties. Furthermore, direct observation of patient care may be limited or unfeasible due to restrictions related to limited space. Under such circumstances, only individual one-on-one training may be possible in many cases. While this is good for the fortunate single trainee, it prevents broader observation by more trainees. As a result, medical personnel may eventually be called upon to perform skills without ever having previously observed their performance. Modern imaging and communication technology allows the performance of medical procedures to be visualized via videos, the Internet and video conferences in addition to real time presentation of procedures being performed.

Objective

The objectives of this study were two-fold. Firstly, we sought to create and evaluate an Internet accessible (E-learning) course to teach useful procedures in trauma patient care. Secondly, we sought to develop teaching modules presented via real-time video-conferences demonstrating the performance of trauma care medical procedures in cadavers.

Methods

E-learning course

The first Internet accessible course developed addressed two subjects: airway access and thoracic drainage. The demonstrations of these critical life-saving procedures were produced from records of real clinical cases, cadaver dissections, and three-dimensional animations. The course was taken by 6th (final) year medical students of the USP-SM, and upon completion was qualitatively evaluated by means of a questionnaire applied to the students.

Video conference

A teaching model of trauma care was employed using the Internet, videoconferencing and videostreaming. Instructors taught courses through real time videoconference meetings. During each course, the instructor showed selected documented trauma cases and surgical procedures performed in cadavers and proceeded to discuss the cases and procedures with all of the videoconferencing participants. Importantly, this course enabled standard procedures, as well alternative maneuvers, to be performed, demonstrated and discussed. All course discussions and demonstrations were recorded by videostreaming software, enabling the course contents to also be viewed at any subsequent time by any person with access to the website.

Results

E-learning course

The E-learning course was evaluated by a student questionnaire. The questionnaire items and responses are summarized in Table 1.

Queries	No. respondents who agreed	
	2006 (n = 37)	2007 (n = 52)
Text is comprehensible.	31	51
Figures were visible.	25	41
Questions direct students' attention to focus on the text.	29	48
The videos improve understanding of the procedures.	32	43*
The videos facilitate the performance of the procedures.	30	30*
The videos explained adequately complications associated with the procedures.	29	33*
The student is interested in other modules of the course.	33	49
<i>Score for the course (on a 0–10 scale).</i>	8	7.64

Video-conference

During an eighteen month period, from September 2006 to February 2007, 22 video-conferences took place with real time participation of a trauma care team from the USP-SM and a trauma care team of the ASU Medical School in Manaus, Brazil. During these events, the number of accesses to the video-streaming varied from 22 to 800.

Conclusion

The present findings suggest that telemedicine resources and technology are useful in training programs and in courses intended to update medical professionals in trauma patient care.

Evaluation of the Effectiveness of a Psychoeducational On-line Program Directed to Children & Teenagers with Neuromuscular Disease

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The neuromuscular diseases are genetic character affections, generally hereditary, which fundamental symptoms are the atrophy and the muscular weakness. Among these, the muscular dystrophy of Duchenne is the most common neuromuscular disease in the childhood. Its symptoms appear around of two years old and it only happens in men. This subtype has a degenerative character, and life expectancy is between 20-30 years old. In a symptomatic level, the muscular affectionation is very vast. Orthopaedics instruments are a necessary solution to facilitate the movement. However, around twelve years old the use another kind of instruments, like the wheelchair, becomes necessary. Another aspect is that frequently problems of depression, anxiety occur, these are related with the uncertainty and the progressive loses. To go through the mourning process usually entails a progressive social isolation related to mobility problems. The lack of communication and interaction with peers produce an increase of stress levels, of solitude feelings, defencelessness and helplessness.

Objective

The main aim of this study was to evaluate the effectiveness of an online program for the development and the enforcement of self-esteem, social skills, problems solving strategies and decisions taking in children and adolescents with neuromuscular disease.

Methodology

15 subjects of Bizkaia (a Basque Country region) with different types of neuromuscular disease and ages between 5 and 18 years-old took part in the project throughout 2007. 11 were men and 4 women. 10 were affected by Muscular Dystrophy of Duchenne, 1 Spinal Muscular Atrophy, 1 Miastenic, 1 Miopatia Nematítica, 1 Charcot marie Tooth and 1 Miopaty. 9 of them were attending classes in the primary school, 4 in the Secondary school and 2 had adapted classes.

A pre post evaluation was made, in which the following psycho-social variables were valued: Health related quality of life, self-esteem and coping strategies. The evaluation that was carried out consisted in a semistructured interview in which qualitative and quantitative data were collected. On the one hand children between 5 and 12 years-old, were evaluated with the questionnaires: Measurement of quality of life related to the health Questionnaire in children and adolescents "KINDL" (reviewed version) (Ravens-Sieberer and Bullinger, 2000) and the Evaluation of the Self-esteem in Primary Education questionnaire (Ramos, et al., 2006).

On the other hand children between 13 and 18 years old were evaluated with the following questionnaires: Measurement of life quality related to the health in children & adolescents' questionnaire "KINDL"(reviewed Version) (Ravens-Sieberer and Bullinger, 2000). The Coping scale for Adolescents "ACS" (Frydenberg and Lewis, 1997) and the 5 form selfconcept questionnaire „AFS" (Garci y Musitu, 1999).

The psychoeducative Online Support program applied through a Web site (www.aventurapirata.deusto.es), was designed and developed specifically for this study. The program was divided into two subprograms according to the two groups of age, one focused on children with ages between 5 and 9 years and other on children and adolescents with ages between 10 and 18 years old. Both subprograms were structured in ten sessions, 2 weekly sessions, in where they went more deeply into the different topics (Table 1).

SUBPROGRAMME: Group 10 to 18 years		
	Theme	Objective
Session 1	Self and Self-esteem	Develop and Enhance Self-esteem.
Session 2	Non-Verbal Communication	Knowing about Social Skills and learn not Verbal fluency.
Session 3	Communication skills	Learn strategies to initiate maintain and end a conversation correctly.
Session 4	Communication Skills 2	Learn strategies to initiate maintain and end a conversation correctly.
Session 5	The Assertiveness	Learning to use an assertive style on the interrelationship with the other.
Session 6	The Request for Favours.	Learning to make requests adequately.
Session 7	Responsibility, Autonomy and Independence staff.	Learning to assume their own responsibilities, and to develop and enhance one's Autonomy and Independence staff.

A. <i>Session 8</i>	Decision Making and Problem Solving Strategies.	Learning strategies for proper decision-making and the resolution of problems that may arise.
Session 9	Inappropriate thoughts	Learning strategies for the management of inappropriate thoughts.
Session 10	The Relaxation	Learning to relax through breathing and imagination.

Table 1. Program sessions for one of the two subgroups (for example)

The steps that had to be done by the children were the following one:

1. Access www.aventurapirata.deusto.es, web site.
2. Enter a personal code, they were provided with that code in advance, and go into the restricted area.
3. Access to the respective session.
4. Reading of theoretical instructions of the topic of the session.
5. Carrying out the activities that were planned on the web site.
6. Tasks to do at home, to spread the topics treated on the web site to their living environment.
7. A weekly chat group. Analysis with the therapist about the subjects

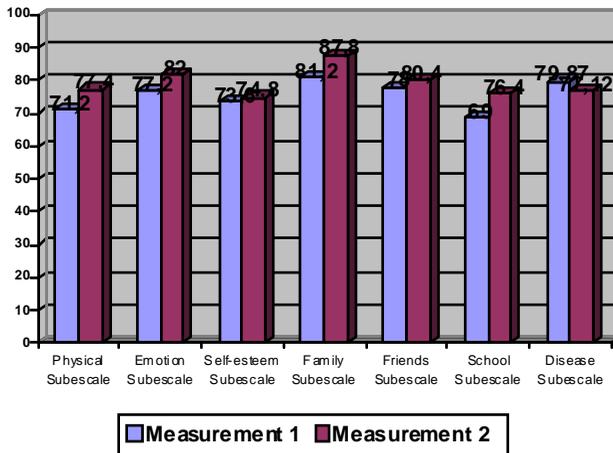


Figure 1. Ratings percentage of the average of 11 cases in the 1st and 2nd measurement (Kid- Kiddo versions)

treated in the sessions of that week (Only 10-18 year-old group).

Results

The data collected related to the studied psychological variables (Coping, Self-esteem/Self concept and quality of life) through different questionnaires are the following ones:

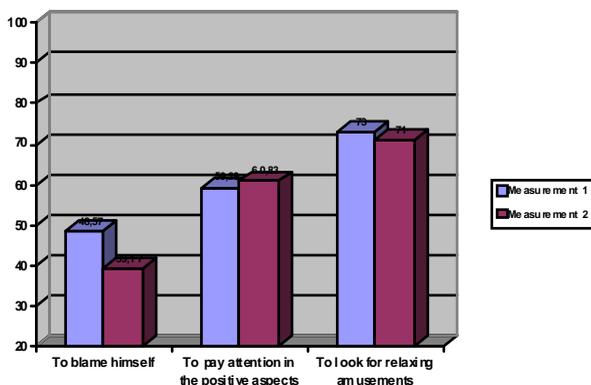


Figure 2. Ratings percentage of the average extent of 7 cases coping strategies focused on the emotion

a) Quality of life.

Although in the case of the smaller children of 8 year-old differences were not found, in the group of children and adolescents with ages between 8 and 18 years old, in the “pre-post”, were detected variations in the quality of life levels (Figure 1). In particular, the improvement is more appreciable in the following indicators: emotional life and family life. In the remaining indicators, the improvement is low to medium level.

b) Coping

The children and adolescents of the clinical group between 13 and 18 years used mainly the following coping strategies, (see the figures 2 and 3).

As we can see, there is a significant decrease of the negative feelings of guilt. After the intervention there was: a smaller incidence of self-criticisms, perception and feeling of guilty and a higher style of causal attribution of the implication in the personal problems.

In the same way, we could notice a change in the positive attitude in different strategies focused on the problem (to see Figure 4). The levels of ignorance of the problem were small before the beginning of the program

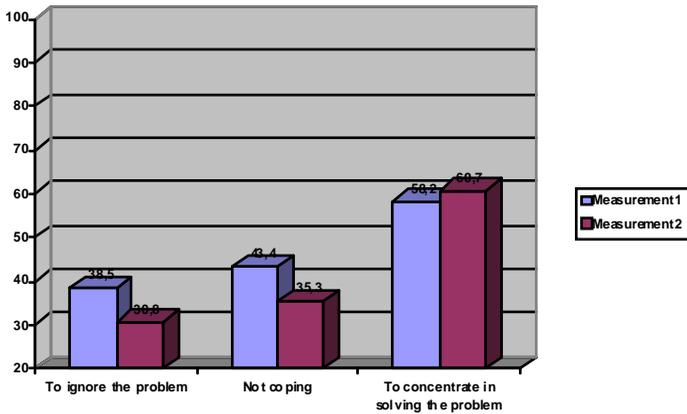


Figure3. Ratings percentage of the average extent of 7 cases strategies focused on the problem

(38.5%) and they decreased to the 30%. On the contrary, the children increased their level of implication in the problem from 58.2% to 60.7%.

c) *Selfconcept*

About the self-concept and self-esteem refer, the AP-E and the AF-5 questionnaires were administrated to two differentiated groups: children with ages between 5 and 12 years old and children and adolescents with ages between 13 and 18 years old. The first group of age obtained scores that indicate an improvement in 50% of the cases. In the remaining, there is a stable situation and a slight decrease in three cases.

About the group of age between 13 and 18 years old, with who an online intervention session about the self-concept was included, the results were the following: In the first place, about the emotional self-concept, we observed that in four cases, before the beginning of the program the emotional level of self concept was medium- high or high, in one case there is a medium level and a low level in one case. In the second evaluation, in the three cases medium high or high levels stay in the same level and the fourth case couldn't take part in the program.. On the contrary, two cases with previous medium low or low levels turned into medium high or high levels. The success rate of the program in this section was of 50%. Secondly, the social self concept was evaluated, in which is appraised an improvement in two cases and a worsening in another one. The reason of this last one obeyed to a serious worsening in the health state, which

produced a home isolation that affected to the capacity of the person to maintain the social networks. On the other hand, in other two cases, maintenance of the social level of auto concept is appraised.

Conclusions

Taking into account the data that were collected, after the intervention phase is possible to see an appreciable improvement, mainly within the group of children and adolescents of 13 years old or more, talking about the perception of their quality of life. A reduction of some negative strategies of coping for the problems solving has been objective, as the selfguiltiness, denial of the problems and lack of coping strategies and the increase of others like concentrating in solving problems or paying attention to the positive things. One of the reasons for the improvement of these variables is related with the providement of some strategies through the on-line program, different strategies focused in the improvement of their social skills, their self-control levels and their anxiety levels. Although the results within the group of children and adolescents with ages between 13-18 yearsold seem positive, there are not significant changes in the other subgroup. There are some possible interpretations of these data. In the first place, the group of small children with neuromuscular disease, with an average of age near to seven years, it seems that they did not have enough knowledge about the usefulness of the online application program. In particular, there was no a generalization of the knowledge and strategies acquired through the online program. This little ecological validity can be attributed to the evolutionary phase of the childhood development or the little perception of threats or losses associated to the evolution of the disease. However, we think that the psychological impact of the program in this group must be analyzed in a longer term. At the present time, improvements related to the objectives and procedures are being introduced, specially, within the inferior group of age. This program as a whole, we considered that has displayed a positive development.

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Evaluation of the Effectiveness of a Psychoeducational On-line Program Tailored to Parents of Children and Teenagers with Neuromuscular Disease

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Introduction

In our country there are a few epidemiologic studies, from which derive that the prevalence of degenerative chronic pathology is situated around 40,000 patients in Spain (Spanish Neurology Society, 2001). In other countries, as France, it is considered that the quantity of cases with the most frequent neuromuscular disease in the childhood, the Duchenne muscular dystrophy, is 1 of each 3,500 male newborn (French Association against Miopatias). This absence of epidemiologic data is joined with the scarce amount of studies which value both neuromuscular disease impact and the actions focused in psychosocial interventions in the affected's family members (Böström, K., Ahlström, G., 2006). In these studies, the paradigm of coping with stress by Lazarus and Folkman (1984) is a valid reference model, as it gives a theoretical framework to understand cognitive and behavioral efforts developed to manage internal and /or external demands, adjusting their emotional response and/or searching solution for the problem (coping), (Ahlström, Wenneberg, 2002).

Most of the researches emphasize the existence of a series of frequent situations in the management of the children with a disability which affects directly to the family's quality of life (Cummings, 2001). These situations could cause high levels of concern advancing future stressors; in view of compassion and pity reaction of their friends or in view of how to explain the problem to their child and the rest of the people (Fitzpatrick & Barry, 1990), and they are going to favour the appearance of emotional problems as depression and low self-esteem (Buchanan, et al., 1979, 1989).

In this way of things, it has been described another problem derived of the constant cares of a child with a neuromuscular disease, like a high level of stress for parents, higher in mothers, as they have the role of the main caregiver (Nereo, et al., 2003; Cummins, 2001), the physical problems derived of mobility (Düger, 2003; Naidoo, 1984) excessive demands of

time and burden, financial problems (Ziolko, 1991) as well as a high deprivation of a normal family life (Zeitlin et al., 1987).

One of the most recent studies (Böström, Ahlström, G., 2006), emphasize that family members could feel that their family is exposed and, as result, it may live suffering and worry situations, could have a higher probability of conjugal and familiar problems, stigmatization and social comparison, a social network reduction, overprotection behaviors towards their child with disease, tendency to live here and now, worried about the heritability of the disease, guilty feelings and lack of hope.

The diagnostic of a neuromuscular disease supposes an especially stressful moment for the family, even more when there is a delay in the confirmation of the disease and if the way of receiving the new is not perceived like positive (Green & Murton, 1996; Firth, 1983). Although exists a consensus generalized on the stages of adaptation to a disability (Kubler-Ross, 1970) in the case of the relatives of neuromuscular patients, can occur repeated cycles of lost and adaptation as the deterioration of the affected person increases, putting on test their skills of coping (Konfeld and siegel, 1980).

Before this raised reality, it is emphasized the necessity to give individual and/or group psychological support (Miura y Agari, 2005; Borthell, 2002) as well as the importance of encouraging to the participation in the rehabilitation process to the relatives of neuromuscular patients (Reid & Renwick, 2001; Padrone, 1994), focusing on the psycho-social rehabilitation as on the provision of information about the disease, educating on how to face with it and informing on the existing resources of support (Natterlund and Ahlstöm, 1999; Böström and Ahlstöm, 2005) giving self-confidence to them (Solden, et al., 1999) so that they can give sense to its situation, creating a conceptual system about the disease and the place that occupy in their lifes (Harper & Peterson, 2000). The online psychological support is proposed as an alternative directed to the psycho-social rehabilitation, since it can be a tool of remote support for the relatives of neuromuscular patients. In this way, systems like online chat group or the creation of an informative web site, can be very useful if we take into account the lack of time of the relatives, who usually are tied up to the house because the cares that the affected person demands or because they are the only people in charge of their care, that they have obligations that make difficult to set a face to face meeting and in addition they can be geographically isolated.

New technologies have demonstrated the viability of the psychological online support in diverse collectives. Some of that collectives are: neuromuscular patients and relatives (Soutter, 2004), people with physical

disability with the objective of reducing its feeling of solitude (Hopps, et al., 2003), patients with breast cancer (Weinberg et al., 1996), to promote support and informative services for people with brain injury and their main caregivers (Rotondi, et al., 2005), family therapy, specially in the cases in which their members lived geographically far (King, et al., 1998), persons with some personal and specific troubles, as well in the promotion of the introspection and patients who suffer from cystic fibrosis (Hubbard, et al., 2005).

Objectives

The main intention of this study is to value the effectiveness of an online intervention psycho-social program directed to the relatives of children and adolescents with neuromuscular diseases through online psychoeducatives activities and chats. With this propose, we are developing different actions to reach the following specific objectives: a) quantitative and qualitative evaluation of psycho-social variables of a group of parents of children affected by disease to neuromuscular b) evaluation of the effectiveness of an online psychoeducative intervention program, c) evaluation of the effectiveness of an online group intervention program through chats. The present article will be focused on the quantitative evaluation of the psychosocial variables (anxiety state - characteristic and depression), based on the data collected until 2007.

Methodology

Design: This study analyzes the result of 37 fathers and mothers with children affected by a neuromuscular disease in the following variables: anxiety state - characteristic and depression. For the collection of the data there was made a quantitative evaluation consisted in a self administration test protocol that users answered at their home. The chosen design is of cross-sectional, pre experimental, previous to any intervention. The results were analyzed using the statistic package SPSS- 15.

Subjects: A total of 37 parents of children and adolescents affected by diverse neuromuscular diseases were members of the intervention group with an average of age of 41.7 years and with a medium level of studies (54.1%) or high level studies (24.3%). The group of participants, formed by 18 fathers and 19 mothers, came from the neuromuscular patients association of Bizkaia, Alava and of the Principality of Asturias.

The common characteristic of all the participants was the fact that they have a child with neuromuscular disease, in concrete: muscular dystrophy of Duchenne (N=11), muscular dystrophy of Becker (N=1), miopatia

nemalítica (N=1), miopatía congénita (N=1) miastenia (N=1), Charcot marie Tooth (N=1), Pelizaeus Merzbacher (N=1), spinal muscular atrophy (N=1) and mitochondrial disease (N=1).

Evaluation Instruments

The following instruments were used: Inventory of depression of Beck, 1978 (Spanish adaptation by Sanz and Vazquez, 1997) which purpose is the detection of depressive emotional states according to the cut scores. Questionnaire of anxious state - characteristic. STAI - ER, (Spielberger, 1970). This includes separated scales of self evaluation that measure two concepts of anxiety: a) state: transitory emotional condition of human organism and b) characteristic: relatively stable anxious propensity.

Results and conclusions

A statistical analysis of the average scores of the participants in the variables was carried out in anxiety characteristic, anxiety state and depression variables. According to the standards, the group of mothers scores over the average in anxiety been ($M=63.16$), reflecting clinical values more elevated in mothers with children affected of Muscular Dystrophy of Duchenne, (DMD), ($M= 64.18$, $DT= 30.22$). In all the group of evaluated parents, items which receive scores over the average reflect fatigue ($M= 1.76$, $DT= 0.98$) tension ($M= 1.68$, $DT= 0.91$), sadness ($M= 1.68$, $DT= 0.81$) and worry by possible misfortunes in the future ($M= 1.68$, $DT= 1.02$). This last item is particularly significant in fathers group with children affected by DMD ($M=2$, $DT=1$), although the centil score in anxiety of this group is in the average score ($M = 49.82$, $DT=31.9$).

The results relative to the anxiety characteristic scale, the centils scores of the group are near the average and no specific subgroup stands out ($M= 45.59$; $DT= 30.11$). However, an item by item analysis shows one more time the tiredness feeling, specifically in mothers whose children have a disease different from the DMD ($M= 2$, $DT=0.89$). Another outstanding item indicates the tendency "to take things too much seriously", where the parents whose children have different diseases from the DMD obtain values over the average ($M= 2.57$, $DT= 0.78$).

For the evaluation of the depression level, it was registered as normal scores between 0-9 and a slight depression between 10-15 (Sanz and Vazquez, 1998). Taking this into account, the group of mothers whose children have DMD scored an average of 11.27 and a typical deviation of 7,08 and they show a high score in items that indicate pessimism, irritation, fatigue, dissatisfaction and weeping, suggesting a low level of depression. About the group of parents whose children have a different disease from the

DMD the insomnia item score is over the average. On the other hand the group of mothers whose children have different diseases from the DMD obtained an average of 8 points in the final score of the Beck.

As a whole, the study reveals a medium-high level of stress related to the take care and pay attention to the children with neuromuscular disease tasks and with the gender.

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How to Provide High Quality Contents for Low Resource Settings

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Abstract: In the following paper we make a comparison between the different available SCORM offline players which from our point of view allow decreasing the cost of delivering high quality resolution content to low resource settings.

Introduction

One of the bottle necks to deliver educational content to low resource settings is the internet speed connection needed to download high quality content, in most of the cases heavy files.

Producing educational material sometimes requires double effort adapting it to different kind of internet audience: low resource settings, having low speed connection, and industrialized countries.

But, is there any solution to provide high quality interactive educational materials for low resource settings using developments already made for the industrialized countries? Is there a way to produce education material, independently from the internet audience settings? Is there a way to track the students' progresses having a low speed internet connection?

Well, most probably the answers to these questions are the SCORM offline players.

SCORM offline players help to deliver educational content developed with SCORM standards through a USB memory stick, a DVD or a CD rom. The learners are able to play any size of content that has been packaged within SCORM standards. The offline players offer a possibility of tracking the learners when synchronized with a central LMS. The offline players send just the interaction (for example score, time of interaction) that is a very small size file using XML. The benefit is three fold: there is no need to readapt the didactical material according to the internet bandwidth, secondly the students' progress can be tracked and thirdly it is possible to deliver high quality content to low resource settings.

By doing this you also assure quality control of the didactic materials through students feedback.

Material and methods

We hereby compare 4 of the SCORM offline players available on the market. A check list has been used to enquire about the following topics:

1. Possible integration of the offline player to any LMS.
2. Execute file generation that includes the content in the offline player and all the configuration settings for the deliver on a CD Rom or USB.
3. Compatibility with 2004 and 1.2 SCORM compliance.
4. Certification of the product 2004 and 1.2 by ADL labs.
5. Technical support plan for costumers and response timeframe.
6. Unit price up to 1000 perpetual licenses.
7. Type of files synchronized between the offline player and the LMS.

Product, company	URL
Scormuntethered, Rustici Software	http://www.scorm.com/products/scormuntethered.asp x
Offline player, Harginber Systems	http://www.harbinger-systems.com/offlineplayer.htm
Meridian Anywhere 3.0, Meridian Knowledge Solutions, LLC	http://www.meridianksi.com/products/meridian_player.asp
Xyleme`s Offline Player, Xyleme	http://www.xyleme.com/mobile_learning
SCORM player™ - Learning offline, Global Tech*	http://www.globalteach.com/GlobalTeach/SCORMplayer/tabid/60/language/en/Default.aspx
Backpack, Blackboard*	http://www.blackboard.com/extend/backpack.htm

Table 1. SCORM offline players

*No reply, no contact, no possible to test the product

The only company giving us a demo copy has been Meridian. The eLearning team at our institution tested the Meridian and the other offline players (Xyleme, Harbinger, Scormuntethered) with a demo through videoconferences.

Check list result

All the assessed offline players could be integrated in any LMS, could generate an execute file and configuration setting to place content on a CD-rom or USB and had 2004 and 1.2 SCORM compliance. All the products have a 1.2 ADL labs certification except Harginber (in planning phase) and Xyleme. In Table II a brief description of costumers supports. All the products have a unique price up to 1000 perpetual licenses except Harginber Systems. The synchronization between offline players and LMS is done using XML.

Product, company	Technical support
Scormuntethered, Rustici Software	Accepted request: by email and/or phone calls. Response timeframe: one business day; Time of problem resolution: depedending on problem.
Offline player, Harginber Systems	Technical support provided by email. Response timeframe: for severe or show stopping cases the quickest response commitment is within 24 hours, for normal cases where the support is for non-severe cases the response will be provided within 72 hours.
Meridian Anywhere 3.0, Meridian Knowledge Solutions, LLC	Accepted request: by email telephone from 8:00 a.m. to 8:00 p.m. Eastern time on weekdays other than on Meridian holidays. Meridian uses an online Requirements Management System (RMS) and third party software named Phaseware to collect and manage customer service responses in order to facilitate and track the process. The system enters the requirement as a ticket and date-time-stamps the item to facilitate timely resolution. The project manager has real-time visibility of each ticket and its status.
Xyleme `s offline Player, Xyleme	Not provided.

Table II. Description of technical support for customers

Conclusions

1. SCORM offline player is an option allowing the delivery of high quality graphical content independently from bandwidth conditions;
2. It allows to track the progress of the students in low resource settings through the integration of the tool within a LMS;
3. It reduces the cost of educational materials 'chain production' for any educational environment;
4. The students' tracking allows a content quality assurance and ensure feedback for further adaptations;
5. Harbinger's offline player is one of the best options we assessed: we got a very strong customer support with quick response all the time and that gives a good idea of kind of help desk available.

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Medical Informatics Education and Distance Learning at Sarajevo Biomedical faculties

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Introduction

In Bosnia and Herzegovina, Medical informatics has been a separate subject for the last 15 years with regard to Medical curriculum at the biomedical faculties in the country (1,2). Education in the field of Medical informatics is based on the concept which is used in developed countries, according to the recommendations of the working groups EDU – Education of Medical Informatics, of the European Federation for Medical Informatics (EFMI) and International Medical Informatics Association (IMIA). Theoretical and practical teaching and training performance as a whole is performed by use of the computer equipment, and the final knowledge check of the students is also performed using the Data Base Management System MS Access specifically designed to cover full teaching and training material by using question sets in the data base which encircled nearly 1500 question combinations. The distance learning is logical step that can further improve this method of education. In this paper, the authors present 15 years of experience of Medical informatics education at biomedical faculties in Bosnia and Herzegovina.

Medical informatics Curriculum

The Curriculum of Medical informatics of the Faculty of Medicine of University of Sarajevo involved both practical and theoretical parts. Since 1992 at the Medical Faculty, University of Sarajevo there had been Cathedra for Medical Informatics. The content of education is 30 hours of theoretical and 45 hours of practical education for students of the Medical Faculty, 15+15 hours for students of Faculty of Dental medicine and 30+30 hours for students of College of Nursing. From 2002 the subject is split into two parts: Basics of medical informatics with funding of 15+15 hours in the second semester of studies and Applicative medical informatics with funding of 15+30 hours in the eleventh semester. The final exam is due after the 11th semester. In past years the curriculum was modified and harmonized, but the basic one was the Program of Sarajevo Cathedra for Medical informatics.

Students have practical computer training for a period of 15 weeks. We first provide a very short introduction to the architecture of computer systems, MS DOS, Windows 2000/ XP with all their characteristics and instructions, which are most frequently in use. So students are familiarized with the style of delivery of contents on the computer, work with documents, installation of software and hardware, ways of making work on the computer faster, ways we can fix windows, as well as ways we can set up the computer desktop are all taught. Students have training in Excel, Word etc. During the semester, the students perform specific operation such as creation of data carrier for manipulation with medical information. After completion of this carrier, the students collect some data from patients that are entered into the database created by students. The information was analyzed by statistical program such as Excel. After this we consider student eligible for final exam that consists of two parts.

Electronic Examination

Both part of exam are performed using computers. Students must perform some of the task that includes preparation of information that should be analyzed, gathering of data, data manipulation, and finally analysis of data. Student must recognize the importance of every step and show that he is ready for medical data manipulation. First step is creation of data carrier that contains all data that must be analyzed. Second step is creation of database and final step is data analysis and descriptive analysis with statistical analysis.

The Theoretical part of examination is done using the multiple choice answer form provided by special software with randomly selected questions for each student. The final knowledge check of the students is also performed using the Data Base Management System MS Access specifically designed to cover full teaching and training material by using question sets in the data base which encircled nearly 1500 question combinations. In such way, using the combinations of questions it is possible to give different set of questions to each student. At the beginning of test, each student fills up the information about his name and index number. The time of solving all questions is limited to one hour. After exam it is possible to see result immediately. The students prefer this method because it is much easier to them to solve the test and they no need to wait for results as it is case when we perform the classic multiple choice test. The usual number of questions to be solved is twenty. There are six different scores that can be obtained. The mark “five” means that student did not pass the exam. Other marks are marks from 6 to 10 meaning that ten is the best mark. At least eleven questions must be answered correctly to

pass exam and get mark six. For the best mark students need to answer 19 or 20 questions correctly.

Distance learning, registration and testing

Such way of practical and theoretical path of final exam make possible to perform such procedures such as electronic registration for exam and distance testing (3). Possibilities of introduction of distance learning in

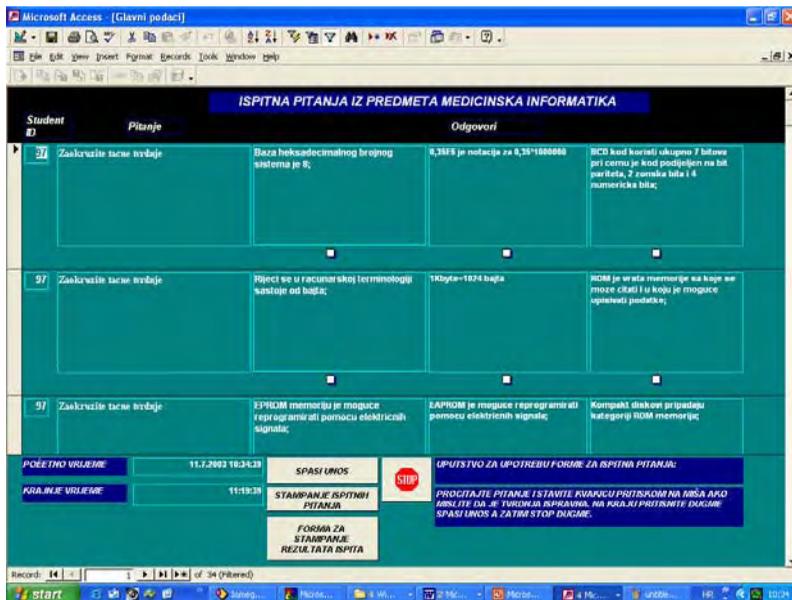


Fig. 1. Screen window of exam questions

medical curriculum are the title of project which has been realizing at Cathedra for medical Informatics, Medical faculty since year 2002. Project is approved by Federal and Cantonal ministries of science and education. The purpose of this project is to support improvement educational process at biomedical faculties using contemporary methods, methodologies and information technologies in accordance with strategy and objectives given by Bologna declaration. Pilot project is realized during five years, theoretical and practical part of subject Medical Informatics are adapted to modern concepts of education using world trends of distance learning. One group of students from Medical faculty was involved in this project, which was finalized by electronic registration of exam and electronic testing on 20

June 2005, in public in Physiological amphitheatre of Medical faculty in Sarajevo. The project and phases of its realization we described in other papers (3), and basic advntaes and disadvantages we have noticed so far. In progress is the adaptation of curriculum of neighbouring countries in Medical informatics and content of methodological units with the Bologna process (4,5). Curriculum, teaching materials, application for the exam, the exam itself and checking of results are possible at the web site (www.imasic.org/mi).

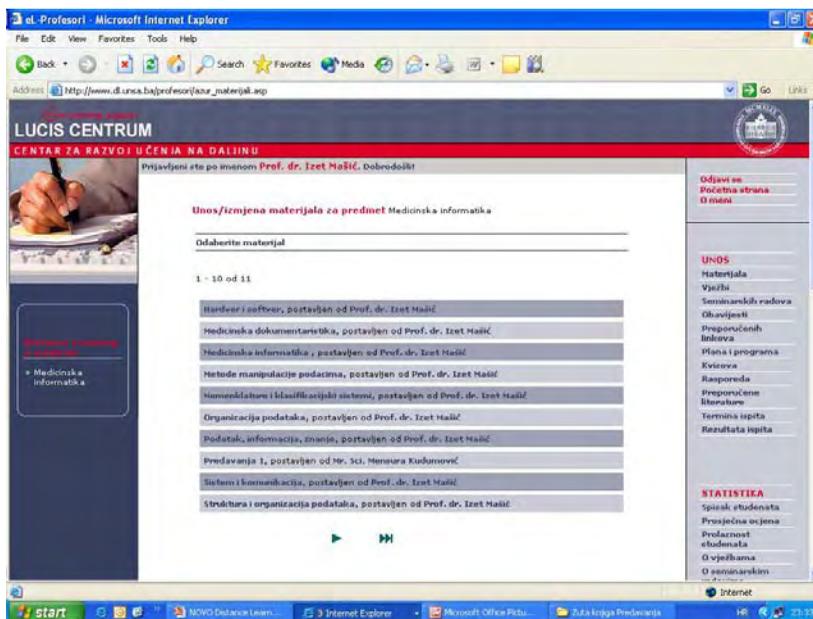


Fig. 2. Lecture content of Curricula for Web based Medical informatics education

The screenshot displays the LUCIS CENTRUM website interface. At the top, the logo and name 'LUCIS CENTRUM' are visible, along with the tagline 'CENTAR ZA RAZVOJ UČENJA NA DALJINU'. A navigation bar on the right contains links: 'Odjavi se', 'Početna strana', 'O meni', 'POGLEDAJTE', 'Materijale', 'Vježbe', 'Seminarske radove', 'Obavijesti', 'Preporučene linkove', 'Plan i program', 'Kvizove', 'Raspored', 'Literaturu', 'Prijava ispita', and 'Rezultate ispita'. The main content area shows a user profile for 'Ivan Jarak' and a course page for 'Medicinska informatika'. The course page includes a welcome message, a list of materials, a list of lecturers (Mr. Sci. Mensura Kudumović and Prof. dr. Izet Masić), and exam information for the year 2005. A sidebar on the left contains a search bar and a list of course materials. Below the main content, there is a section titled 'Metode manipulacije podacima' with a progress indicator showing 3 out of 8 questions. The current question asks for typical errors in data manipulation, with four multiple-choice options: A. greške detekcije, B. greške interpretacije, C. greške kolaboracije, and D. greške pri upisivanju podataka. An 'Odaberi' button is located below the options.

Fig. 3. Architecture and Medical informatics content on the Web site

Distance learning method of education is in a pilot phase and waiting for official approval from the appropriate institutions in charge for high education. In total, education from Medical informatics gained 2500 students. At postgraduate students of the Medical Faculty, University of Sarajevo there are subject Medical Informatics with funding of 15+15 hours and this type of education enabled over 800 medical doctors all medical specializations.

Conclusion

Distance learning or learning from distance represents the educative technique which occupies significant place in the actual medical education of health care workers at the international plan, also in Bosnia and Herzegovina. This method of education is very useful in the domains of all kind of educational process: for undergraduate, postgraduate and continual medical education. It represents the educative technique of the significant effectiveness, which has to have at the disposal both the adequate technological infrastructure as well as previous education of the lecturer and user, adopted the teaching plans and the evaluation mechanisms of knowledge. By use of the rich choice of technological models, in relation to the traditional method of learning, enables the simultaneous education to the great number of students of the various profiles, the approach to all the relevant forms of data bases and data knowledge as well as the mechanism of the evaluation by the eminent institutions and lectures.

This concept of learning based on practical test using computer and online test are ideal way of examination. Electronic registration and testing is important step in developing modern education that include distance learning. We hope than in future this is going to be widely used technik for education at biomedical faculties in Europe. Education in the last 15 years using experiences from other countries in which the field is developed and the recommendations in curriculum from medical informatics are given by the working groups of the European Federation of Medical Informatics (EFMI) and International Medical Informatics Association (IMIA). The up-to-now organization of instruction and the continuing innovation of the educational process from the Medical informatics chairs and their collaborators insured the high rating at the Medical faculty of the University of Sarajevo and also outside our country. The satisfaction of our undergraduate and postgraduate students with contents and organization of the teaching process up to now is indisputable and proven.

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Multimedia Teaching Systems as Educational Tool in Everyday Work of Pharmaceutical Companies 5 Years of Practical Experience

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Abstract: Background: Daily activity requires constant learning and training. The most effective tool is multimedia teaching system on CD/DVD or online.

Aim: To analyze the 6 year experience in creating, elaborating and practical use of teaching systems for pharmaceutical companies.

Results: Our systems save time of medical representatives and managers, traveling expenses (distant learning and testing), the systems are easily adjustable to different aims and conditions, they improve and intensify the learning process and finally increase sales and profit of the company.

Keywords: multimedia, teaching, system, pharmaceutical, company

Today the terms and conditions of successful business require permanent postgraduate education and training of employees. To meet the goal numerous corporate trainings and seminars are organized. In pharmaceutical business they are directed to teach medical representatives and increase sales in the end. In addition, companies actively proliferate knowledge or information for practicing specialists via conferences, symposiums and round tables. The report focuses on experience of creation and implementation of multimedia teaching systems for medical representatives of pharmaceutical companies and is based on results of 144 projects done during the last 6 years.

Concept and terms: The main difference between the multimedia teaching systems and traditional paper tools (including electronic books) are as following:

- Multimedia teaching system supposes the obligatory presence of interaction between a student and a teaching system. In this case computer is a consultant, helping to organize teaching.
- Multimedia teaching system allows a student to get the most of all existing and various types of electronic information.

- Multimedia teaching system must consist of at least 2 basic modules: Teaching and Controlling Modules. If the latter module is not present, the system can't be considered the teaching system.

Multimedia is a technical description of a software product, meaning a possibility to integrate any type of electronic information into a project: video, sound, animation, photo, PowerPoint, Macromedia Flash, hypertext, text, databases, three-dimensional graphic arts, Internet and e-mail. Due to combination of these facilities and possibility to navigate instantly, multimedia is practically the most powerful and effective tool to present information.

Interactivity means communication between a student and a teaching system. According to IMS all elements of the program providing interactivity namely navigation, hypertexts and hypermedia references and links, manipulation of objects, must be easy understandable, clear and do not require any special IT knowledge. Exactly the interactivity enables a student to navigate, to choose the needed kind and type of tests or information, to save or send results.

Final testing and self-control of knowledge differ in procedure of testing and analysis of the results. Self-control is based on simultaneous operation of both Teaching and Controlling modules.

Architecture of multimedia teaching system It consist of two main parts: teaching and controlling modules. Depending on aims and tasks there are different types of organization of these modules and their subsystems. For example, teaching Module consists of several sections with the set of questions in the end of each. With every correct answer a student will go to the next question. In case of mistake the system responds variously, for example: test is interrupted and the system opens a source of information with the correct answer for reference; or it signals about a mistake with a sound and a message; or test goes on and with the last question the system displays the total score of wrong and correct answers. Thus, testing is carried out simultaneously with the process of learning.

In case a company needs to have detailed information about the test and knowledge, the system is equipped with the reporting Module. A report may contain: calendar date and total time spent; average time spent to answer a question; number of correct and wrong answers. If necessary the system delivers the final report to the office via e-mail or directly to the corporate database server. This is done by Delivery Module.

Module	Function or content
Teaching module	Teaching content, algorithm of educational process, navigation, technical part allowing to play video, sound, animation, 3D and other multimedia content
Controlling Module, including the subsystem of tests and monitoring subsystem.	Questions and answers (tests), algorithm of questioning, analysis of answers (counts wrong and right, time and other parameters)
Report Module	Creates a resulting file (report)
Info delivery Module	Delivers the final report to the office by e-mail, fax or other (on-line)

Table 1. Architecture of multimedia teaching system

Teaching module:

Type of educational material	Mastering
Text on paper	9%
Text on PC screen	3%
Audio (played once)	17,5%
Graphic information (photo, pictures, graphs, diagrams)	22%
Graphic information with audio comments	28%
Video (played once without sound)	32%
Video (played once with sound)	51%

Table 2. Efficiency of perception of different forms of information

Text on PC screen: Pharmaceutical companies pay a lot of attention to publications in medical periodicals; therefore, it's quite an important educational and informational tool, usually reproduced in Acrobat. The better the layout of the document, the better is perception of the text and information. Our experience tells that the most effect is achieved when combining screen text and print out option.

Audio: We do not use a lot of audio lectures or reports, instead we prefer synchronous comments to graphic information, for example, author comments to slides.

Graphic arts: Illustrations improve perception of text and are widely used in multimedia teaching systems. The most powerful is animated

graphics, thanks to Macromedia Flash. Flash animation with sound quite often is more informative than real video.

Video is the most powerful tool of teaching. It is very important to provide a full control over the video, including direct access to any segment.

Hypertext: In fact, a hypertext is the additional system of navigation. Used in multimedia teaching system, hypertext is especially useful to create so-called «popup prompts» decoding abbreviations and terms.

Hypermedia is one of the main components of multimedia, because it creates and executes navigation between different elements of heterogeneous information: texts, images, audio, music and video. Due to the synthesis of different types of information the system turns into a powerful teaching tool.

Controlling Module

In any multimedia teaching system a major role belongs to objective control of quality of knowledge and to the estimation of efficiency of teaching methods. Exactly the controlling module distinguishes the teaching system from presentation or info system. To estimate adequately the quality of knowledge we need: well structured and informative Teaching Module; subsystem of tests with questions and answers; monitoring subsystems to control correct and wrong answers, time spent etc. In any case, before to create Controlling Module it is necessary to define the ultimate goal of teaching. For example, if we aim to get a medical representative with 100% knowledge about a preparation, we have to base the controlling module on questions describing this preparation (indications and contra-indications, mechanism, active substance, possible complications). The criteria will be correlation of correct and wrong answers. If we aim to train certain skills and abilities, for example in presenting the information about a preparation, we have to estimate average time spent to answer questions (a time of reaction) or the efficiency in recognition of certain situations.

According to the recommendations of IMS Global Learning Consortium, there are followings basic types of tests:

- Simple choice – that is 1 question and 2 answers, one of which correct.
- Multiple choices – to choose a correct one or several one from 4 or 5 answers.
- Manipulation with objects: construction, moving and arrangement of answers or objects.
- Fill in or check box tests.

The monitoring subsystem controls correct and wrong answers, monitors average time spent, total time and other parameters. Today it's possible to

load practically any level of difficulty and parameters to get information needed.

Report Module This module generates a report, based on the info from subsystem of monitoring. The module differs in difficulty level depending on the initial task of testing. While the practice shows that most claimed is an index of wrong answers in absolute value or in percent correlation with right answers or total number of questions.

Info delivery Module The module delivers report to the office. Usually it goes via e-mail or directly to a corporate database on the customer's server. If necessary we may encrypt the report.

Practical results As for today we have completed 144 multimedia teaching systems for the representative offices of Bayer, Berlin Chemie, Mepha, Gedeon Richter, Nycomed, Astellas, Dr. Falk Pharma, Ranbaxy, Boehringer Ingelheim, Heel, Servier, Sanofi Aventis and other. These projects differ in general concept, ultimate goal and difficulty level.

Companies pay a lot attention to teaching of both doctors and medical representatives. They differ a lot. **Multimedia teaching system for doctors:** Teaching module, as a rule is based on video lectures and congress reports and texts of articles published in medical journals. The controlling module as a rule is a multiple choice test. The test doesn't generate report, it's not stopped in case of a wrong answer, a doctor doesn't get any points or results. The main task of this system is not to control but to encourage a doctor to get more knowledge on the subject.

Multimedia teaching system for the employees of pharmaceutical companies: Teaching module comprises any type of information – video, audio, text, animation. If necessary we create it for a customer. Controlling module usually consists of 2 sections – so called office test and absolute knowledge test.

Office test usually is a multiple choice test. A student answers questions one after one without any notice from the system about correct or wrong choice. After the last question is answered the system displays the final result with the total number of question, number of correct and wrong answers. It's mostly used during corporate training and seminars to monitor acquired skills and knowledge or new employee's progress. The time to answer is monitored by a lecturer or trainer as well as results. Absolute knowledge test is different: a company wants it's employee to have 100% knowledge of the subject. To reach this we use multiple choice test with a single correct answer among 4 or 5 variants. In case of mistake the test stops, all the results are terminated, the system opens the particular section of the information module for a student to refresh his knowledge. The test

starts again. Every time it starts the questions are displayed randomly. If you answer correctly all the questions you see so called result on a screen.

Conclusions

The main and the most significant results are:

- Our systems are time saving for both teachers and students;
- The knowledge acquired stays in a student's memory for a longer period of time;
- Multimedia teaching systems are efficient cost saving tools, reducing traveling and similar expenses for a company;
- Multimedia teaching systems are easily adjustable to meet concrete and specific tasks of a pharmaceutical company.
- Our systems save time of field force managers responsible for teaching and testing,

And finally all mentioned above sums up in increase of sales which is the main task of any manufacturer for today.

Virtual Health Care Knowledge Center in Georgia

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Abstract: Several years ago, any talk related to the Internet, would have to be preceded by an explanation of what it is and how it works, but at present eHealth became the essential part of life and practical activity. eHealth is the dissemination of medical information using the digital medium. This field absolutely depends upon Information and Communication Technologies. eHealth has a great potentiality; however there are unfortunately today few examples of large services; it allows a better exploitation of limited hospital resources and of expensive medical equipment; and it helps to address the problem of unequal access to healthcare. Throughout the world the number of people requiring special care is increasing as the proportion of elderly people rises, at the same time, in a high-tech age the expectations of the society for a better healthcare are also rising. eHealth offers the opportunity for improving healthcare services and for making healthcare expertise available to underserved locations. The project “virtual Health Care Knowledge Center in Georgia” is an online integrated web-based platform to provide remote medical consultations and eLearning cycles. World Wide Web and compact disc-read only memory technologies have introduced new prospects for delivering continuing medical education (CME) to regional healthcare professionals. However, evidence concerning the effectiveness of these technologies is providing CME, and approaches to their evaluation, is limited. The rationale of the article is to present a model for evaluating the effectiveness of computer-mediated CME courseware too. The project “Virtual Health Care Knowledge Center in Georgia” is the NATO Networking Infrastructure Grant to promote the development of telemedicine in non-NATO countries. The project implemented a pilot to organize the creation of national eHealth network in Georgia and to promote the use of innovative telemedicine and eLearning services in the Georgian healthcare system.

Introduction

The term globalization involves a complex series of economic, social, technological and political changes seen as increasing interdependence and interaction between people and companies in disparate locations. The phenomenon globalization has already reached the medical field, most importantly in the areas of knowledge, diagnosis and therapy. The access of as many people as possible to these areas should be guaranteed by a technically efficient man-machine interacting system and by an effective organization of specialists around the world. An efficiently operational and organized exchange of medical information increases the quality of diagnosis and therapy, and assures the continuous education of the medical personnel. The main task of a medical informatics system is to enable medical non-experts to gather, exchange and discuss relevant data at any time with experts in any place on the world. A wise conception of such a structured dialogue for consultations and continuing medical education is based on a user-friendly, fast, simple, efficient and sustainable system for the exchange of medical information. Countries with middle and low incomes are often affected by severe limitations in the practice of healthcare. The result of this inefficiency often translates in inappropriate treatment of patients due to inaccurate diagnosis. The rapidly expanding information and communication technology (ICT) allows that day after day we are near to closing this gap.

Description

eHealth can be designated as a special form of information technology; as a method of delivering medical services by electronic means of communication; with the provider and the recipient of these services being at different places. eHealth enhances quality, accessibility and efficiency in all aspects of health delivery. Efficient national planning, evaluation of health policy, a cost effective delivery of healthcare all require the speedy, accurate and comprehensive exchange of data. But knowledge of eHealth is fragmented and often circumscribed to experts. Progress amongst countries, regions, institutions and individuals is unequal. eHealth systems and services combined with organizational changes and the development of new skills are key enabling tools. They can deliver significant improvements in access to care, quality of care, and the efficiency and productivity of the health sector. The amount and complexity of health related information and knowledge has increased to such a degree that a major component of any health organization is information processing. The health sector is clearly an information intensive sector which increasingly depends on information and

communication technologies. These technologies are supporting progress in medical research, better management and diffusion of medical knowledge, and a shift towards evidence-based medicine. eHealth tools support the aggregation, analysis and storage of clinical data in all its forms; information tools provide access to the latest findings; while communication tools enable collaboration among many different organizations and health professionals.

It should be especially noted, that eHealth has many socio-economic benefits; they can generate new sources of revenues for service providers and equipment suppliers and can optimize the use of available human and capital resources in countries with middle and low incomes. But it needs to be implemented carefully and managed well. The impact of eHealth on healthcare structures can be significant. In this respect, this field can be viewed as a tool to reorganize or to build up new healthcare structures. It also raises concerns about liability, confidentiality, competition and other policy and regulatory issues.

Results

The implementation of the Virtual Health Care Center in Georgia (VHCC) started at March 2005 by realization of project “Virtual Health Care Knowledge Center in Georgia”. The topic was the implementation, evaluation and adaptation of telemedicine services for Georgia. In the frames of the project the technical resources of two Georgian organizations were improved and developed. As a result of the project implementation Georgian Telemedicine Union has its own teleconsultation server and main telemedicine unit in the capital, Tbilisi. GTU’s Internet connection is established by DSL technology – 256 kpbs. In the frames of the present project implementation the first regional telemedicine unit at Kutaisi (West Georgia) at Public Health Imereti Regional Center was established. The Internet connection of Kutaisi regional telemedicine unit is established by DSL technology – 128 kpbs. The telemedicine units as in the capital so in region established the close collaborative links with different healthcare organizations.

The first step of this project implementation which aimed set up and installation of the teleconsultation server realized by NATO-country project co-director, Dr. Schrader Thomas has been completed at June 2005. The service can be reached at <http://vhcc.charite.de>.

The server is mainly applied for remote medical consultations, which are implementing through the tool Simple Machine Forum. For the purpose to organize remote consultation in the most effective and comprehensive degree the each case for consultation is supervised by responsible person

(Georgia country project co-director – Dr. Kldiashvili Ekaterina). This will include the notification and kind remaining of experts about uploading of the new case for consultation and ensuring of obtaining second opinion.

For the purpose to organize remote consultation in the most effective and comprehensive degree each case contained as description (the resume of medical history) and illustrations (microphotographs, CT images, Xrays and etc.). Just to create the full impression regarding the case the resume of medical history includes the data regarding the patient's objective condition, complaints, working diagnosis and clinical findings. As soon as the case was uploaded at the server the notification letter was sent to experts.

The main problem revealed is the price of Internet in Georgian regions. Despite of the objective that the fiber optic cable network system is functioning as in the capital so in regions, the most part of Internet users are located in the capital, therefore the Internet service is expensive in regions. Another difficulty is the low computer and English language abilities among Georgian healthcare audience.

At June 2007 the implementation of the project “ePathology - Virtual Pathology Center in Georgia as the Continuation of Virtual Health Care Center” has been started. Overall methodology that will be used during the project implementation is dissemination of information, exchange of experience, education/training, demonstration and practical implementation of work. As a result of the present project we will gather and prepare all relevant information, disseminate materials, create web-pages, update web-page information, host project gathering, provide eHealth, Telemedicine, eLearning service, virtual conferences, seminars and webinars (seminars in the web), etc.

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Chapter 8

eHealth for Developing Countries and Low Resource Settings

Access and Connectivity for Community Based Health Workers in Developing Countries: Employing Wireless Technologies

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***Abstract:* Health systems in developing countries face an uphill task in combating the double burden of chronic and infectious diseases facing their populations. Scarce financial resources coupled with the massive brain drain have depleted the health workforce. A negative impact on the timely achievement of MDGs is resultant outcome. However, Community Based Health Workers (CBHWs) have been recognized as essential for healthcare in developing countries but they will need empowerment to fill this gap. Using eHealth for supporting their activities could result in improving health system performance. Wireless/mobile technologies are available in developing countries for supporting voice and data communications and they are henceforth presented here for this purpose.**

Introduction

Health systems in developing countries face an uphill task in combating the double burden of chronic and infectious diseases facing their populations. Scarce financial resources [1] coupled with the massive brain drain that has led to the loss of mostly high and medium level health workers [2] has further worsened this situation. The Millennium Development Goals (MDGs) have been set by the United Nations as a driver for tackling these disease burdens in developing countries. MDGs are a set of eight goals that were adopted by the United Nations (UN) in September 2000 [3]. This includes calling on countries to carry out more collaborative activities against poverty, illiteracy, hunger, lack of education, gender inequality, child and maternal mortality, disease, and environmental degradation.

MDGs-related diseases account for the majority of morbidity and mortality in most developing countries. However, there have been concerns raised about lack of direction and resources in meeting the defined targets by the set date of 2015 [1]. A major contribution of MDGs is that they have helped in situating these major health burdens within the global development agenda and discourse [4]. Rapid achievement of the health related-MDGs can be effectively attained by adopting the principles of the Alma Ata Declaration of Primary Health Care (PHC) [5]. Of particular importance to this present discussion is the principle of community participation in delivering essential health services.

The principle of community participation makes the case for using health workers drawn from within the community for primary healthcare delivery. The shortage of adequate human resources to tackle public health problems has also been identified as a major impediment in many developing countries [2].

Recently, there have been calls to focus strategies on the development of substitute health workers for the provision of health services in developing countries [6]. Community Based Health Workers (CBHWs), as long standing providers of primary healthcare in many developing countries [7], can henceforth be regarded as such. The World Health Report 2006 [8] was focused on highlighting and addressing the global shortage of health workers but with a special focus on developing regions. The critical roles of CBHWs in delivering essential health services in these regions were emphasized. Their importance to health service delivery is further underlined by the fact that they constitute about one third of the health workforce on global average [9]. However this ratio might be higher in developing countries where there is evidence to show that the increase in immunization coverage was accountable to the use of CBHWs.

Employing mobile/wireless information and telecommunication technologies [(m)ITTs] to support their healthcare activities was a notable recommendation of this report [8]. Therefore supporting CBHWs with mITTs should henceforth be considered as a top priority.

Using ITTs as enablers is integral to the MDG agenda [3]. As a response, the WHO has also proposed using eHealth (ICTs in health) for enabling effective health services especially in developing countries [10]. Also, the ITU has continuously made a case for the use of "broadband" mITTs for bridging the digital gap between developed and/within developing countries[11]. The reduced implementation time, lower maintenance costs and high network adaptability of wireless over wired connectivity networks was ITU's rationale for this proposition. In developing countries, the relatively low cost and affordability of mobile-user devices in comparison

with fixed computers [12] also deepens this rationale. Therefore, this paper proposes using mITTs for supporting CBHWs' healthcare activities in developing countries. mITTs in this paper is taken to include wireless connectivity and mobile access devices.

ITTs for eHealth in developing countries

eHealth is the use in the health sector of digital data transmitted, stored and retrieved electronically in support of health care both at the local site and at a distance [10]. Therefore, mITTs are just platforms or scaffolds for eHealth applications [13]. The major difference is that it is wireless instead of wired, or it is mobile instead of fixed and it is scalable instead of rigid.

As the internet provides a global and a distributed platform for access to online services and information, its use for bridging the digital divide and for enabling developmental activities has been documented in many developing countries. Internet applications such as web services, e-mail and instant messaging (IM) can provide access to health information and services through mITT connectivity. These applications have been demonstrated to provide eHealth services in developing countries. For example, the RAFT programme is an open source web-based telemedicine network from Mali [14]. The network gives health workers' collaborative eLearning and teleconsultation access over local and almost continental-wide distributed network through terrestrial and satellite wireless connectivity.

The rationale for providing developing countries' CBHWs with connectivity and access through mITT-enabled eHealth networks will further be developed below.

Community Based Health workers

CBHWs comprise the variety of health workers that are selected, trained, and work within the communities. They should be accountable to their communities, and be enabled and empowered by the health system, but may not be part of it and they normally have shorter education than professional workers [7]. In the context of Africa's health system, they are regarded as a broad group of low-level health workers, located in rural, urban, semi urban settings [7]. They carry out health organisational tasks such as home-based patient care, environmental health improvement, supporting health programmes such as large-scale immunizations, and diagnosis and/or treatment of diseases such as pneumonia, TB, HIV/AIDS, malaria, maternal and childhood diseases. Their activities can henceforth be supported with organisational support systems such as electronic health records (EHR), decision support systems (DSS) and teleconsultation to mention a few.

Aside from delivering essential health services, they are also social change agents within their community.

Henceforth, supporting CBHWs with a mITT infrastructure to enable their health and social activities could have a positive impact on their performance. For example, on a home visit to a HIV/AIDS sufferer, a CBHW with access to the patient's medical records through a PDA can effectively track compliance to medication such as ART drugs and also to monitor their health status and progress. This has potential for ensuring better patient outcomes with an eventual improvement of the health system's performance as a whole. CBHWs as presented above in this section are very important to the delivering of essential health services to citizens in developing countries. Therefore, the use of mITTs for eHealth purposes will be discussed in the succeeding sections.

mITTs for eHealth in Developing Countries

The use of mITTs for developmental purposes like health services in developing countries have long been promoted by ITU [11]. However, at the moment their use (mostly GSM/GPRS, WiFi) in most developing countries is limited to voice communication with little use for data transmission. This is despite the emerging availability of broadband mITTs such as WiMAX and 3G in these regions. Broadband mITTs are frequently required for communication and data transmission within health systems, as they are process and information intensive organizations. In addition, the need to provide access and connectivity to health information systems (HIS) to health workers for effective patient care and health system performance further reinforces this notion.

mITTs Access and Connectivity models for CBHWs in Developing Countries

CBHWs working within the community can be provided Internet access through different type of fixed or mobile access points. These can be used to provide either voice or data transmission in either store and forward or real-time modes.

Proposed models for fixed wireless access include the use of Public or Private Call Offices (PCO) [15], the Gremeen Bank Village Pay Phone (VPP) [16], and the Community Telecenters, DakNet model of Community Information Kiosks [17] connected through broadband mITTs. For example, low-cost, store and forward data access platforms like SMS, MMS, and voice access through voicemails can be provided through GSM-based public or private shared access points. These can be provided through the GSM enabled "Shared Access To Data" concept, a system of providing

internet access to multiple users from a single point. The “Shared Access to Voice” scheme, the deployment of a portable GSM-wireless box-phone complete with solar charging accessories, an attempt to imitate a commercial public phone booth, can be adopted for voice communication [18]. These two “shared access models” could also be employed for use by a team of CBHWs working together within a health post or centre.

The deployment of these concepts through the Gremeen Bank -VPP model or Community Information Centres (CICs) could provide an appropriate connectivity means for CBHWs in rural and urban regions of developing countries. E-mails and web services can then be accessed through shared desktop PCs located in the CIC such as in the Nakaseke MTC model in Uganda [19]. In addition, real-time voice communication for CBHWs can be provided through “Shared Access To Voice” model or through VOIP in CICs.

A mobile-fixed or semi-mobile concept could be equipping CBHWs with mobile devices such as mobile phones, PDAs and wireless smart cards or USB memory sticks. These can be asynchronously connected to wireless access points (WAPs), or with wired or wirelessly connected desktop PCs through infrared, Bluetooth and WiFi either within CAPs as in the UHIN, Uganda concept [20] or as in DakNet model in India [17].

Real-time multimedia and near real-time applications such as videoconferencing and instant messaging (IM) through the web can also be provided through wirelessly connected PCs within CICs for teleconsultation or interactive e-Learning sessions as demonstrated in the iPath project [14]. Public access points through community digital screens, as in the Mindset Health programme [21], can also be employed. The proposed FonePlus concept from Microsoft can also be used. This aims to make mobile phones to provide internet access through televisions that are widely available in most developing countries.

A fully mobile community internet access for a CBHW could be provided with WiFi enabled mobile devices that are in turn connected directly to community WAPs on a real-time basis [22] or ad-hoc basis through mobile access points (MAPs) on bicycles or public buses, as in the DakNet project in India [17]. These mobile devices could then provide data and voice access through packet-access wireless networks. The use of low-cost mobile end user devices such as the One Laptop per Child project (OLPC) and its imitator such as the Intel Classmate, could make this approach economically and technically feasible in developing countries. For example, a team of CBHWs on a community immunization programme could employ the “Shared Access to Data” model with an OLPC device for entering or accessing vaccination information of patients on the field.

These are suggested approaches that could make use of the already existing CAPs in developing countries for supporting CBHWs health working activities. However, a fully mobile wireless connectivity and access that will support the nature of CBHWs activities could be through GPRS and WiFi networks.

Conclusion

The importance of CBHWs to the healthcare delivery in developing countries has been presented.

Providing access and connectivity to CBHWs through mITTs has the potential to contribute to the health human resource capacity building objective of the WHO. Access to organisational knowledge systems such as DSS, CME and EHR through these models could enhance the achievement of better health outcomes for patients and effective health care services delivery. However, the successful adoption and diffusion of the technologies will require issues of organisational, technological, cultural and end-users to be put into a synergistic perspective. Organisational issues such as a change in work pattern of the CBHWs, negotiation of access with CICs, or fees agreement with private providers will have to be sorted out. The reorganization of the health systems to accommodate these changes will also need to be put into perspective. A major extra-organizational issue is how to make mITTs financially accessible at low cost for CBHWs. Technological issues like design of mobile devices for portable and seamless connectivity and access within the community, design and configuration of wireless networks for optimization are also important. Our research work is presently exploring how these issues can be understood through proposed evaluations of mITTs usage by CBHWs within health systems in developing countries.

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Adoption of U.S. Immunization Registries in Ukraine

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Abstract: Ukrainian Health Care system is challenged by the absence of Immunization Registries (IR). Instead of development from scratch, it will be beneficial to adopt U.S. best practices recommendations. Centralized system inherited from Soviet Union eases IR integration. There are issues with reminder-recall notification, but they can be solved. The successful project will help to harmonize Ukrainian Health Care system to world standards and promote Electronic Medical Records and other Public Health Registries projects.

Immunization Registries (IR) play an ultimate role in delivering high quality preventive services for patients. They are valuable computerized systems allowing uniform immunization data collection, used for identifying patient immunization status, vaccination due date and producing reminder-recall notification for patients and their providers [1]. IR are an effective clinical assessment and monitoring tool for providers; they provide public health specialists with data for monitoring services (e.g., assessing immunization rate or monitoring compliance with immunization schedule) and for research and audit [2]. Additionally, communities use IR to monitor immunization coverage.

Positive impact of IR integration into day-to-day activities will boost up immunization rate among adult and children population, and help to identify high-risk population with such conditions as asthma, where vaccinations could interfere with severity of symptoms or conditions [3]. The main purpose of the paper is to focus on Subject Matter Experts (SME) best practice recommendations for IR integration from other countries, in particular, from the U.S. [4]

Ukraine is challenged by the absence of healthcare registries (particularly immunization ones) and Electronic Medical Records (EMR). An extensive paper-based record keeping system inherited from the USSR is ineffective and leads to excessive data collection. Information collected is not structured or coded and does not contain unique patient identifier information.

Ukrainian health care model is primarily oriented on providing medical services with less emphasis on prevention and monitoring. Integration of IR would strengthen monitoring of immunization services, improve quality and comprehensiveness of reporting, as well as become a starting point for electronic patient information.

Adoption of U.S. best practices recommendations for IR, and customization of pre-existing software is a great alternative to local development projects. This is an opportunity for Ukrainian Health care system for designing and developing up-to-date, structured, complete and organized sources of patient information ensuring privacy, confidentiality and security.

Despite the number of differences in Ukrainian and U.S. healthcare systems, most of issues can be resolved, and U.S. IR could assimilate into Ukrainian routine healthcare practice. At several cases Ukraine has even better options for IR integration.

For best practices adoption purposes different entities should be linked and explained. The main health care authority in Ukraine is Ministry of Health. Public health services in Ukraine are represented by Sanitary Epidemiological Service (SES) which has monitoring and controlling functions. SES is present in national, oblast (region), and rayon (borough) levels [5,6]. At the latter level SES officers monitor providers' performance. Polyclinics physicians from rayon health facility should be considered as immunization services providers. SES should be considered as IR host.

In 2005 American Immunization Registry Association (AIRA) in partnership with the CDC/NIP established Modelling of Immunization Registry Operations Workgroup (MIROW) composed of SME. MIROW employs business modelling principles and surveys to improve IR operations. They found that IR are experiencing lack of widespread provider participation: providers perceive participation as dual data entry, which increases of their workload without having any benefits [3].

In the USA participation of providers, patients and their guardians in IR is mostly voluntary [7]. In contrast, centralized Ukrainian system would force most of the parties to participate in Ministry of Health initiatives, which makes it possible to collect complete and accurate data. However, further development of private practices would create some difficulties as patients would prefer to have immunizations privately. This may disrupt vaccination information flow. Mandatory reporting of immunization information to family practitioner (or GP) seems to be a reasonable solution.

Providers' negative perception of IR could be changed by explaining outcome benefits which particularly affect their own activity [4,7]. Before

the project launch training and refreshing sessions should be arranged. Users will either appreciate new software features or at least adjust to them.

Inability to put a new procedure within existing process should be resolved with involvement of Business Process Improvement specialist who will produce detailed description of a new process including some improvement within existing one.

Introduction of patient reminder-recall options will not be that straightforward in Ukraine. Most of Ukrainians do not use voice mail and did not get used to Interactive Voice Response systems; there is no such service as Mail Forwarding; mail service itself is not reliable enough; it is difficult to identify an actual patient's address; and e-mail is not available for the majority of people. On the bright side, providers are responsible for keeping their up-to-date information and providing patients with annual medical examination; in pediatrics practice they are responsible for attending or inviting patients to the clinics several times per year.

Currently SES officers at provider level have administrative and monitoring functions only. However, it would be valuable if they could facilitate collaboration with social services authorities or census bureau in order to acquire list of patients living within a particular geographic jurisdiction related to a provider. Up-to-date list of patients could be used for reminders-recall notifications. Regular notifications should be issued by providers only; overdue notifications should be issued by both, immunization providers and SES officials.

Medical records of a patient in the USA are distributed between providers, insurance companies, etc., which makes it difficult to identify Immunization Home (i.e. primary immunization provider), vaccination date and actual immunization status [7]. Furthermore, U.S. patients have right to switch between providers. MIROW SME had to create additional business rules guideline to be applied for patients moved or lost to follow up [8].

In Ukraine public clinics usually deliver immunization services free-of-charge to individual residing within particular geographic boundaries, i.e. to patients who are registered with local providers. Because of cultural and economic reasons Ukrainians do not relocate as often as Americans. If an individual's records are stored in one place, data duplication and conflicts will not be a problem.

Ukrainian healthcare system is being harmonized to the world standards. This includes decentralization as well as development of insurance companies and private providers. That is why early adoption of advanced U.S. practices will be beneficial for the near future.

USA, Canada, UK and many other countries incorporated their IR years ago. The initial idea was that IR should to be linked to EMR. However,

many providers have problems with transition to EMR [3]. Usually their aggregated data is collected and stored within legacy Patient Administrative System (PAS) only. Most PAS were designed long time ago without considering options and standards for data-sharing, and collaboration with other PAS or IR is a challenge. Therefore, submission of paper based form or an electronic form with manual data entry is still preferred type of submission for IR.

For best practice recommendation integration purposes Ukraine Health Care System should be considered as a paper-based system. During incorporation process much attention should be paid to SME recommendations related to paper-based practices in the USA. A successful IR project in Ukraine may become a baseline for further development and implementation of EMR and other health registries (e.g., cancer or birth defects).

Technical support group (consistent of supportive IT developers, project managers, coordinator, etc.) within participating organization would reduce negative feedback and secure smooth IR integration. Peer-review sessions would promote participation in IR; even provision of some incentives could be considered. Addressing the financial issues of the project, Steering Committee (Ministry of Health in case of Ukraine) should contact international organizations and assess available grant opportunities [9].

Development and maintenance costs would be lower than in the USA, as Ukrainian IT workforces are highly qualified, educated and relatively inexpensive. However, there are hardly any SME available to make the difference. Ukraine as well as other ex-USSR countries is an attractive market for overseas consulting companies, specialized in e-health projects, particularly in IR.

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EHealth Market Segmentation Framework in Developing Countries

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Abstract: e-Health is an e-Service bringing better access to medical information and expertise to medical staff and patients for the improvement of diagnosis and treatments among patients. In order to attract the private sector to the implementation of eHealth services in developing countries; it is important to provide a market study. The market segmentation theory is a tool to divide the market for the purpose of understanding who your potential customers are. According to the classical approach, market segmentation can be characterized as follows:

- Demographic (age, gender, geographic, income, education)
- Psychographic (attitudes, life-style)
- Behavioral (usage patterns, use, loyalty)

One common criterion for developing market segmentation is grouping potential customers based on needs. The qualitative study showed that the needs for e-Health center on diagnosis, treatments, and education. Medical personnel are seeking to improve the accuracy of diagnosis and treatments, as well as the quantity and quality of education.

e-Health segmentation in developing countries should have specific-developing country segmentation. In this paper, the framework for segmentation is presented. The first level segmentation based on differences among developed and developing countries is public (state-owned) vs. Private sector segmentation. In order to develop marketing strategies, the needs and behavior of medical professionals in these two very different sectors must be understood. The qualitative study indicated the needs of medical professionals are based on a needs-based segmentation for having better diagnosis, better treatments, and education. Within the segmentation of private and public sector, sub-groupings by rural and urban geographic segmentation is necessary, as there is a vast difference in these two geographic regions in developing countries. The second market segmentation step after the urban vs. rural groupings should be type of environment, such as hospital or community. Rural regions in developing countries will be more

community-oriented. A psychographic segmentation based on attitudes to e-Health could also be explored. There are other segmentation variables for some specific e-Health applications such as HIV/AIDS, TB, Malaria, cardiology, skin diseases, etc.

The standard market segmentation variables that are widely used in marketing strategies in developed countries will need to be adapted to developing countries.

Keywords: eHealth in developing countries, eHealth market

Introduction

eHealth is an e-Service bringing better access to medical information and expertise to medical staff and patients for the improvement of diagnosis and treatments among patients. eHealth is an Information and communication Technology (ICT) application in the domain of eServices.

There is a big shortage of medical staff in developing countries and eHealth could be a solution to this growing problem and has been on the agenda of important International Organizations, such as the International Telecommunications Union (ITU) and the World Health Organization (WHO). These organizations have made e-Health an essential agenda item with national organizations from developing countries given incentives to develop an e-Health strategic plan in their respective countries. Coming to the implementation phase, there is a forecast that some of eHealth services could be introduced by private sector [1]. Therefore there is a need for a professional approach to marketing of eHealth services [2].

Marketing strategy

In the development of marketing strategy it is important to understand who your potential customers are. This tool is called the market segmentation. It divides the market into groups based on needs and priorities. According to the classical approach [3], market segmentation can be characterized as follows:

- Demographic (age, gender, geographic, income, education)
- Psychographic (attitudes, life-style)
- Behavioral (usage patterns, use, loyalty)

One common criterion for developing market segmentation is grouping potential customers based on needs. A needs-based segmentation clusters potential buyers based on having similar needs. Market segmentations should first start with needs. Needs-based clusters form the highest level of segmentation. Once the needs-based clusters are formed, these clusters can

be further segmented using demographic, psychographic, and behavioral groupings. Empirical studies that I have been involved in indicate that demographic segmentation is too general and does not tell you enough about the customer. However, in developing countries due to the vast differences between rural and urban environments, a demographic segmentation will be important.

The qualitative study made in several developing countries [4] showed that the needs for e-Health center on diagnosis, treatments, and education. Medical personnel are seeking to improve the accuracy of diagnosis and treatments, as well as the quantity and quality of education. Using the above qualitative study in developing countries, a preliminary market segmentation strategy for developing countries can be made.

The first step for eHealth market segmentation in developing countries will divide public and private sector medical staff. The characteristics of the public sector for eHealth are centered on the Health authority. The public sector is driven by the eHealth master plan for specific implementation features within state-owned hospitals and medical institutions. Many doctors who work in the state-owned hospitals also have their own private office or clinic. Most doctors practice in the public sector due to Health Authority policies and to stay close to this important body.

In comparison to the public sector, the private sector in developing countries is based on a single office setting where family doctors are in need of IT support tools and software applications. The motivation for doctors to work in the private sector is financial and driven by technology such as the Internet. The research further states further segmentation in developing countries based on the urban vs. rural environmental characteristics, as there is a vast difference in these two geographic regions in developing countries. The literature supports this special grouping [5], where the design of e-Health readiness in rural areas was researched. Similarities and differences were found among urban and rural in Canada and therefore, this study along with my qualitative study provides the basis for this segmentation. As readiness models were different in Canada among urban and rural areas, and then this can be applied to developing countries as well as supporting evidence to this market segmentation theory.

The second market segmentation step after the urban vs. rural groupings could be type of environment, such as hospital or community. Rural regions in developing countries will be more community-oriented.

A second strong contender to a needs-based segmentation is behavioral market segmentation in developing countries. In developing countries, we can look at community vs. hospitals' use of e-Health. Specific e-Health applications such as cardiology, skin diseases, Malaria, and HIV/AIDS

segmentation is an example of behavioral segmentation. These areas of diseases and the types of diseases are very different from developed countries and thus, warrant a different market segmentation strategy.

The next research for market segmentation in developing countries will identify if a relationship exists such as: e-Health to age, gender, and education. The question is how strong are these factors for warranting separate market segmentation in developing countries?

A psychographic segmentation based on attitudes to e-Health could also be explored. This was preliminarily investigated in the qualitative research study published in [4], where an overwhelmingly number of respondents were favorable about eHealth. The respondents cited the importance of medical experts in the acceptance of e-Health services in their hospitals and/or clinics. Currently, when the medical staff that was surveyed encounters a difficult patient situation and needs further medical advice and possible solutions, they tend to turn to other medical experts in their environment for further discussion. This is consistent with Everett Roger's theory of innovation adoption where opinion leaders (medical experts) are key to innovation adoption. The next sources of additional advice are through traditional medical books and if access exists, the Internet and on-line medical journals and databases.

Conclusion

In developing countries, the role of the private sector is becoming increasingly important as the private sector and only the private sector will have the financial means to develop eHealth products and services. This paper gives providers of e-Health solutions (products and services) guidelines as to the factors that influence customer needs in developing countries and some different characteristics for developing specific market segmentation strategies.

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Pakistan – How to Speed up the Introduction of EHealth Services in Developing Countries

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Abstract: Pakistan has a population of about 160 million and it is one of the most densely populated countries in the world. The ration of the number of doctors to population is 1: 1555, and for the case of specialists, it gets even worse, 1: 12,800. This makes it difficult to get quick and easy access to medical services.

One of the practical solutions to this problem is the introduction of eHealth/telemedicine which could help to improve access to medical services and better use available resources. In order to understand the position of the local medical community with regard to eHealth services, the study was done in Rawalpindi by collecting answers of medical staff to the questionnaire. It was received 111 answers. The majority (86%) supported the idea of eHealth but they mentioned that there is no so far any policy in their hospitals on the introduction of eHealth services in medical practice. There is not enough information about practical aspects of eHealth and in particular in developing countries. eHealth is still stay outside of training program in medical universities. The key position of the medical nurse in the introduction of information technology into medical practice is not recognized yet. The administration of medical organizations is not well informed about potential benefit of eHealth technology. Several recommendations have been proposed on how to speed up the use of eHealth services.

Keywords: eHealth in developing countries, eHealth/telemedicine policy.

Introduction

The Islamic Republic of Pakistan was formed in 1947 by the partitioning of British India into India and Pakistan. Pakistan is the 6th most populous country in the world with a population of 150 million. 65% of the population is living in rural areas. The ration of the number of doctors to population is 1: 1555, and for the case of specialists, it gets even worse, 1: 12,800. This makes it difficult to get quick and easy access to medical

services. The medical services in many places are far from sufficient. Pakistan is strategically located in the heart of Asia. It holds a significant place among the community of nations and is an important member of several regional organizations. Pakistan is a developing country with large amounts of natural and human resources. The Government of Pakistan is considering the improvement of health services for all citizens as one of the highest priority area.

Health Sector Policy

All citizens in Pakistan will have access to affordable health care. Emphasis will be given to prevent health of women, children and other vulnerable groups in the society. Priority will be given to health promotion through information, education and communication for a healthy life style for all.

The Ministry of Health has announced the following goals:

- Provision of quality health services that are accessible and affordable to all citizens.
- Enhanced quality of life of all citizens by preventing and promoting health and curing diseases.
- Management of the health system is streamlined in order to deliver services effectively.
- Development of a sustainable health system by mobilizing resources, developing human resources and utilizing them effectively.

The Government considers that the enjoyment of the highest attainable level of health is a basic right of every citizen. Many improvements in the health status have to be achieved through disease prevention and health promotion.

Role of eHealth

Health authorities in many countries have come to recognize that computerized information system, when established at appropriate levels, can assist in meeting the challenge of improving health care delivery and organizational efficiency. The term eHealth refers to the practice of medicine over a distance. The diagnostic and treatment decisions and recommendations are based on medical information transmitted through telecommunication systems. The introduction of eHealth/telemedicine will help to improve access to medical services and better use available resources. eHealth solutions and services require multidisciplinary collaboration, with the active participation of telecommunication operators and health care professionals.

The platform for any eHealth services is telecommunication infrastructure in the country. Therefore the International Telecommunication Union, being one of the main supporters of eHealth services worldwide, recommended during the World Telecommunication Development Conference in the year 2002 in Istanbul; that ITU Member States consider establishing a national committees/task forces comprising representatives from telecommunication, health sector and other interested parties. The Telemedicine Association of Pakistan which was set up in March 2005, can play the very important role in the implementation of eHealth services and provide an umbrella for all telemedicine activities in the country.

eHealth projects in developing countries offer an opportunity for people living in underserved and rural areas to obtain improved health care services. Various private and government organizations have already participated in implementation of telemedicine in Pakistan [1, 2]. Nevertheless the spread and acceptance of eHealth services are still moving very slow. For this reason it was decided to organize eHealth survey and check the opinion of medical staff.

eHealth Survey

The study was done in Rawalpindi and Islamabad. Therefore the opinion was checked among doctors working in urban area and in particular in big cities. The questionnaire was prepared which consists of many questions. Due to the limited size of this paper, only some important results are presented. It was used interview method. It was received 111 answers. The majority (86%) supported the idea of eHealth but they mentioned that there is no so far any policy in their hospitals on the introduction of eHealth services in medical practice. Who participated in this study? The information is presented in Table 1 and 2. The majority of respondents were doctors, six of them have PhD degree. It was good representative sample of medical staff.

Table 1

	Frequency	Percent	Cumulative Percent
doctor	76	68.5	68.5
radiologist	5	4.5	73.0
head of clinic	3	2.7	75.7
medical teacher	1	.9	76.6

	medical student	19	17.1	93.7
	nurse	6	5.4	99.1
	Technical staff	1	.9	100.0
	Total	111	100.0	

Table 2

	Frequency	Percent	Cumulative Percent	
	some college or associate degree	23	20.7	20.7
	bachelor's degree	74	66.7	87.4
	masters degree	3	2.7	90.1
	doctorate degree	6	5.4	95.5
	other	5	4.5	100.0
	Total	111	100.0	

At the beginning of the survey two questions were asked:

- Have you heard of eHealth prior to this survey? The positive answer was 61%.
- Where have you heard about eHealth? The results are presented in Table 3. The medical training and continuous medical education (CME) play so far a small role, only 26.12% together.

According to Table 3, 72% of medical staff has heard about eHealth. The comparison with the first question and the difference in 11% is due to the fact, that these people have heard about eHealth but they did not understand it well. In conclusion the level of awareness about eHealth is very low in spite of several telemedicine activities implemented already in Pakistan.

Table 3

	Frequency	Percent	Cumulative Percent
during medical training	26	23.42	23.42
CME	3	2.70	26.12
medical journals	10	9	35.12
newspapers	6	5.4	40.52
TV	8	7.2	47.72
Conferences/seminars	7	6.31	54.03
colleagues	16	14.42	68.45
from this survey	22	19.82	88.27
others	3	2.7	90.97
internet	1	.9	91.87
no response	9	8.13	100
Total	111	100	

The next question was the following: According to your opinion, what would be necessary to do in order to introduce eHealth services in medical practice? 68% of participants recommended strongly informing medical staff and in particular health administrations at different level about potential benefit of eHealth services and provide more information about successful experience in this field. The key position of the medical nurse in the introduction of information technology into medical practice is not recognized yet. The lack of information is one of the main obstacles today. Based on successful stories and experience it is necessary to develop guidelines on how to use eHealth facilities. Because eHealth is so broad definition; it is important to have guidelines accompanied by good training for each application.

Conclusion

The local eHealth policy must be in agreement with any overall informatics policies in force in a country as well as with its overall health sector policy. It is important to develop “eHealth Master Plan of Pakistan”. This is a national eHealth policy document which will guide and coordinate

all eHealth projects and activities helping to eliminate interoperability problems between different telemedicine systems.

Based on the eHealth Master Plan approved by the Government, it is important to provide the strategic planning for the implementation of eHealth services and solutions at the level of each hospital and any other medical institutions. These documents will guide the health administration to organize the implementation of eHealth in well coordinated manner.

Gaps in legislation and the uncertainty of rules applying eHealth services pose a legal risk for both the doctors and their patients. The code of conduct for the practice of eHealth have to be urgently developed.

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Tele-Psychology: Users' Demands

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Abstract: The presentation focuses on results of a survey assessing users' attitudes toward Tele-psychology service as part of ongoing project OHN 1514/2005, funded by National Science Fund, Bulgaria. Project's strategic goal is to develop and offer a virtual high quality psychological service to people from remote areas that have no contact with licensed psychologists. The project enables experts to communicate directly with clients and perform remote consultations, supervision, etc. The objective of this presentation is to report changes and trends in clients' attitudes towards innovative distance psychology care. The first part of the survey was performed in spring 2006, while the second – in 2008. Age and gender differences as well as changes in preferences toward various communication channels will be discussed.

Keywords: Tele-psychology, remote consultations, users' demands

Introduction

Tele-psychology is the provision of psychological services in a technology-assisted environment, including telephone, internet media (written, voice and digital pictures) and video conferencing [1]. No doubt this is the future of psychology due to 2 main reasons. 1. The obvious trend of increasing of psychological disorders in the years to come and the heavy burden that these kind of disorders place on individuals, families and communities all over the world. No country is immune to them, although some disorders may differ in frequency. 2. While many people suffer from a variety of psychological disorders, care is not available to all who need it. A simple example is depression. According to WHO [2] only in the European Region, 33.4 million people per year have been estimated to suffer from severe depression. These are 58 out of 1000 adults! Of all the disability-adjusted life-years lost, depressive disorders account for the largest share. Care providers recognize the problem in less than 50% of all depressed patients seeking medical care. Only about 18% of such patients get correct

and specific treatment. And this is in Europe, where the situation with human resources is much better than in other regions of the world. Europe is a leader with 3.0 psychologists and 2.4 social workers per 100 000 population.

That's why (In this respect/According to that) Tele-psychology is an excellent tool. It is applying modern communication infrastructure to offer psychological help and consultations to those who need it, no matter where they are and at what time of the day or night this happens.

The survey

This paper presents in brief the first steps in development of Tele-psychology as a part of an ongoing project OHN 1514/2005 funded by National Science Fund, Bulgaria. Project's strategic goal is to develop a virtual high quality psychological service for people from rural areas that had no contact with licensed psychologist. In the period 2005-2009 the project has to test and evaluate pros, cons and overall effectiveness of Tele-psychology services and thus to provide a platform for its wide introduction.

As part of the project a study assessing the users' requirements was performed. The objective was to follow the changes of attitudes toward Tele-psychology and adapt our understanding and offerings according to users' demands.

A total of 450 users took part in the study. The first survey was performed in 2006 and 2 years later, a second survey was done.

As a first step, we were trying to find out whether potential users are ready to use Internet as a media to receive psychological help and/or advice or prefer face-to-face contact with the expert. The

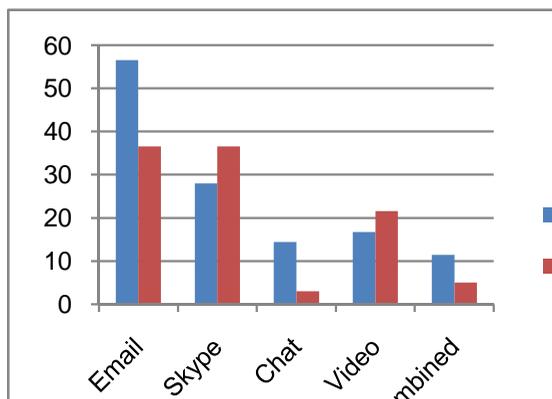


Fig. 1 Preference of communication channels

results were more than promising – almost 76% of participants are ready to use Tele-psychology for receiving psychological help or support.

The second important question was about the preferred communication channel with licensed

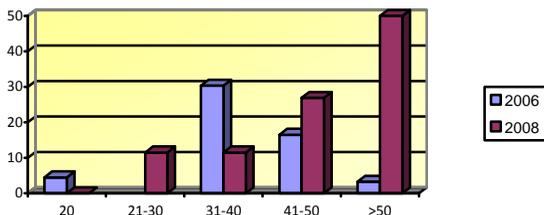


Fig. 2 Change in women's attitude

psychologist. Despite of our expectations, with time the preference of e-mails as main communication source has dropped within 2 years with 20,2% (fig. 1). At the same time, both Skype program and video programs gained strength. The preference of Skype had increased with 8,6%, while the amount of video supporters – with 5%. An explanation of the revealed difference in the preferable communication channel is: Skype, as user-friendly, free of charge or a very cheap program became more and more popular. In addition, it combines possibilities to use written and /or voice messages and video plus the benefit of providing storage of written communication for further analyzes. That's why users feel reluctant to use it. This result also reveals that if professionals would like new communication technologies to be accepted as unavoidable part of healthcare services, more attention has to be dedicated on the advertisement and making ICT technologies user friendly and acceptable in citizens'

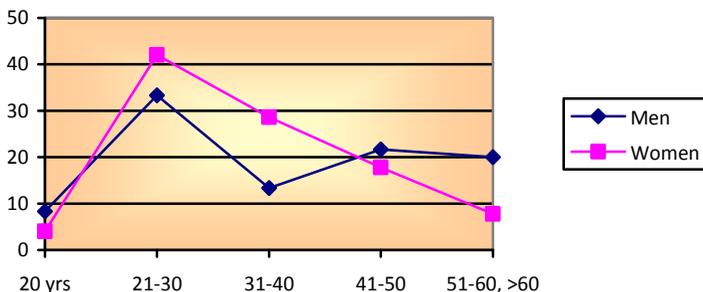


Fig. 3 Sex and age differences in acceptance of tele-psychology

everyday life. This may ensure the gradual acceptance of tele-health services.

Another interesting result is connected with gender differences in attitudes towards Tele-psychology. Comparing the samples of women 2006 vs 2008 a clear tendency for increasing the acceptance of Tele-psychology service is revealed (fig. 2). More and more women, especially after the age of 40 years are ready to turn over to Tele-psychology help. All of them are working women, with secondary or high education, engaged in the offices 5 days a week. Tele-support for them is a gift “from heavens”. Unfortunately, the answers of men were not well distributed over various age groups to perform similar analyses.

One more interesting result was found – in general, there is a different age pattern between men and women when Tele-psychology is concerned (fig. 3). Till late 20’s both sexes need and look for psychological help, while after that age the interest and needs of women gradually decline. The decline is very sharp in men in the 4th decade of life. Around the age of 50 men again start looking for psychological support, which may be explained with the crises of the middle age.

The presented results do not answer all possible questions. The survey is still going on to accumulate more data. Based on the above mentioned results the project will not change dramatically its preliminary concept. We’ll continue to offer e-mail Tele-psychology support, relying mainly on text messages. Visual contact will be used only in case of necessity and after preliminary agreement between users and psychologist.

Acknowledgements

The survey and the project are realized with the financial support of National Science Fund, Bulgaria, project OHN 1514/2005.

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The Role of Education for the Introduction of EHealth Services in Developing Countries

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Abstract: Today there is no doubt that eHealth services are useful to all countries and in particular developing countries. They are important for many medical specialties and with the help of modern information and communication technology the people in developing countries will have better access to medical services and it will be also improvement in the quality of services as well.

Recently the WHO requested the opinion about eHealth from the Ministry of Health of all Member States and published the report of the WHO Global Observatory for eHealth under the title “Building Foundations for eHealth”. Nearly 60% of the 192 WHO Member States provided the information to this survey. The overall opinion about eHealth was positive. On the other side the implementation of eHealth services in developing countries is still very slow. There are many reasons behind that. However we would like to study y one important aspect – the awareness of medical staff in developing countries about eHealth. Three countries were selected for this study, namely Uganda, Pakistan and Bhutan. The selection was done on the basis of the readiness of the local staff to participate in this study. The questionnaire has been developed and distributed. Taking into account that some of medical staff will be not aware about eHealth, a short introduction this new technology was included in the beginning of the questionnaire. In order to collect information, the interview method was used. Overall, the survey found that there is a positive attitude toward eHealth and those respondents would like to know more about eHealth in terms of solutions (products and services available), successful case studies in other countries, and more education both in medical universities/schools and post-education. The respondents strongly highlighted that education will play the crucial role in the adoption and wide implementation of eHealth services. The main obstacle today is not due to a lack of funds. eHealth services could be implemented gradually in line with available resources. The problem is

that the decision makers in a health sector are not well informed about the benefits of the application of modern information technology into medical practice.

Keywords: eHealth in developing countries, telemedicine

Introduction

Today there is no doubt that eHealth services are useful to all countries and in particular developing countries. They are important for many medical specialties and with the help of modern information and communication technology the people in developing countries will have better access to medical services and it will be also improvement in the quality of services as well.

Recently the WHO collected the opinion about eHealth from the Ministry of Health of all Member States and published the report of the WHO Global Observatory for eHealth under the title “Building Foundations for eHealth” [1]. Nearly 60% of the 192 WHO Member States provided the information to this survey. Overall opinion about eHealth is positive. On the other side the implementation of eHealth services in developing countries is still very slow. There are some reasons behind that. But we would like to study only one aspect – the awareness of medical staff in developing countries about eHealth.

Opinion of developing countries

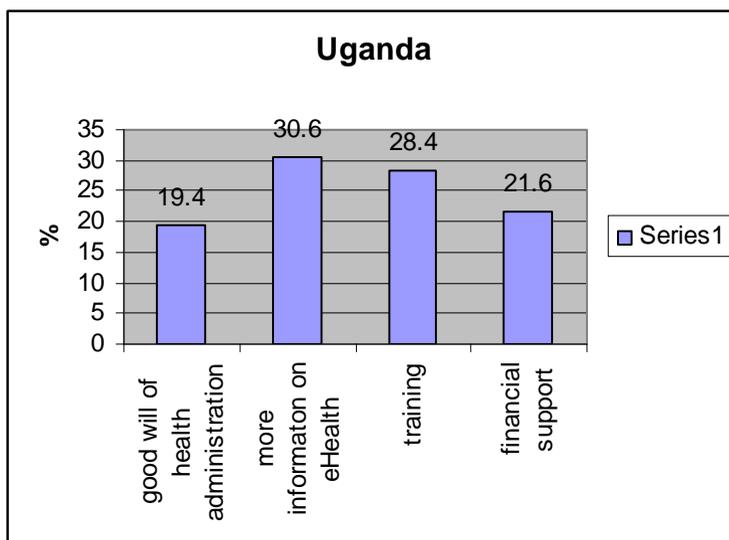
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In the questionnaire there were the following questions:

1. Have you heard of eHealth prior to this survey?
2. Where have you heard about eHealth?
3. What is your own opinion about eHealth services for developing countries?
4. What would be necessary to do in order to introduce eHealth services in medical practice in developing countries?

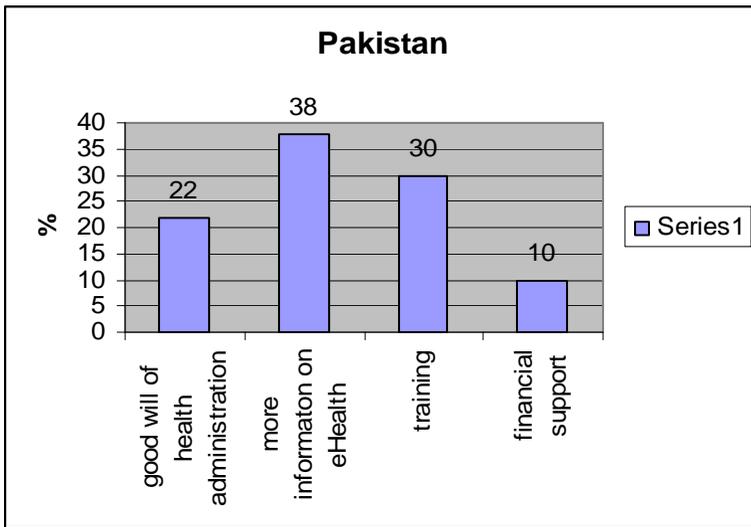
Uganda. The chairperson of Telemedicine Association in Uganda, Dr. Catherine Omaswa has managed the distribution of the questionnaire and the organization of interviews. The questionnaire was distributed among the

medical staff in the main hospitals in Kampala. 58 persons were interviewed. There were 37 doctors, 13 nurses and 8 from the health administration. The first question has been answered by 73% positively. This is because one of the first telemedicine pilot projects of the International Telecommunication Union was implemented in Uganda in the year 2000. The two big state hospitals in Kampala were connected together by a telemedicine link for transmission of X-ray images and medical consultation. This project gave a chance to the medical staff in Uganda to understand better the potential benefit of information technology in health care. Therefore 56 from 58 respondents (96.6%) were in favor of eHealth services for developing countries. There is no one who was against eHealth. Two persons did not provide any answer. The answer on the fourth question is presented below.

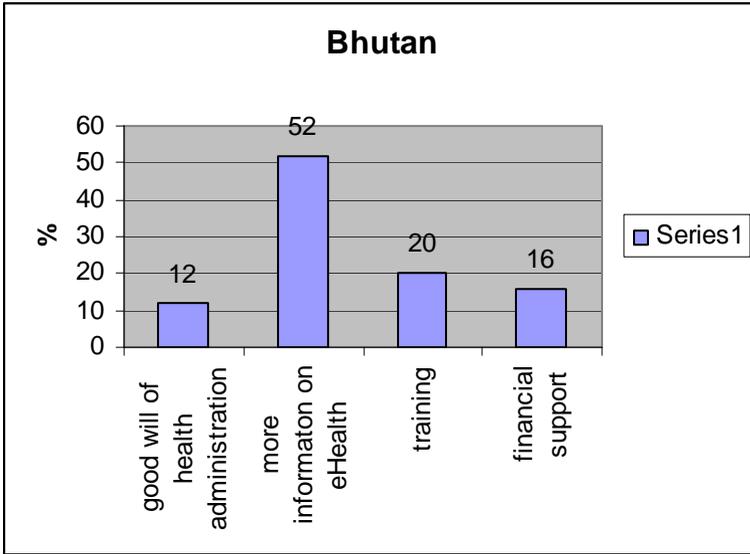


Pakistan. The survey in Pakistan was implemented under the supervision of Professor Asif Zafar Malik, the chairman of the Telemedicine Association. The questionnaire was distributed among medical staff in two main cities in Pakistan – Rawalpindi and Islamabad. It means that so far the opinion was not gathered from medical staff working in rural areas. There were received 111 answers. In this case, 61% of the respondents have mentioned that they knew eHealth. The results for the third question are the following: 86.5% supported the introduction of eHealth services, 6.3% were against and 7.2% did not provide the answer. Below there is the answer to

the last question – What would be necessary to do in order to introduce eHealth services in medical practice in developing countries?



Bhutan is a small country. The total population is only 0.8 million and about 80% of the people live in sparsely populated rural villages. The number of doctors is only 122 and doctor/population ratio is about 1 to 6667, which by any standard is very low. The primary health care system is operated by nationally trained paramedics. The Ministry of Health is aware about usefulness of eHealth and considers it as an effective strategy to meet the health care needs of population living in rural and remote areas, and improve the quality and sustainability of services. The country has already benefited from several small pilot telemedicine projects implemented with support from international organizations such as the International Telecommunication Union and the World Health Organization. The interview with the medical staff in Bhutan was done by Ms Lungten, ICT Officer in the Ministry of Health. She asked opinion about eHealth from 16 members of medical staff including doctors and paramedics. They were from the hospital in Thimphu and five regional hospitals from Lhuntse, Trashigang, Trongsa, Bumthang and Gelephu. The positive answer to the first question was received only from 31% of respondents. It means that only 31% of the medical staff knows what is eHealth. Then after the short briefing about eHealth, 87.5% of medical staff was agreed that it is useful for Bhutan. The answer on the fourth question is presented below.



Conclusion

The results achieved indicate clearly that developing countries need more information on eHealth services. They understand that the introduction of eHealth services is important for developing countries but they need to learn more about it in order to speed up the implementation. The respondents strongly highlighted that education will play the crucial role in the adoption and wide implementation of eHealth services. The main obstacle today is not a lack of funds. eHealth services could be implemented gradually in line with available resources. The problem is that the decision makers in a health sector are also not very well informed about the benefits of the application of modern information technology into medical practice.

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Unified Public Health Informational Space of the Republic of Uzbekistan

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Abstract: The paper outlines current stage of e-health development process in the Republic of Uzbekistan

The main purpose of the introduction of modern information systems in public health sector is "the preservation of human health" by improving the efficiency and manageability of treatment and diagnostic process, the rational use of resources, and improvement of the quality of medical care.

Therefore the aim of the recent reformation of public health information system is the creation of the National Integrated Information Health System (NIIHS).

NIIHS refers to the information system, allowing the formation of the structured set of information resources covering the whole area of Public Health, created with regards to the interoperability and compatibility issues over various IT and telecommunication means designed to collect, store, search, manage and use information.

Unfortunately, nowadays the introduction of ICT is confined by the disjoint frameworks of various individual projects. However the establishment of an effective health care system is not possible without the unified information space. One of the major limiting factors of this process is the lack of common standards for electronic interaction.

"Scrappy informatization" of the Public Health sector must be overcome through the adjustment of various information systems of the departments of the Ministry and ensuring coordination among them in the field of information resources cooperation. In this case, we should carefully consider the experience of developed countries of the world at the early stages of automation, and give the primary role to the centralized approach, avoiding spontaneity.

The unified platform will reduce the time required for data entry, simplify information access, and establish reporting transparency among medical institutions. Currently, data fragmentation and the lack of synchronization between the different subsystems led to the necessity for search for new

solutions, which should be based on individual subsystems integrated among themselves. Most of the efforts are given to the task of establishment of electronic systems interaction standards, based on the idea of two-way exchange of information: each system should be able to accept data from other systems and transmit data to other systems.

ICT Experts of the Ministry of Health of the Republic of Uzbekistan have stated that the main task is to create a unified information space:

- Development of the unified management information system of the Ministry of Health and its departments, agencies and centers, for controlled collection, storage, processing, sharing, transmission and use of information;
- Providing information support to the operational activities and decision-making process based on complete and accurate data of the Ministry, its department and public organizations;
- Analysis and synthesis of national and global experience of information systems development for public service, the development of principles of the integration of the proposed unified information system into the international system of information exchange of public authorities;
- Development and implementation of a set of institutional, regulatory, legislative and technical measures for the creation, maintenance, operation, support and development of a unified information system, in full accordance with the functions and tasks of the Ministry of Health;
- Development and implementation of a set of standards and means for coordination of the units of the unified information system with information systems of related authorities to ensure interdepartmental cooperation, in accordance with established regulations and procedures;
- Development of regulatory, legal and methodical support for the establishment, operation and implementation of a unified information management system of the Ministry of Health;
- Establishment of the necessary infrastructure to ensure proper functioning of a unified information system of the Ministry of Health, as well as interagency and international cooperation systems.

As a result, currently the Ministry of Health of the Republic of Uzbekistan sets construction of the Unified Integrated Health Information System as the number 1 priority, as well as mechanisms and instruments to accompany and support the proposed information system - this is the key issue for the establishment of the Unified information system of the Ministry.

To address the issue in 2005 the concept document "National Integrated Information Healthcare System" was developed (the paper can be found at

http://www.med.uz/eng/doc/National_IHSIS_of_Uzbekistan_Concept_EN.pdf), which has received positive feedback from international experts.

NIIHS must be a system aimed at the implementation of the fundamental objectives, namely public health protection services provided on the basis of NIIHS, should be safe, timely, effective, rational, patient-oriented and ensure equality. NIIHS is a modern and transparent health care system aimed at improving the quality of services to the entire population of Uzbekistan by positioning the patient at the centre of the entire health care system (patient-oriented).

NIIHS should take advantage of the coherent and thoughtful approach, which consists of a set of specific steps. Each step is a special service aimed at addressing critical issues of health care. Moreover, NIIHS services operate on a single general principle, under which certain parts can and should be reused within the following steps under development strategy that will lead to long use, reducing costs and improved quality of health care.

Because of the low level of ICT infrastructure (telecommunications, computer networks), the proposed NIIHS should correspond to the current situation and to provide a mechanism to overcome this problem. Solution architecture must provide services to patients at the most remote areas, while being ready for connections to the central system through authorized access. Therefore, remote health centers must be able to (full functionality) work independently, irrespective of central communication system integration. This can be achieved through the "thin client" technology with a complete set of features (management and local data storage, the use of security mechanisms, etc.). After fulfilling a preliminary requirement for the connectivity, all data and information collected during the work offline, will be accepted and can be reused across a single, integrated system, regardless of the access point. External applications must be able to regularly connect to the central system through optimal use of existing resources, infrastructure (i.e. using wireless networks, mobile networks, etc.). As for the most remote areas, the infrastructure resources can be used from time to time to receive data from other systems connected to the Integrated Health Platform (IHP) for sending data to the central repository or to access specific features of the system (e.g. telemedicine, medical portal, digital libraries etc.).

The National Integrated Information Healthcare System (NIIHS) can be divided into 2 main parts, supporting each other. The first part consists of the Integrated Healthcare Platform (IHP), which is a common communications infrastructure. The second one represents external medical applications, as well as other systems that provide an interface to all authorized participants of Public Health sector (see Fig. 1).

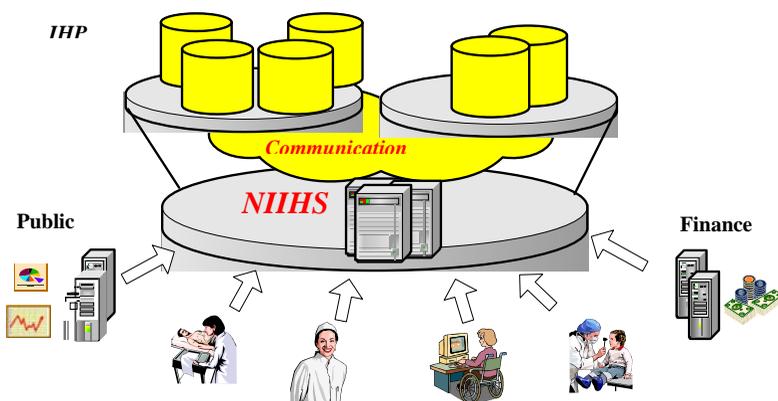


Fig. 1.

Integrated Healthcare Platform (IHP) should form the basement of the proposed system. It must be built on the components that are mutually connecting all subsystems forming unified common infrastructure. This approach allows easy adding new applications and disabling unnecessary ones.

All databases and applications forming NIIHS are independent products sharing certain principles. The integration of all these components into a single integrated system provides a strong tool for the open data exchange, information management and the optimum health care. The openness of the system and its conformity to standards also allows for the connection of any other database or storage system required for the proper health system workflow. Moreover, the central administration system reduces the administrative costs of managing public health sector. Using a common infrastructure, as described above, various medical institutions and related agencies can connect to the Integrated Healthcare Platform, and thereby to become a part of NIIHS.

In order to implement the system Innovation Project for the development and implementation of the Health Management Information System (HMIS) was established, and problem task group was formed.

Nowadays the model of the NIIHS is tested through a pilot project in one of the regions of the Republic of Uzbekistan.

The basement for the system is the registry of all Medical Institutions of the republic. Each body is classified by various parameters e.g. territory, supervision, service type etc. according to current legislative documentation. The other parts of the system namely human resources,

financial flows, equipment, beds and others are linked to the medical bodies.

One of the main priorities of the system became the creation of an electronic human resource management system in order to form a coherent picture of the development of human capacity in the healthcare sector, in order to improve the quality of HR planning and control within the Ministry of Health of the Republic of Uzbekistan.

The main purpose of the pilot project is to create an information system for managing personnel potential and to form comprehensive registry (database) of Human Resources for the Ministry, which involves all employees including doctors, nurses, non-medical personnel (accountants, drivers etc) as well as students of medical universities. In the final run that will allow better identification of the trends within the industry and support forecasting, planning, selection, placement and efficient use of resources.

The main objective of the pilot project is to create a coherent picture of the development of human capacity, and medical education and identification of key issues for planning the next stages of the reform.

To realize these goals in 2006, a study was conducted to identify existing information flow of personnel data. The study revealed that the data flows were unidirectional and aggregated at each stage that resulted in distortion, duplication and loss of the information (see Fig. 2).

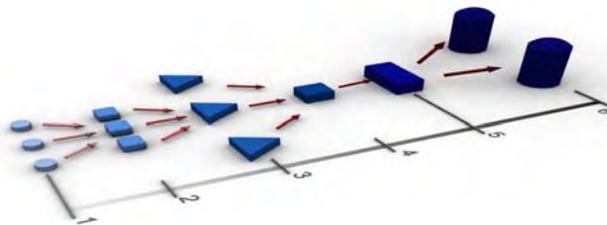


Fig. 2.

The arrows on the figure indicate the current flow of information. The scale and color show the quality of the data transmitted. Obviously, medical bodies themselves provide information of the highest quality – the data are collected and stored in its original format. The data collected are transferred to the superior bodies, so the quality of the data is preserved, as indicated by light arrows. At the second level (district level) the data obtained can be modified for various reasons (typing errors, wrong mathematical aggregation, data loss or deliberate alteration of data), resulting in distortion of the real picture. At the third level (region level) the data are aggregated

once again leaving the risk of distortion and falsification. Data from the regions are transferred to the Institute of Health (body responsible for statistics preparation for the whole Ministry) for state-wide aggregation and processing. The results are accepted as the national statistics. Next, the information is transmitted to the Ministry of Health, which in turn reports to the parent bodies.

As can be seen, the flow of data is designed such as that at the fifth level the Ministry of Health is the only consumer, and not the owner of the original data. The data are of poor quality that makes nearly impossible further information processing and proper decision-making. Additionally, there is no 100% guarantee on the validity of those reports and data, which is indicated by dark arrows: data at each stage lose its quality and usefulness. Moreover, current system has no feedback mechanism.

To solve the above mentioned problems, it was decided to establish "Human Resource Management Information System", which will be a combination of streamlined organizational information resources, information systems and communications, which allows collection, storage, search, handling and use of information.

Anticipated solution to the problem is to redirect main data flows as shown in the following chart (see Fig. 3).

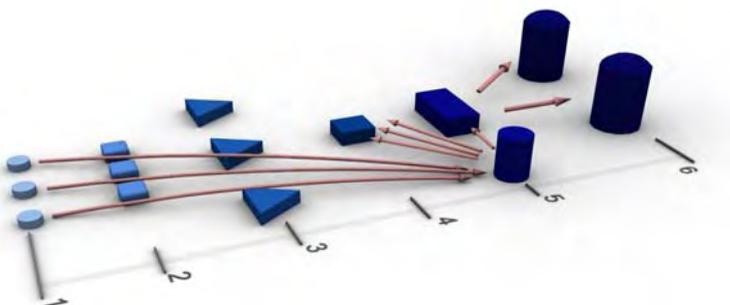


Fig. 3.

As can be easily seen, the entire flow of information has radically changed. Now, all primary bodies collect and transmit data in the Central HR Database of the Ministry of Health, which is supposed to become an all-embracing data store. Thus, the raw data are input into the system in its original form, which gives a guarantee of the validity of the information received by end users. All other levels (medical bodies, local authorities, Institute of Health and the Ministry of Health) will access the data through the unified interface and according to strict access rules, which will

determine the level of access. If required the system will compose reports required while preserving complete veracity of the quality of the information received. Also, the proposed system eliminates time restrictions, since all the information is always up to date (compared to about one year period that is currently required to collect and process the data from all the regions of the country).

Therefore the proposed solution provides the following features and benefits:

- Direct transfer of the primary data to the database eliminates the possibility of modifying the original data (accidental or intentional);
- Instant access in real-time to any aspect of the information;
- Unified data store eliminates data duplication;
- Reduction/Elimination of paper as a media results in significant economic benefit;
- Only primary medical bodies are eligible to input data, while others can only read it via different reports;
- Management at each level can get the real-time picture of their region/department and take appropriate action;
- Time-effective search for any information (compared to paper-based system);
- Universal access from everywhere via the Internet/Intranet (assuming sufficient privileges);
- Complete removal of intermediaries for data collection and aggregation
- High level of security;
- Proper permission schema provide access only to relevant data;
- The system is scalable and can be integrated with other health management information systems.

Target Users:

- The Ministry of Health (human resources management and planning, dealing with personnel policies and management/rationalization of financial resources within the sector);
- Republican Center for licensing and certification of doctors and pharmacists (qualification categories awarding);
- Tashkent Institute of Postgraduate Medical Education (training, continues education and specialization);
- Local public health authorities (human resources management and planning)
- Institute of Health;
- Medical Universities;
- Related Ministries and Departments (Ministry of Finance, the State Committee on Statistics, etc.).

Advantages:

- The system does not require special hardware, software or expertise from the user. Ordinary personal computer, access to the Internet or Intranet and basic computer skills are sufficient for effective use;
- The solution saves time and costs of all persons involved into HR management
- The main costs comes at the time of initial database load in the primary data collection, subsequent maintenance cost are minimal;
- Subsequent (after initial load) costs and time spending are reduced to a minimum.

Expected results:

- Keeping all related data (including archiving) in one place;
- Rich querying possibility;
- Analytical reporting;
- Various statistics;
- Forecasting tool;
- Proper human resources distribution over the country.

And in particular:

- Improved error detection and accuracy of recording and timely submission of data;
- Improvement of public accountability;
- Better budgeting for the education, specialization, continuous training and financing of health care employees;
- Definition of staffing sufficiency and determination of staffing requirements within the Ministry;
- Definition of mismatches between position and education of doctors;
- Development of the state HR registry of the Ministry of Health of the Republic of Uzbekistan (doctors, nurses, students, masters, etc.);
- Better planning for medical personnel training;
- Identify current needs in medical staff;
- Identify current needs in non-medical staff (supporting personnel);
- Proper planning of certification of medical personnel;
- Reducing the costs of personnel and document management.

By implementing the project the Ministry of Health will receive a tool for human resources management and planning which will allow determining the level of employment, position/education mismatches, staffing requirements, doctors that have not been retrained for long period of time, etc.

After successful completion of pilot phase of the project and to conduction of expert assessment, the information system will be scaled to the whole country.

As a conclusion, it should be stated that the main objective of introducing information and communication technology in the health sector is to develop e-health system of the Republic of Uzbekistan as a part of a national program of building open information society "e-Government".

Chapter 9
Teledermatology

Africa Teledermatology Project: A Viable Model of Telemedicine-Supported Dermatology Healthcare Programme in Sub-Saharan Africa

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***Abstract:* To leverage a growing internet infrastructure for health purposes in Sub-Saharan Africa, a store and forward dermatology consultation and E-learning Project (“Africa Teledermatology Project”) was set up in January 2007 linking the Department of Dermatology, Medical University of Graz, Austria and the Department of Dermatology, University of Pennsylvania, USA to a number of Sub-Saharan medical centres located mainly in Uganda, Botswana, Lesotho, Malawi, Swaziland and Burkina Faso. Since its inception, over 120 teledermatology-supported patient encounters have been completed. Consultations are based on text and image-rich clinical documents. In addition, several tele-teaching and E-learning opportunities are offered on the project website. Overall, the initiative promises great potential to provide prompt dermatological consultation services to underserved medical centres in Sub-Saharan Africa, and should serve as a model of teledermatology-supported healthcare programme.**

Introduction

Sub-Saharan Africa has some of the world’s most underdeveloped and poorest countries. There are disparities in health care access, especially in rural areas where up to 80% of the population live including a general shortage of doctors, specialists and other medical care workers, ill-equipped medical care centers, and inadequate infrastructure. The prevalence of infectious diseases and the growing problem of HIV-associated diseases further create a significant economic and health burden on African governments. Telemedicine has previously been shown to possess great potential in improving healthcare (1, 2).

für Entwicklungsfragen (KEF) der Österreichischen Akademie der Wissenschaften”) especially for Uganda centres and the American Academy of Dermatology (AAD).

We hereby present the main activities and achievements since the project’s inception in January 2007.

Project Activities

Tele-consultation: Since its initiation, the Africa Teledermatology Project has been beneficial in diagnosis and management of more than 120 consultations sent over the project webpage <http://telederm.org/africa/>. Of these, 35% of cases were children; 25% of cases represented HIV-associated skin conditions. The majority of were inflammatory/infectious skin conditions and a minority involved skin tumours. In 35 cases, skin biopsies were also additionally submitted for processing and evaluation at the Medical University of Graz and University of Pennsylvania in order to confirm the diagnosis.

Tele-teaching and E-learning: A number of tele-teaching opportunities are available on the project website including (1) a comprehensive list of dermatology literature sources, (2) a dermatology curricula, (3) a list of exemplary cases with comprehensive discussions “case of the month”, and (4) a “discussion forum” for problematic cases.

Secondary achievements: The project activities have resulted in sensitization of policy makers in the Ministry of Health of relevant African countries about the benefits of teledermatology.

Challenges and Limitations

The main challenges faced include (1) limitations in Telecom Networks in developing countries which have created setbacks in enhancing international linkage and collaboration, and (2) the relatively slow adaptation to the concept of teledermatology by some African users.

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KSYOS TeleDermatology The Netherland Safe and Reimbursed

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Abstract: Widespread use of TeleDermatology integrated in regular healthcare has proved that TeleDermatology leads more satisfaction among patients, general practitioners and dermatologists, to higher production volumes at lower costs and to better quality of care.

Keywords: Teledermatology, KSYOS, TeleConsult, Telemedicine

In The Netherlands, in total over 4000 general practitioners practice TeleDermatology on a regional basis together with 164 dermatologists. The number of TeleConsultations is still increasing. In 2006, 8.000 TeleDermatology Consultations have been performed. In 2007, this has increased to 15.000. For 2008, in total 30.000 TeleDermatology Consultations are projected. New projects are set up in Belgium, Scotland, Italy, Austria and Germany.



Fig. 1 TeleDermatology prepared camera, available with the system

TeleDermatology leads to 70% reduction of physical referrals to the dermatologist in those patients that the general practitioner intends to physically refer to the dermatologist (71,8% of all teledermatology consultations). In 28,2% percent, the general practitioner asks for advice for diagnosis and/or (better) treatment. The dermatologist responds meanly within 5,6 working hours, resulting in

prompt and better care for the patient in stead of being on a waiting list for 2 – 4 months. TeleDermatology saves 25 – 35% of medical costs, depending on the fee for teledermatology and for the costs of regular

dermatological care. This does not include cost savings from prevented travelling or absence from work.

Patients are highly satisfied because of earlier and better treatment, close to their home. General practitioners are satisfied because of the learning effect and better service to their patients. Dermatologists are satisfied because they like to do TeleDermatology and the intensified relation with their regional general practitioners.

The KSYOS

TeleDermatology System is a secure, web based system that meets Dutch standards for safe medical communication over the internet (fig. 1 and 2). It use the Unique Health worker Identification pass (UZI-pas) that has been implemented by the Dutch Ministry of Health in order to secure safe communication. It connects with the national IT health infrastructure as described by the National Information and Communication Technology Institute in Care (NICTIZ), as set up by the Ministry of Health.

KSYOS TeleMedical Centre has officially been recognized as health institution on December 30th, 2005. It is the first virtual health institution, working with over 2000 doctors. This number is increasing daily. Being a health institution, KSYOS TeleMedical Centre delivers software, hardware (TeleDermatology adapted digital camera's, docking stations), education, support, quality monitoring, administration and billing. It is bound to legislation with regards to privacy procedures, protocols for the management of patient data. Control and audit procedures as well as internal responsibilities have been taken care of.



Fig. 2 User interface of KSYOS TDCS

TELECOMP – A Telemedical Compliance Management System for Patients with Psoriasis

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Abstract: Psoriasis is one of the most common chronic skin diseases, affecting about 2% of the population world wide. Continuous clinical monitoring with periodic assessment of the state of the disease is essential for long-term therapy optimization. We present a mobile phone based telemedical compliance management system for psoriasis-patients. Using special software, patients can acquire health parameters such as their body weight, take photos of their psoriasis lesions, and report adverse effects. The data are automatically sent to a monitoring centre, where they are provided to the patient's physician via the use of a web-browser. In case of therapy relevant events, email or sms notifications can be sent to the physician. If necessary, the physician can send feedback messages to the patient, e.g. for admitting the patient to the clinic for further examinations. The system has prototypically been implemented and functional tests have proven its functionality. In a next step the system will be used in the course of a medical case series.

Introduction

Psoriasis is one of the most common chronic skin diseases, affecting about 2% of the population world wide [1-3]. The overall prevalence of psoriasis is similar in men and women [2]. Psoriasis lesions can appear all over the body, but the most common regions are elbows, knees and scalp. The typical course of the disease is identified by periodic acute episodes and remission phases [3] – requiring a systematic therapy, individually adjusted to each single patient.

Though psoriasis can be treated in several ways, up to now, no healing from psoriasis is known [4] and long-term therapy is needed. Additionally, the therapy with biologicals can sometimes cause adverse effects, making the patients insecure and decreasing the adherence to therapy. Due to these

facts, continuous clinical monitoring with periodic assessment of the state of the disease is essential for long-term therapy optimization.

Tele dermatology – even with mobile phones – has already successfully been used for telemedical diagnosis of skin cancer and wound treatment [5, 6]. Still, none of the existing systems involved the patients themselves. Therefore, continuous monitoring of the evolution of dermatological diseases is not provided satisfactory so far.

It is the aim of the present work to provide an easy way for documenting the course of the disease during acute episodes as well as during remission phases by the use of an electronic therapy diary. Besides detailed acquisition and documentation in the course of clinical examinations at the health care centers, data are collected by the patients themselves. This is intended to help patients and physicians to optimize the therapy during each of the episodes of the disease.

Materials and Methods

The patients are equipped with a mobile phone (Sony Ericsson K770 or K800 with 3,2 megapixel camera, London, UK) with special telemonitoring software based on Java 2 Micro Edition (Sun Microsystems, Inc, Santa Clara, CA 95054, USA). Using this software, the patients are guided through the data acquisition process. They are asked to enter health parameters such as body weight, and special psoriasis related parameters (e.g. "SAPASI"). Known adverse effects of their medications



Fig. 1: Photographs of lesions are made using a common mobile phone with integrated high-resolution camera.

are enquired. Finally – using the software – the patients take up to five high resolution pictures of their lesions. Patients are asked to stick reference markers of known size and colors close to their lesions (Fig. 1). This is intended to help the physicians analyze the lesions and also to allow for automated size and color correction. All data are stored on the mobile phone and securely transmitted to a monitoring centre via UMTS.

In case that the patients report adverse effects or other complications an alert is sent to the dermatologist via SMS or email automatically. All data transmitted by the patients can be reviewed by the physicians via web-interface. The evolution of each lesion can be visualized (see Fig. 2). The integrated feedback system allows for sending messages to the patients, e.g. for admitting the patients to the clinic.

Results

<input type="checkbox"/> Alles auswählen			
#	Vorschau	Datum der Erstellung	Eigenschaften
<input type="checkbox"/> 1		20.02.2008 tt.mm.JJJJ	Ausdehnung <input type="text" value="gleich"/> Infiltration <input type="text" value="stärker"/> ohne Hilfe aufgenommen? <input checked="" type="checkbox"/> >> weiter zur Untersuchung
<input type="checkbox"/> 2		24.02.2008 tt.mm.JJJJ	Ausdehnung <input type="text" value="gleich"/> Infiltration <input type="text" value="gleich"/> ohne Hilfe aufgenommen? <input checked="" type="checkbox"/> >> weiter zur Untersuchung
<input type="checkbox"/> 3		25.02.2008 tt.mm.JJJJ	Ausdehnung <input type="text" value="gleich"/> Infiltration <input type="text" value="gleich"/> ohne Hilfe aufgenommen? <input checked="" type="checkbox"/> >> weiter zur Untersuchung

Fig. 2: Lesion evolution as seen by the physician via the web-browser

Up to now, the system has prototypically been implemented. Data acquisition, reviewing and feedback generation have successfully been tested. In the course of 2008 the system will be validated in a group of 20 patients at the department of dermatology and venereology of the Medical University Graz.

Discussion

Continuous monitoring of psoriasis lesions can only be realized in an affordably way, if the photos of the lesions are taken by the patients themselves. Still, taking photos of one self's lesions may be a difficult task – depending of the location of the lesion (e.g. on the back). Therefore, it is suspected that patients will sometimes need partners assisting them in taking such photos. Analyzing, whether the quality of the photos taken by the patients themselves is sufficient for diagnosis, is also part of the study.

In the course of the study, particular attention will be put on the usability of the system. The data acquisition process was intended to be kept as simple as possible. Therefore both – the acquisition of health parameters as well as the recording of photos – were integrated into one single Java application on the mobile phone. Whether patients will cope with the resulting software remains to be seen in the course of the study.

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Chapter 10

New Trends in eHealth

Consumer Attitudes towards eHealth in Greece – an Update

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Abstract: WHO/eHealth Consumer Trends Survey investigates the use of the Internet for Health and Illness (H&I) in seven European countries: Norway, Denmark, Latvia, Portugal, Greece, Germany, and Poland. In 2005 and 2007, a stratified sample of 1000 men and women in each county participated in computer assisted telephone interviews guided by a common core questionnaire and additional country-specific questions that in Greece, investigated the citizen's attitudes towards eHealth services and their willingness to pay for them.

This article provides a 2007 update on eHealth consumer trends in Greece as regards to acceptance of remote medical visits, granting remote access to one's medical record to expedite diagnosis, and accessing their Electronic Health Record (EHR) via the Internet. Results indicate that although use of the Internet for H&I has increased significantly since 2005, the consumers' attitude towards eHealth is only marginally improving, suggesting that further incentives and eHealth awareness campaigns are necessary.

Keywords: eHealth consumer trends, electronic medical record, remote medical visits, telemedicine

Introduction

WHO/eHealth Consumer Trends Survey investigates trends and perceptions of Internet use for Health and Illness (H&I) in seven European countries [1]. The 2005 results of the survey indicated that although, in Greece use of the Internet in general and for H&I remains the lowest in Europe, people were keen to access their EHR online and even pay for it. On the other hand, probably due to low Internet literacy, in 2005 they were quite reluctant with telemedicine: only one out four felt comfortable with a remote medical visit.

The same country specific questions, using the same methodology were used in 2007, to identify eHealth consumer trends in Greece.

Methods

The two waves of the survey were carried out in October 2005 and May 2007. Both waves of the survey were conducted using Computer Assisted Telephone Interviews (CATI) and involved in each phase 1000 men and women between 15 to 80 years, who expressed their opinion on the use of the Internet for H&I. The sample was stratified for gender, age, and place of residence. The reference questionnaire was created in English and translated to the national languages of the participating countries, using the dual focus method which involves translating for meaning and a focus group.

Results

Results shown in Table 1 reveal that consumer attitude towards telemedicine in the form of remote medical visits has improved, but remains low (2005:24.6% - 2007:28.0%). Higher acceptance is observed among men with higher education and holding white collar jobs, in the age group of 35 to 44 years old, living in urban areas. Among those comfortable with telemedicine, willingness to pay remains high, with seven out of ten (2005:70.7% - 2007:73.2%) willing to pay €10 for every remote medical visit via a computer or video-phone (Fig.1).

Although security and privacy is a rising global concern, a statistically significant increase was identified in consumer attitudes toward granting remote access to one's medical data to expedite diagnosis or receive a second

opinion. In 2007, more than half the respondents (2007:54.1%, 2005:44%), would grant to a doctor they have never met, access to their medical information, for a prompt valid diagnosis ($p < 0.001$).

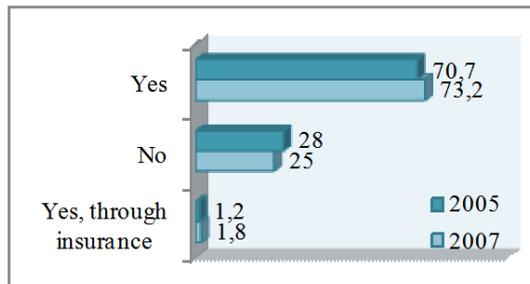


Figure 10: Respondents positive to remote medical visits willing to pay €10 per visit.

When asked if they would go online to access their EHR that is maintained by the hospital or their general practitioner and includes medical history, medication, past and recent diagnosis, and examination results such

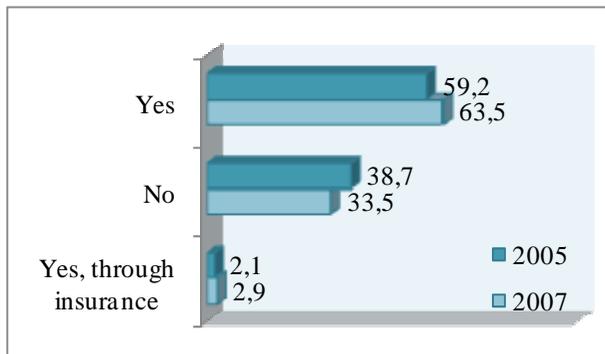


Figure 11: Respondents willing to access their EHR online, also willing to pay an annual fee of €30 for the service.

as radiology or laboratory examinations, two thirds of the respondents were positive (2005:61.7%, 2007: 64.7%). Moreover, the majority 63.5% (59.2% in 2005) would pay an annual fee of €30 for this online EHR service. An

additional 2.9% (2.1% in 2005) spontaneously indicated that the fee should be paid via private or public insurance (Fig.2). The two waves of the survey, separated by 18 months, indicate that in Greece use of the Internet in general (2005:42.2%, 2007:47.2%) and for H&I (2005:22.9%, 2007:32.1%) is steadily rising. At the same time, however, Internet use remains the lowest among the countries participating in the survey. Health related Internet use among Internet users was 68.0% in 2007 (54.3% in 2005, $p < 0.001$) [3].

Table 2: Attitudes against innovative eHealth services in Greece, by gender, age, education, situation of work and place of residence. Percentage (%) of positive answers. N=1000.

	Participate remote medical visit		Grant remote access to their EHR		Willing to access their EHR online	
	2005	2007	2005	2007	2005	2007
Gender						
Male	30.9	37.9	47.0	57.2	66.7	67.4
Female	18.5	18.5	41.1	51.1	56.9	62.1
Age						
15-24	24.9	24.7	50.3	63.9	72.8	75.3
25-34	31.3	26.7	58.8	55.9	75.8	71.8

35-44	27.9	35.7	47.0	60.4	65.0	70.3
45-54	25.6	25.7	35.3	52.0	61.5	65.1
55-64	20.6	31.1	43.4	53.0	55.1	61.6
65-80	16.1	23.5	27.6	38.3	37.9	42.0
Highest education level						
Primary school/None	17.3	15.3	29.7	38.4	46.7	42.9
Secondary school	24.8	26.5	48.2	53.8	67.6	67.0
University/Polytechnic	36.4	38.7	57.9	64.4	72.8	73.9
Situation of Work						
White collar	33.7	37.3	53.6	58.7	72.0	73.4
Blue collar	24.1	25.9	43.1	58.6	63.8	70.7
Not Working	19.2	22.7	38.4	50.5	55.1	58.7
Place of Residence						
City	27.6	30.6	47.3	59.0	63.8	67.9
Minor city	17.7	24.2	46.0	54.8	63.7	61.3
Villages	20.6	22.2	35.3	40.4	55.6	58.1
Rural area	20.0	28.0	20.0	36.0	60.0	56.0
Total Sample	24.6	28.0	44.0	54.1	61.7	64.7

Conclusion

As Internet literacy rises, people tend to accept use of the Internet for H&I, but not as much for telemedicine. Potential eHealth consumers even those that have never used the Internet, are inspired by innovative online services that provide information on H&I. Given that eHealth services are still not widely available in Greece, policy makers, health professionals and the eHealth industry should make every effort to encourage and facilitate the provision of secure, comprehensive, and high-quality eHealth services.

Acknowledgment

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Diagnostic Image Archive System for Rapid Web Based Access to the Consultant through Metropolitan Area Network

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Introduction

The rapid advancement in the field of bioinformatics and e-health is demanding. It is better to work out now to face the concerned problems or issues in the near future. The information and communication technologies have paved the basis of medical image storing, forwarding and reversely receiving expert's opinion through Picture Archiving and Communication Systems (PACS) from the other side of the Hospital Information System (HIS) from Data Fusion Centre (DFC). When distant diagnostic work stations are involved then web-engineering can play its vital role. The limitations of compression techniques and securities of sending images are restored by creating DFC at one place, where whole data is controlled and monitored. In the developing countries the medium class or low income category have problem of travel and accommodation for medical image diagnosis, when they have to travel from small towns to the big cities. The involvement of the proposed DFC discussing the issues for better quality assurance and socio economic balance of this category of the society. The workable model is expected to be utilized for metropolitan area networks for the availability of radiologist and attending quick response available and cure to the patients at their door-steps.

Modalities of images

Modalities are the use of images for radiological diagnosis purpose evolving different energy types. For example, taking images through ultrasound using sound energy, using light energy or radiations to get

internal images of bones, using heat energy to get thermal images of the body [1]. For in-depth information mostly radiological images are of its importance where various techniques like ultraviolet radiations, x-rays and gamma rays are identified as ionizing category of radiation [2]. On the other hand the non-ionizing techniques are visible light and infrared. These radioactive materials can also be used to acquire internal images for the purpose of Nuclear Therapy.

Medical image processing and compression

There are basically two compression techniques, one is lossy such as Transfer Control Protocol (TCP) and other one is User Datagram Protocol (UDP) and is lossless, when images are sent through internet. The other way of image compression techniques is Joint Photographic Expert Group (JPEG) and Moving Picture & Expert Group (MPEG), which uses bit map transition of diagnostic images. Whenever bit map transmission is used first we use compression technique and transmit on the other site by reconstruction and increasing resolution factor. During this process error in bit rate occurs, also some delay in packets of an image transmission called jittering appears in the output. Headers data is also included which increases the size of the image on return back. For teleradiological images it is required to obtain minimum deterioration factor for images for which repeated transmission of images with average or compromise between TCP and UDP is done for better achievements. The American College of Radiologist has defined teleradiologic images into two categories; one is low resolution consisting of 500 x 500 x 8 bit information of images and other high resolution image consisting of 2000 x 2000 x 12 bit size of the image [1, 6]. For full colored image of high matrix the file size for radiologist would be 12 MB.

Imaging and PACS System

For further details on the evolution and management in the PACS refer to [4]. PACS is a system for medical image capturing in digital form and sending to distant place for analysis and diagnosis of images through DFC. This data centre will help in error detection or bit rate loss for reconstruction of the images, till it is accurately imported or exported through web engineering techniques. For further details refer to [3]. The network for PACS system starts from collecting images and storing in depository at central hub. It is also called Data Fusion centre [8]. All images can be retrieved and sent to this point when ever needed. One example of telemedicine is the use of nuclear medicine from distant, which can be utilized for PACS system for radiological diagnosis of the patient [9].

Similarly other types of images such as CT, MRI and ultrasound are broadcasted and acquired for the same purpose.

HL7 & DICOM Format

In the perspective of biomedical engineering, Health Level 7 (HL7) is more effective for interactive programming, particularly dealing with large data for high resolution radiological images and is useful for data fusion purposes. For the HL7 version 3 standard requirements are Hospital Information System (HIS) / Radiology Information System (RIS) as shown in table 2 in the reference page 58 [7]. The ACR and National Electrical Manufactures Association (NEMA) have set a standard of DICOM for medical image interconnectivity, workflow, storage, display format and compression [5]. This system also provides patients personal medical information database for the technicians before scanning any type of radiological images.

Web engineering & metropolitan area network

Our proposed model including the DFC using the MAN is available with image capturing devices directly or indirectly for transmission and reception of the images. Our network also includes laptops, palmtops and v-wireless telephones as the components of the MAN along with hardware connectivity with image processing software. By using the web engineering techniques images are sent through internet using TCP or Hyper Text Transfer Protocol (HTTP) and extensible markup language (XML).

Issues and securities of PACS System

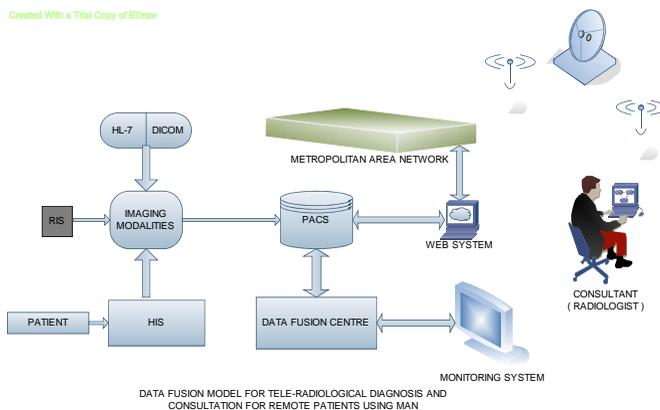
The data hiding for patient personal data security against hackers can be defended through firewalls into the detection system and semantic antivirus software to be sued for security concerns. Furthermore encryptions and de-encryptions software may help the data diffusion centre or hub by means of PACS centre.

Data Fusion Tele-Radiological Consultation System

This model uses data fusion centre or huge storage system to keep record in form of databases for ready reference to the experts and HIS. The collecting images for diagnosis and serve with consultants and priority on patient basis from distant to save time, travel as well as cost and botheration of the patient particularly in developing countries. Generally, patient goes for getting their radiological images from one place and consult with expert by traveling long distance and bother for accommodation and other cost. Therefore this Data Fusion Centre serve as key role for all patients to get

their radiological images, information and expert opinion and distribute to their concerned hospitals. The patient information is kept in their concerned hospital information system and is sent for record to the data fusion centre. On the other hand the patients are guided to get their radiological images from their nearest place. These images are in the form of X-rays, CT images, MRI and nuclear medicine depending on the diagnosis requirement of the patient. Here the radiological information system keeps record of the patient and after following the HL7 and DICOM standards send the information to PACS. Where, after managing information is sent to data fusion for monitoring purposes and sent to web engineering port after clearance from management information system (MIS). Now data is ready for distribution to metropolitan area network via satellite link to connect experts for their opinion. The monitoring system and data diffusion centre is responsible to note for the quality of the images and analyze the bit loss and jittering factor for correction. Finally, data diffusion centre will send report to the HIS for patient's satisfaction and treatment.

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Materials and Methods

First of all the patient is registered through database of the Hospital Information System. Then magnetic resonance images are captured by MRI machine made by siemens of powered 1.0 Tesla. Consequently, these images are sent to the PACS link (9410) acquisition device, which stores this data in analog form in the hard disk for further analysis. The images are then monitored and send to DICOM machine for producing bitmap image and with the help of dry viewer (8100) laser imager are in form of x-ray film are available for direct observation of the image in group or set of images in terms 14/12/20 images on one plate. These are further

compression by JPEG techniques to standardize the format of sending data to the radiologist. Finally the compressed images in the form of sub folders and folders are sending to the experts (radiologist) at distance, who diagnosis the image and sends back the diagnostic reports of his observation and opinions.

Results and Discussion

The patient’s diagnostic images were sent for teleconsultation or expert opinion from municipality to the metropolitan cities by using JPEG compression techniques. The loss of bit rate results has been calculated to be averagely 2% to 3% of the whole still compressed image of the patients. This loss has not much effect on the overall information of the diagnostic images in the form of black and white images. The returned message occupies more pixel memory for the same size of the still image due to jittering effects and source and destination tags, because information is sent in the form of packets. Our research is in progress and more results will be presented in our future work. The table I represents the typical radiological sample of patient’s data for expert opinion.

Table I

Typical clinical radiological patient’s data for teleconsultation

T image examination	Still image Uncompressed folder size type of Diagnostic (MB)	No. of images in Folder	Bit map size of the image folder (MB)	JPEG Compressed folder size (KB / MB)	Final Compression folder size for teleconsultation (MB)	MRI Image received by Radiologist per package (MB)
MRI Lumbar Spine	76.2	48	19	794 KB	2.18	4.2
MRI Cervical Spine	76.3	48	32	794 KB	2.28	3.1
MRI Brain	95.3	80	4.05	4.31 MB	4.16	5.7

Conclusion

Presently, where there is single connectivity for tele consultation there is need to establish multiple connectivity by some way of creating data fusion centre for interpretation, diagnosis and treatment of patients by the experts. Particularly in developing countries, there is a difficulty for the patient whether they are living in town or metropolitan cities. Looking at the cost travel and accommodation of the patients; it is proposed that a central hub or data fusion centre be created for cost-effective solution for easy access and rapid response to the patients. Finally, not only from this process experts will be benefited but also pharmaceutical companies can analyze the data and new drugs may be produced for better healthcare. The results show that bit rate loss is 2% to 3%, which has less effect at the metropolitan area network. But jittering and garbage increases the data size on the return of the image. However, the report sent by expert is of the important than the returning image. The MRI examination data shows that bit loss rate is negligible and although jittering is need to be considered for further investigations. We have focused on data fusion centre based on tele radiological expert consultation to achieve low cost and burden less solution for the stakeholders. In future, there is need to explore more in depth study for data fusion centre by employing telemedicine.

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Ethical Issues in the Delivery of Telecare and Telehealth Services

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***Abstract:* Telecare and telehealth technologies are in many cases utilised in ways based on medical models of care. This carries the threat of institutional service frameworks being applied in people's homes. Ethical issues arise which are addressed in this paper. Most notably these relate to citizenship, the notion of 'independence, and the importance of personal control. Telecare and telehealth technologies must be harnessed, it is argued, to support independence in a way that empowers the individual.**

Introduction

Given demographic changes and healthcare challenges affecting all countries in the European Union and beyond, there is something of an inevitability relating to the further development of telecare and telehealth services. This is borne testimony to in the European Commission's 'eHealth Taskforce' report [1] that pointed to a €21 billion market for 15 EU nations in 2006 with a potential for 'explosive growth' in which 'telemedicine and homecare (is) the segment with the greatest potential for financial and clinical impact and ... due for immediate explosion'. Two of six 'main' factors driving the change were noted in the report as i) the expectations of citizens-patients; and ii) patient empowerment.

The use of the term citizen is instructive here insofar as it is a pointer to people's own obligations (in this case for their health). The notion of people being the passive recipients of services is, therefore, to be a thing of the past and can only be socially acceptable (or, we might surmise, supportable through public funds) for those with high support needs. The mantra is, therefore, now one concerned to 'help people to help themselves'.

Lifestyle Monitoring and Telehealth

To explore some of the ethical issues around this change in service approach, the gaze of this paper falls on lifestyle monitoring and the use of telehealth monitors in the United Kingdom. Both fall within the broader remit of what we now term 'telecare' [2]. And while it could be argued that, because such services are embryonic, a discussion is premature, this paper

contests that the opposite applies. It is essential to consider such services in their early manifestations in order to challenge, if necessary, the technical and operational parameters that underpin them.

Lifestyle Monitoring

With regard to the lifestyle monitoring a range of proprietary systems are increasingly operational. In most cases these rely on the use of PIRs (passive infra-red sensors) that send information to an intelligent hub in people's homes. Less commonly, other sensors are utilised to monitor the use of doors, cupboards, water, electricity, etc. At the very least, these systems offer information about patterns of activity and, for instance, the fact that someone is awake and moving from room to room.

Potentially more useful is the fact that, when analysed according to algorithms regarding the activities monitored, the information derived can give pointers to indicate the extent, timeliness and regularity of their activity. Lifestyle monitoring can, therefore, indicate a person's wellness when measured against their 'normal' activity pattern (or its frequency) and their presence in the home. All are regarded as having particular applicability in relation to the needs of people with dementia [3].

Telehealth

The telehealth equipment on which this paper focuses is used by people who are able to measure their own 'vital signs' - including blood pressure, blood sugar levels, weight and pulse. Devices are linked to a monitor that passes the information to a third party. That third party, normally a health practitioner (or someone working under their guidance), is able to advise on any irregularities and will, in many cases, be involved in encouraging and advising the user regarding their lifestyle.

Merits and Demerits

The merit, in appropriate contexts, of the lifestyle monitoring and the telehealth equipment described is not contested. What is remarkable, however, is the manner of their operation within telecare and telehealth services being seemingly rooted in medical models of care. Hence the focus is on providing professionals with information so that they may make judgements regarding a person's well-being. Little or no control or responsibility is vested in the user.

In this context the people who are intended to benefit from the technologies can be viewed as the recipients of care determined according to professional assessment or diagnosis and appear permitted, in large part, able to abrogate responsibility for their own health and lifestyle. The service user then remains indisputably a patient or 'client' rather than a citizen.

He/she is, as a consequence, dis-empowered, their independence compromised and a key tenet concerned with changes in service paradigms is undermined.

Ethics

The call in this paper is for a more robust ethical framework to underpin the use of lifestyle monitoring and telehealth technologies. This demands that the equipment demonstrates greater configurability and is operable according to new citizen centred and empowering approaches. The demand is not remarkable. Assistive technologies are now more commonplace and afford increasing control to more people with support needs. The links to the notion of 'smart homes' where empowerment and control are focal [4].

What is slowing progress towards the adoption of more appropriate technologies and related services is arguably the link of lifestyle monitoring and telehealth with long-term conditions often found among older people. The latter includes heart failure and chronic obstructive pulmonary disease (COPD). For professionals utilising such technologies for the first time the incentive for change their approach is diminished because they may have internalised views that see service users as dependent and compliant.

It is right, of course, that technological options are being considered in order to meet people's healthcare needs. What is being overlooked is the fact that the meeting of those needs must be done in different ways when this takes place in people's homes. A key issue relates to independence and the measure of control that people wish to maintain.

Independence

We change our view regarding the meaning of independence in accordance with our personal circumstances. But the element that stays in place relates to the control that we exercise over our homes [4]. The threat to that control increases where there is deterioration in our physical, sensory or cognitive ability. We also face increased risks unless these are mediated by changes in our living environment - part of which involves the use of technologies.

It follows that if we are to maintain a sense of independence relationships with healthcare professionals must allow for greater decision-making on the part of the person concerned. It is ethically appropriate, it is argued, that this should be the case. Some of the implications for the way in which technologies operate have been noted. This also, however, has implications for the way in which people give consent for the use of technologies, especially where there are automated means of sending personal data to third parties.

Technology Configuration

It follows from the foregoing that what is required are technologies that are more configurable and do not operate in ways that can dis-empower the user. It has been suggested that lifestyle monitoring tends to dis-empower. This may have contributed to relatively high numbers of people refusing to accept the equipment in their homes [5].

The operation of telehealth equipment may similarly be regarded as dis-empowering, though not in the same way. With telehealth devices the user is in control of their use. What is generally lacking, however, is the adequate feedback of information whereby the user can feel more in control of the information and able to take more responsibility for their own health.

It is ethically inappropriate when data gathered by lifestyle monitoring or telehealth equipment are automatically transferred to third parties with no or limited feedback being able to be provided to the user.

Conclusion

While health and related services are configured according to medical models there is an evident risk, illustrated in relation to both lifestyle monitoring and telehealth, that medical (and institutional) models of care will be applied in people's homes. In view of issues around independence and control, and the importance that we attribute to people's status as citizens, it is ethically appropriate to challenge such perspectives and call for technologies that respond to a different agenda.

The response must include greater equipment configurability so that users are able to set or change (albeit in accordance with protocols agreed with professionals) operational parameters. Affording such control will not, it is considered, compromise progress towards the meeting of clinical objectives. It would, however, enhance people's sense of independence and *ipso facto* the potential for greater personal well-being.

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HEALTH@HOMELL: Integration of the Living Lab Approach in EHealth Projects

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Introduction

Nowadays, companies are facing key challenges with respect to positioning their products in the market. Questions like what are the user needs/preferences are extremely important in order to deliver to the customer the right product, in the right moment while minimizing risks and costs.

In order to create a realistic view of such end-user needs, non-intrusive monitoring of users under controlled environment and observing techniques (based on the latest ICT evolution) could help business developers, researchers and developers to detect actual user needs “on air”. Other benefits include the validation of the proposed solutions as well as evaluating other variables beyond technical aspects (like the psychological impact).

This idea is developed in the Living Lab concept (as a user-driven open innovation framework) with a great potential for eHealth projects.

Project development hurdles

The creation process of a new service, product or system contains, most of the times, a high degree of uncertainty in terms of feasibility and “exit-to-market” strategy of the final service, even in those cases in which a classical life cycle have been adopted. Such uncertainty is highly related with two issues:

1. User adoption of the product: Will the product be adopted by the market? Does it fit the actual user need? Is it user-friendly enough? Are we addressing the right user segment?
2. The business point of view: Will it be feasible to deliver it to the market in a profitable way? How long it will take? (time-to-market) Will it be easy to maintain and evolve?

These questions are not easy to answer beforehand and only experienced company staff and deep market knowledge seems to be confident tools to sustain the decision and help to launch the service. Nevertheless, these tools

come short if new markets are faced specially for the case of disruptive products.

The solution to these problems relays on getting as close as possible to the customer needs, preferences and behavior patterns, in order to exactly identify the niche where the future product or service should be directed to.

The theoretical model for the innovation process is depicted as a sequential list of activities:

1. Define a technological map
2. Identify knowledge sources
3. Collect technology opportunities
4. Evaluate ideas
5. Define innovation plan and detailed project proposals
6. Manage innovation projects
7. Analysis of obtained results
8. Transfer technology to competence centers

These tasks could be graphically sketched as a bottle-shape diagram with bottle necks in tasks 2 and 8. First of all, technologies should be identified in order to concentrate efforts (which should be the most profitable) Also, from multiple research lines undertaken, it is requested to decide which of them are closer to the market (user adoption).

Living Labs

Of all the techniques used to minimize risks in those two issues, Living Labs have been proved to be the most reliable (no matter the area of work we were dealing with). Their single requirement is that a final user should be at the end of the value chain. This is why the user is located at the very center of the development process, fitting the need of getting closer to the user, reducing time and effort to identify needs and problems and even the way to solve them.

Living Labs allow researchers, business and marketing managers to analyze user acceptance and usability of the service as well as to make an assessment of feasibility to take the product into the market. This is quite natural because the user identifies needs, defines requirements and tests the products in real environments, participating in almost every stage of the product innovation cycle.

This is also the actual difference between Living Labs and test beds and pilots. In the latter two, the product is evaluated by the user at the end of the project, including the key issue about whether the product fits a real need or not.

A Living Lab offers to the researchers an open space to observe what the user does and needs, to act on his/her environment to see how he/she reacts

under some changes, to deploy new products and services, to check acceptance and even simulate specific situations in which no interaction is viable (e.g. to simulate an Intensive Care Unit of a hospital).

From the eHealth projects point of view, Living Labs offer the perfect conditions to reduce the risks taken (from a business point of view as well as from the public health side). On the other hand, there are further issues that usually obstacles the creation of real Living Labs. They are mainly related to ethical and legal aspects derived from observing private spaces of people in their real day life, using actual homes as test scenarios, recording and managing private info about their health status, treatments, diagnoses, prescriptions, etc.

Usability Centers

A complement to Living Labs is the Usability Center. They allow researchers and developers to intensively tests their products and services before commercializing them in an extremely controlled environment, created ad-hoc for this purpose, independently from where the user usually lives or works, etc

The main advantages comparing with Living Labs are that the environment is completely controlled and monitored (using cameras biometric and environment sensors, etc...), and the ethical issues are minimized from the moment that the users is taken out of his/her environment and put in an artificial one, to monitor what he/she does, how he/she behaves. As the user has given his/her explicit consent to monitor the scene, the Usability Center benefits from an extraordinary flexibility about the type of testing that can be implemented in the lab. The drawback is that the user doesn't participate in the definition phases, but the most important is that the results are not so much realistic than those coming from the Living Labs. Nevertheless, both approaches (Living Labs and Usability Centers) are complementary and show a clear synergy.

Table I: Comparison Living Labs-Usability Center

	Pros	Cons
Living Lab	User centered Real validation Direct observation	Privacy Ethics
Usability Center	No privacy problems Higher control in tests	Not user centered No user environment used

Conclusions

It seems evident that a mixture of both methodologies (Living Labs and Usability Centers) might be the ideal approach to implement open innovation policies, selecting each of them in the proper stage of the development lifecycle. This is especially useful when evaluating the market strategy for disruptive technologies. Living Labs seem to be more efficient to identify needs and requirements involving final users in this process. Living Labs also offer the chance to test and analyze the results in a real life environment, with the heavy restrictions associated to ethics. In this point, Usability Centers could be a complement to Living Labs in those cases for which the privacy of the users could be interfered.

Acknowledgements

We gratefully thank the European Network of Living Labs members, for their support and commitment to disseminate the Living Lab concept at European level.

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Integrated Telemedicine Services, Based On Medical Telecenters Network - Experimental Results

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Abstract: In this paper there are presented the experimental results obtained within the project TELMES, developed during the period 2005-2007. The experiments were performed during 3 months, at the end of 2007 year, in a pilot network consisting in 3 medical telecenters located in Bucharest, Pitesti and Iasi.

Introduction

The main purpose of the project “Multimedia Platform for Medical Teleservices Implementation” – TELMES was to realize a secure multimedia transmission for medical data (digital images, video and text) and one medical records acquisition system in order to enhance the quality of medical services provided by General Practitioners in our country. The TELMES project enable for different medical staff to provide complex medical teleservices that could be done through a regional telecenters network. Therefore, complex medical teleservices could be enrolled in the positive trend for Romania, to increase the use of the ITC technologies in the field of the public services (e-commerce, e-government, e-health, etc.).

In this paper there are presented the experimental results obtained within the project TELMES, developed during the period 2005-2007.

TELMES Network Structure

The TELMES network consists in a lot of medical telecenters connected within a multimedia platform that allow implementation of applications from the complex medical teleservices category.

At this moment we're developing a pilot network that consist in two regional telecenters, located in two Cities in Romania - Pitesti and Iasi, and a Network Management Center located in Bucharest (fig.1). The TELMES

network has the following main component parts: **Regional Medical Telecenters, Network Management Center and Medical Data Base.**



Fig. 1 TELMES structure

The Regional Medical Telecenter - RMTc, is a structure having all needed logistics, furniture, IT systems, and telecommunication devices, made up at a region level, and

designed for medical teleservices implementing and exploiting.

Medical Data Base – MDB represents a well defined data structure for defining and managing all system dates. For each region we define a **medical regional database- RMDB** that will contain all patients and doctors that resides inside that region. Fig.2 presents an example with electronic medical recording of patient into MDB.

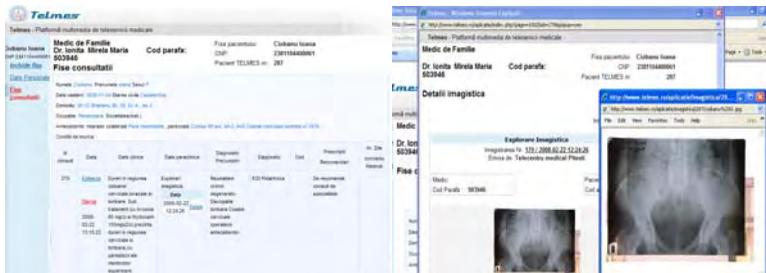


Fig.2 Electronic Medical recording of patient into MDB

TELMES database use standard SQL for managing data. Because one of the main system architecture is to define a database independent layer we are able to interact with different database systems that support standard SQL language.

Network Management Center represents an entity with the following functions: hosting a central server to ensure the telecenters access to the network; hosting the central database; hosting software applications used

for network management services; ensures the connectivity between regional telecenters, within the TELMES network.

Experimental Results

The experiments were performed during 3 months, at the end of 2007 year, in our pilot network. There were experimented *asynchronous telemedical services* such as teleconsultation and “second opinion” consultation in radiology and, also, *synchronous telemedicine services* “on-line” video consultation. The experiments involved 30 patients presenting chronically diseases of the cardiovascular system, urological and rheumatic diseases and diabetes, placed on a list of 6 GPs from Arges and Iasi regions. Medical staff that participated at the experimental phase consisted in 6 GPs and 8 specialist doctors: 1 cardiologist, 2 urologists, 1 diabetic specialist, 1 rheumatologist, a laboratory doctor and 2 radiologists. There were performed 108 teliagnostics (59 in Pitesti, 28 in Iasi and 20 between these 2 regions), fig.3, 20 second opinion on radiology, fig.4 and 13 video consultations, fig.5

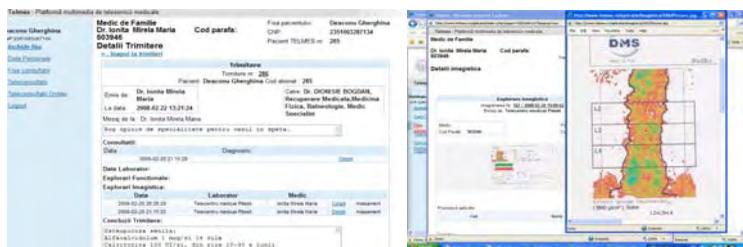


Fig. 3 Teliagnostic example



Fig.4 Second opinion on radiology example

Conclusions

The experimental results has issued the reliability of an integrated solution of a telemedicine network consisting in many local telecenter placed at the GP offices in the participant regions, and regional telecenters located in the regional administrative centre, in the site of big medical



Fig. 5 Video consultation example

centers with specialized medical offices. The pilot network proved the capability to enable the transfer of medical data, EKG, echographics, X-ray images, computerized tomography, RMN and for the histopathology samples, together with different surgical images. In addition, complementary real-time remote consultations were run using the videoconferencing system, in order to acquire more relevant data about the patient actual status. The results of pilot project are valuable for the currently developing of the new medical teleassistance project – TELEASIS that aims to provide, especially for people over 60 years old, a better life quality in their own home environment, by providing the complete medical teleassistance integrated services.

Acknowledgment

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Integration of “Intelligent” SMS into PCS*CARE Clinical Hospital Information System

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Abstract: This paper describes a modern, easy and cost effective method of communication between a healthcare provider and the patient by means of SMS (Short Message Service) functionality. It is an option to cable (letter) communication or a call centre. Currently, most patients use mobile phones. Healthcare provider using H.I.S. (Hospital Information System) PCS*CARE[®] for its routine operation may use the new SMS functionality to its advantage and that of its patients in an array of situations, e.g. call to specific blood donors, call for patients for screening, appointments, cancellations, etc. including response processing.

Introduction

SMS has been around since the beginning of mobile phone services. Initially, not very widely spread, their use has been accelerating and proving its usefulness in many areas. There are currently examples of SMS use within the health sector, however, the presented solution brings the process to a new level; both in terms of ease of use and its automation.

Solution

Comprehensive clinical hospital information system PCS*CARE[®] developed and maintained by PCS Systems, s.r.o., Prague, Czech Republic has been in use by hospitals and other health care providers in several countries (EU, Middle East, Africa) since 1994.

A recent addition to its broad functionality has been the integration of SMS functionality offered by most mobile operators worldwide. The new feature allows for:

- Creation of lists of patients according to defined criteria
- Creation of the actual SMS text
- Automated SMS being sent to their mobile numbers
- Automated response handling

Currently, most patients (if not all) use mobile phone. Healthcare provider using H.I.S. PCS*CARE[®] for its routine operation may use the new SMS

functionality to its advantage and that of its patients in an array of situations, such as, but not limited to, call to specific blood donors, call for patients for screening, appointments, cancellations, etc.

This is useful for both ‘mass’ messages whether on establishment (hospital) wide level, departmental level or for the needs of an individual physician as well as for individual calls on a particular patient. It is, in fact, a replacement of a cable (telegram) or a call centre.

Major Advantages

There are many advantages using this modern means of communication compared to cable, letter or call centre:

- The message reaches the recipient ‘instantly’, regardless of his/her current location (given that the location has signal coverage and the recipient has mobile phone on)
- The cost of an SMS message is many times less that cost of cable or letter
- The SMS message can be sent at any time (no Post Office opening hours limitations)
- The message can be sent directly from the application (H.I.S. PCS*CARE[®]) without any (human) intermediary
- Automated, simple reply handling and storage
- Both SMS messages and the replies are automatically archived within PCS*CARE[®] for future reference
- Important savings in manpower requirements
- It is much less intrusive for the recipient than a call from the call centre

Software Functionality

On the software side, the basic infrastructure is H.I.S. PCS*CARE[®] providing the Patient Register which includes, among many other data the patient’s mobile number. PCS*CARE[®] allows its users to create lists of recipients according to ad hoc criteria (Fig. 1). It is also possible (e.g. for individual patients) to create a ‘reminder’ SMS with predefined future date. Such message is stored within the H.I.S. and sent out on the preset date and time.

Replies are being received automatically and stored within the H.I.S. Simple replies (e.g. “Yes”, “No”, “1”, “2”, ...) are handled and processed automatically while more complicated responses require operator’s evaluation.

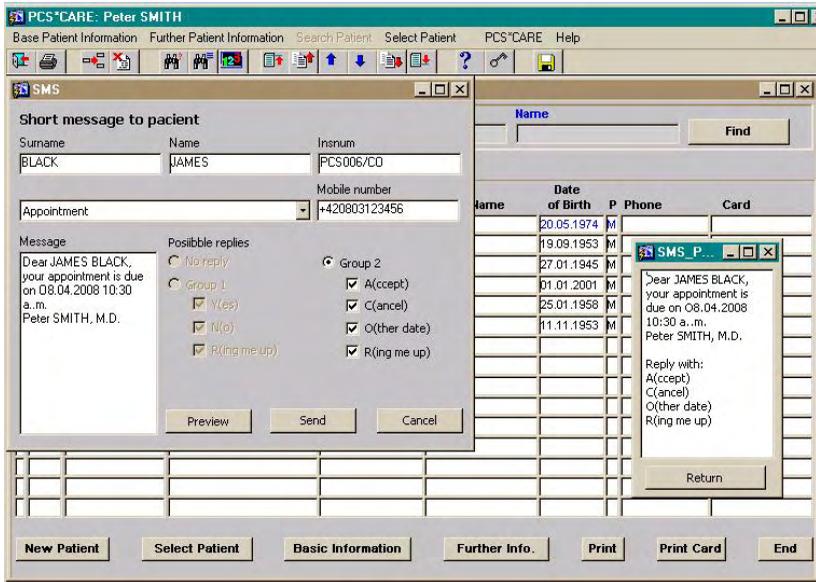


Fig. 1

Technical Requirements

From the technical point of view, a ‘gateway’ to the mobile network is a necessary precondition, the other being the patient having a mobile phone and mobile network access. Should the number of SMS messages sent out by the healthcare provider be really high the use of the mobile operator’s SMS Centre may be a better option. It gives a higher speed and usually better rates can be negotiated.

Summary

The use of ‘intelligent’ SMS within the healthcare provider’s facility brings many benefits to all concerned as shown above. There are nearly unlimited possibilities for using this technology. The ease of use is appreciated both by the patient as well as by the medical staff. There are considerable savings for the healthcare provider while the patient feels being pampered more than before. For the mobile operator it brings additional revenue.

More Intelligent Smart Houses for Better Care and Health

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***Abstract:* Smart home technology is not the solution to create a perfect home environment but has the ability to make a useful contribution. Evaluations of realized smart home projects provide enough support to continue to work on creating intelligent smart homes. However still a lot of effort needs to be invested to really involve all users in the design process and establish cooperation between all stakeholders. Given that the possibilities of the offered technology and services are increasing ethical and privacy issues become even more important.**

Introduction

In the Netherlands, smart houses and smart home technology, specially designed for older people have been implemented in the first pilot projects for older people in 1997. By 2008 a breakthrough of the deployment of smart home technology for this particular target group can be observed. Smart Homes, a non-profit organisation based near Eindhoven, the Netherlands, has been initiator and stimulator of smart home technology from 1993 on.

On European level several IP projects on AAL (Ambient Assisted Living) are running to reach these goals: NETCARITY, PERSONA and SOPRANO. Smart Homes is involved in two of them. In the Netherlands Smart Homes is coordinator of a national project in which several SME's are working on a variety of new sensors and actors that will contribute to smarter houses.

From the projects in the first decade, many lessons were learned: what older users themselves like and don't like about it, how the procedures and processes of design, installation and after service can be improved and where technological solutions themselves are still not sufficient or adequate.

It should be kept in mind that in the period of initiation up to some years ago, technologies like Internet, broadband and cell phones have come to full exploitation. Most projects up to now, however, were started with home

automation within the house itself and no connection to the electronic highway.

In the new generation of smart house development, the aforementioned technologies plus the integration with software packages for e.g. context aware observations and decisions will deliver an entire new dimension of smart living for older people. Various new electronic services are expected to be developed in the next 5 years to come.

In this paper, an overview will be given of the development of more intelligent houses, which may help achieving better quality of care and better health of their occupants.

Lessons learned

By evaluating realized smart home projects useful information can be gathered on utility, usability and accessibility of smart home environments.

During the evaluations it became clear that in order to get a good perspective on the satisfaction regarding smart home technology it is important to consider the environment as a whole instead of focusing only on the technology. The smart home environment roughly consists of three parts: 1) the residents, technical infrastructure and applications installed in a home, 2) a gateway and 3) an external network consisting of among other things service suppliers. Every part has its own, sometimes changing preferences and limiting conditions but still they have to operate as a whole for a better quality of living.

Equipping home with smart home technology is a very complex process especially since it is a new aspect in the building process. This means that the roles and responsibilities between the stakeholders are not clearly defined yet. Special attention need to be paid early on in the building process, for new but also for existing homes, to make sure that the tasks and responsibilities are clear to everybody.

When installing new functionalities it is important that the functionalities are installed gradually and not all at the same time. Furthermore special attention needs to be paid to the location of components. Not only from an aesthetical point of view but also to make sure that the functionalities connect to the technology will work as intended.

The results of our evaluations are that the following applications are most appreciated in the first smart home projects: security applications (burglary and fire), health care applications (nurse call systems and measurement of inactivity), automatic lighting, electrical sun blinds, opening the door from a distance with a speech and visual connection and the possibility the shut

down several applications (for instance when going to sleep) with one single action.

It became clear that some of the installed applications were too difficult for residents to understand. The two main reasons were: 1) the concept behind the functionality was unclear to the users and 2) the number of action the residents needed to perform in order to operate the system was too high. Users aren't passive; they try to create a fitting home environment by taking the matter into their own hands. Sometimes that means making adjustments to the installed system.

From a communication perspective; when explaining users how to operate the system the focus shouldn't be on the technical aspects of the system but on the benefits and the concept underlying the system.

Besides discovering shortcomings of the installed technology it also became apparent that installing technology resulted in the subjective feeling of mastering one's own life, without being dependent on the help of others.

Cooperation between stakeholders

Because of the innovative character of smart home technology all party's have to work intensively together in order to achieve satisfactory results.

In the projects NETCARITY and SOPRANO the aim is to establish an ongoing cooperative relationship with all the stakeholders. A lot of effort has already and will be invested to create long-lasting relationships with stakeholders to make them aware of the potential and benefits of developed technology and services and ensure that they will be integrated into their company processes or in their homes.

Part of establishing a good cooperation is to make partners in the project aware of the fact that the technology is installed in the privacy of somebody's home. Therefore within the projects homes of elderly people will be gradually equipped with available products from the project. Prototype testing will only be conducted outside the homes of elderly. The protocol used is that products will be tested in a lab environment first, and are not only tested as a single product but also tests are performed on the integration of the products. After the products are mature enough they can be placed inside homes.

In the first phase of projects it is important to establish a strong local network and use that as a base for the rest of the project. At the moment the stakeholders that play the most important roles are care takers, service suppliers, local authorities and the end users.

New developments

The greatest advantage of recent developments is that the focus is on non-intrusive technology that can be completely personalised to the individual. The greatest challenge however is to involve users into the design process to fully employ the potential of the technological developments. Involving users in this case means not only consulting them when the product is finished, but giving them an active role in the design process and the actual shaping of technology and services.

This means developing methods that will allow users to define user requirements without explicitly mentioning technology and to make them part of the process that translates those requirements into concrete design solutions.

On a technological level different components are integrated and by using different types of sensors extensive information about the behaviour of residents can be gathered. New to the list of available functionalities and services are services to enhance well-being and telemedicine.

Discussion

From the first smart home projects it can be concluded that users allow technology into their homes; however not at any price. Including all users (e.g. end-users, informal carers, formal carers and service providers) is becoming more and more important as the number of available products and services rises.

Special attention needs to be paid to defining what conclusions and consequences can be connected to the collected data inside the home environment. When installing technology that allows the system to automatically interpret behaviour and respond to behaviour or to distribute data to a third party there has to be an agreement on what is allowed and what not.

Using actual homes as a place to gather information about new technologies and services remains a powerful instrument since in a lab people behave differently than in the security of their own home.

OFSETH: Optical Fibre Sensors Embedded Into Smart Textile for Healthcare Monitoring

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***Abstract:* We present here some results on optical fibre sensors embedded into medical textiles for monitoring of the respiratory movements and blood oxygen saturation in Magnetic Resonance Imaging (MRI) environment. These results have been obtained in the frame of the EU project OFSETH.**

Introduction

Healthcare monitoring is a general concern for patients requiring a continuous medical assistance and treatment. In order to increase the mobility of such patients, a huge effort is pursued worldwide for the development of wearable monitoring systems able to measure vital physiological parameters such as respiratory movements, cardiac activity, pulse oximetry, temperature of the body [1]. Technical or smart textiles incorporating different sensors play a growing role as they are well suited for wearability and ensure good comfort to the user [2, 3]. While most developments have been focused on the use of electrical sensors, the aim of OFSETH project [4] is to take advantage of pure optical sensing technologies for extending the capabilities of medical technical textiles for wearable health monitoring. OFSETH is expected to achieve a breakthrough in healthcare monitoring applications, where standard (non-optical) monitoring techniques show significant limits: for instance, this is the case of anaesthetised patients under Medical Resonance Imaging (MRI), whom physiological parameters must be continuously monitored.

Methods and Material

Integration of optical fibres into textiles

Optical fibres sensors have already demonstrated great capabilities for many applications where distance, electromagnetic compatibility, risk of explosion or need for distributed measurement limit the use of standard competing technologies. Up to now however, their use as embedded sensors in technical textiles for medical applications has not been really accepted, despite their expected positive impact. This is mainly due to the restricted

usability of the sensors from the medical staff point of view, as well as to their poor compatibility with cost-effective industrial textile processes, where manual operations such as confection have to be reduced to a minimum. However, due to their non-invasive nature, optical fibres have a serious advantage over other kind of sensors when integration into textiles is considered. Moreover, an optical fibre is in some way a yarn and can ideally be processed like standard textile yarns.

In this context, OFSETH investigates how the monitoring of various vital parameters such as, cardiac, respiratory rates and pulse oximetry can be performed through pure optical devices and techniques, while, at the same time, textile related processes for the embedding of the optical fibre (such as weaving, knitting, crochet and stitching) are evaluated.

Application scenarios

OFSETH concentrates its efforts on the monitoring of three main vital parameters needed either for anaesthetised or sedated patients under MRI and for ambulatory applications: ECG waveform, plethysmographic waveform, and respiration rate acquisition.

ECG acquisition requires an electrical contact with the patient skin, which cannot be carried out through a pure optical sensor. A commercially available MRI compatible ECG sensor will thus be used.

The plethysmographic waveforms acquisition is performed via a well-known non-invasive technique based on pulse oxymetry. For monitoring the level of oxygen in the blood, the skin is illuminated with a red and an infrared light beam. Analysis of the light reflected by the skin allows determination of the absorption of the skin and underlying tissues at these two wavelengths. In OFSETH, the standard technique consisting on a NIRS (Near Infra-Red Spectroscopy) measurement device is used with main improvements and work is concentrated on the EMI insensibility.

Respiratory movement acquisition: here both abdominal and thoracic movements are monitored. Although the thoracic activity is observed mostly in intubated patients, it is expected that such a measurement could enhance the reliability of the whole monitoring system. Usually, respiratory movements are detected by measuring the impedance changes between different points of the body, which is incompatible with the MRI environment. An optical fibre sensor capable of monitoring the movements of body induced by the respiration process is thus developed. The measurement principle is similar to the one used in respiratory belts where elongation of the abdominal or thoracic circumference originating from respiratory movement is recorded versus time. Several ways of detecting elongation using an optical fibre are investigated: macro-bendings, FBG,

OTDR technique, etc. For the macro-bending sensor, the modification of the loop behaviour leads to variations of the transmitted optical power. Periodic variations allow to determinate the breathing rate. In the case of the FBG sensor, all mechanical strains on the fabrics are converted into physical modification of the FBG that are detected as a shift of the Bragg wavelength. The analysis with a spectrometer or FM/AM converter enables to measure the respiratory rate.



Example of fibre macrobending sensor

Textile integration

Given the variability of the investigated organ (cerebrum, thorax, abdomen, pelvis, upper or lower limb), the monitoring sensor should be placed away from the investigated organ, in order to not interfere with MRI. Concerning the constraints on sensor positioning, no place on skin can be chosen so that we are sure to be apart from the investigation point.

Some places should be kept clear, like the pre-cordium, in order to facilitate resuscitation in case of cardiac arrest or hemodynamical failure. Access to the intra-venous infusion line should also be kept clear, for easy access during anaesthesia or for resuscitation purpose. Absence of venous or even arterial garrot should be strongly assessed, particularly if the cloth is a circular one.

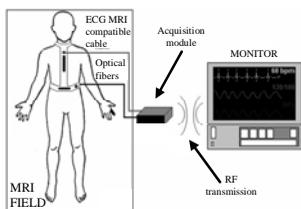
Applications

MRI application

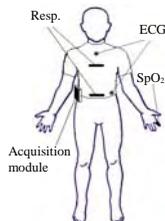
As the acquisition module and the monitor contain electronic components they need to be placed out of the MRI field. The transmission between the garment and the acquisition module will then be done by optical fibres, except for the ECG monitor. Furthermore, the smart textile should be easy to place on the patient, and thus elastic textile bandages have been preferred.

Ambulatory application

For ambulatory application, the acquisition module needs to be placed on the garment. Moreover, for wearability concerns, a complete garment (such as a T-shirt) would be preferred.



MRI application monitoring system



Possible design for the ambulatory application

Conclusions

A new method for monitoring anaesthetised or sedated patients under MRI examination and based on the use of optical sensors embedded into textile fabrics is presented. Such a monitoring system could allow for a higher number of sedated patients to be examined under MRI. Moreover this approach has the advantages of being transportable, reducing the burning hazard for the patient and giving more reliable signals. Further developments on the smart textile incorporating sensors for the acquisition of ECG, plethysmographic waveform and respiratory movements are currently performed within the OFSETH project.

Acknowledgment

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RFID

Opportunities and Challenges in Health Care

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Abstract: In a health care context, the use RFID (Radio Frequency Identification) technology can be employed for not only bringing down health care costs but also facilitates automating and streamlining patient identification processes in hospitals. Tracking elderly and disoriented patients in long term care cases, tracking mothers and their babies in maternity wards, ensuring the right procedure is being performed on the right person at the right time in surgical wards, a "smart" patient wristband that when scanned by RFID reveals patient name, date of birth, admitting orders, insurance information, surgical site, allergic reactions, medication requirements, and blood type are some of the innovative uses of RFID in the patient sphere. In this paper cited Opportunities and Challenges this technology in health care and application of RFID in institution that relative to health care organizations.

Key words: RFID, patient safety, healthcare

Introduction

Nowadays, nursing home and hospitals employ many different methods and devices in order to monitor their patient health. One of most common examples is emergency buttons. Patients and elders can press them and signal for help when they fall or have emergencies such as heart attacks. This type of device however is not effective for patients who have serious medical conditions are easily rendered unconscious. While some care facilities also carry some simple vital-sing monitors, this may be limited to checking a patient vital signs only once a week due to time and money needed to hire staff to handle the monitoring. When a patient health is only checked once a week, there is high possibility that his condition may worsen when the staff is not on duty. In addition, many care facilities also have the need to know the location of their patients no matter if they reside in the facilities or live in their own homes. This often involves the use of video cameras or significant wiring of expensive equipments, but it is often

inappropriate to have video monitoring system in the house of a remotely located patient.

Errors in medication and administration of drugs are one of the largest problems in health care field, costing up to \$ 145 billion annually. Furthermore, not only this problem costly, but they are also fatal, causing up to 98,000 unnecessary deaths every year.

Fortunately, RFID technology has recently opened up doors to many new applications. The scope of this paper is review RFID technology in health care.

Medical errors and RFID

These medical errors can be classified into five categories: poor decision making, poor communication, inadequate patient monitoring, patient misidentification, inability to respond rapidly and poor patient tracking. Employing RFID in correcting these deficiencies and meeting the Joint Commission on Accreditation of Healthcare Organization (JCAHO) patient safety goals is the current trend in enhancing patient safety.

What is RFID?

The abbreviation RFID stands for Radio Frequency Identification. It refers to a technology that uses radio waves for the remote exchange of data between an RFID reader and a so-called RFID tag, which is attached to a specific (mobile) object. The signals from an RFID chip (mounted on the RFID tag) are received by the RFID reader by means of an antenna.

The RFID reader translates the radio signal into a digital form, for example a tag identification number.

The RFID tag is also equipped with an antenna which can be used to add or modify data on the RFID chip.

RFID tags may be passive (requiring close proximity to a reader, and usually applied to track supplies), or active, in which the RFID tag contains a small battery to allow continuous monitoring (used mostly to track equipment).

RFID: passive or active

It can be active or passive. Active tags have a battery with a life of several years, a range of tens of meters and a larger data capacity than passive tags. A passive tag is requiring close proximity to a reader.

Outcomes of RFID in health care

The survey of the various examples of RFID applications in health care identified improvements in (certain aspects of) patient safety and the

optimization of processes as the principal objectives of the application of RFID. Reduction of costs is also an important objective.

RFID applications to healthcare

Category of applications is:

- Tracking and tracing patients
- Tracking and tracing medical Devices and equipment
- Tracking and tracing products and materials
- Tracking and tracing staff
- Tracking and tracing workflows

Tracking of patients/staff and RFID

- Tracking elderly and disoriented patients in long term care cases
- patient with Alzheimer disease who cannot give a history
- tracking mothers and their babies in maternity wards / Making newborns more secure
- right procedure /right person /right time in surgical wards
- Physicians can also use the RFID system to easily locate patients
- Emergency room medical equipment always available and automatic vital sign parameter monitoring

Tracking and tracing medical Devices and equipment

- identification systems for medical device equipment
- Track less duplication and loss of equipment
- Locate medical Devices and equipment and availability (monitoring of endotracheal tube position)
- manage medical equipment

Tracking and tracing workflows

The system helps to ensure less wasted time. It prompts staff when there are any delays in seeing patients and allows them to enter free text explaining why there was a delay, which is useful for audits later on.

Tracking and tracing products and materials

- Tracking and tracing of blood products tags can easily be attached to blood bags and can easily be read (right product and right patient) and blood products management
- Identification of laboratory specimen
- tracking of supplies from the factory to storage shelves
- drug administration

RFID and medication administration

The business case for RFID-enabled medication administration relates to the well-known "five rights" of medication administration: right patient, right medication, right dose, right time and right route.

Examples of RFID applications in countries

- The Massachusetts General Hospital/ location tracking system
- Heartlands Hospital / ENT department safe surgery
- US/ 80 hospital (RFID to link patients to EHR)
- In Germany/drug-dispensing system with RFID can reduce medication errors 5.1 to 2.4 percent
- Singapore/trace health care workers, patients (SARS outbreak)
- The Food and Drug Administration (FDA) safety and security of the nation's drug supply / Passive RFID

Benefits of RFID

- Retrieval of data on contacts between patients and medical and paramedical personnel has been reduced from six hours to around half an hour (the SARS issue)
- Patient safety has improved because information on the patient appears immediately on the screen when the patient is brought into the operating theatre
- Improved coordination of the surgical throughput procedure; Recording of events against time delivers improvements in processes;
- Patient satisfaction has increased due to reductions in waiting times and bed occupancy periods and improvements in internal transport services;
- The number of morning discharges has been improved by 21%;
- The mean time required for the inputting of admissions, discharges and transfers has been improved by 85%, allowing beds to be reoccupied more quickly;
- Staff morale is improved because staff is sent on fewer fruitless „errands" and loses less time when responding to call-outs.
- Locate patients and hospital staff.
- Use this technology to improve patient and family experiences at your hospital.
- Prevent precious losses. Place tags on babies' ankles, and create security alerts or engage door locks to prevent unauthorized exits.
- Improve patient experience for new parents.

- Tag critical items for up-to-the minute inventories.

Four components of information security

- **Confidentiality** means data and information are disclosed only to authorized persons, entities and processes at authorized times and in the authorized manner. This ensures that no unauthorized users have access to the information.
- **Integrity** means data and information are accurate and complete, and the accuracy and completeness are preserved. This ensures that the information is correct and has not been improperly modified.
- **Availability** means data; information and information systems are accessible and usable on a timely basis in the required manner. This ensures that the information will be available when needed.
- **Accountability** is the application of identification and authentication to ensure that the prescribed access process is followed by an authorized user.

Conclusion

Hospitals can regain control and significantly reduce costs by using RFID (Radio Frequency Identification) technology to track clinical staff, patients, supplies, medication and equipment. RFID technology and location systems improve staff efficiency, reduce theft and loss of equipment, and can provide a secure system for controlling medications and blood products. RFID technology can be used in a number of ways to improve the efficiency of the hospital, and therefore improve patient outcomes. RFID can be used to manage medications and inventory. It can track physical objects, such as film & lab specimens and tie them to the patient's electronic records. Using RFID technology can eliminate time wasted searching for supplies and equipment, allowing nurses and doctors to focus on the patients. In addition to, when staffs in health care organization use RFID they ensure four components of information security.

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Short Message Systems for Health Promotion

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Abstract: This report summarizes the health problems of 21st century lifestyle and examines the attributes of Short Messages System SMS to health promotion with reference to relevant innovative applications of SMS. This report is based upon a comprehensive cross-referenced internet literature search and review of both clinical studies and grey literature.

Background

In the western world increasing affluence and improving medical technologies mean that people are living longer and, as a result, more are living with chronic conditions¹. Societies face the challenge of delivering quality Healthcare to all their citizens, at affordable cost and increasingly there is a realisation by policy makers for the need to prevent diseases through education and awareness.

*One of the greatest challenges facing the NHS today is the promotion of 'healthy living'. Major health problems such as obesity, smoking, alcohol abuse and sexually transmitted disease are the consequence of choices that people make on a day-to-day basis.*²

The cost of poor lifestyle choices is significant.

The most common sexually transmitted infection (STI) in England is chlamydia and the number of diagnoses has increased steadily since the mid-1990s. The annual cost of chlamydia and its consequences in the United Kingdom is calculated to be more than £100 million.³

In 2002, poor nutrition accounted for 4.6% of the total disease burden in Europe⁴ whilst obesity which affects up to a third of the adult population in Europe creates a major economic burden through loss of productivity and income, and consumes 2-8% of overall health care budgets⁵. In the UK the full cost of obesity and overweight people is estimated to be in the region of £7 billion a year. The combined cost for treating conditions relating to alcohol and smoking is £3.4 billion a year.⁶

These problems are escalating, for example obesity has tripled in many countries in Europe since the 1980s, and the numbers of those affected continue to rise at an alarming rate, particularly among children. The issue is leading experts to pessimistic conclusions for the future if poor lifestyle choices are not modified;

*‘ .. the steady increase in life expectancy that has marked the 20th Century may reverse itself in the 21st, and far too many of the next generation could end up dying before their parents’.*⁷

To promote ‘healthy living’ new strategies are called for since clearly the message is not getting through. Increasingly developments such as the informed patient⁸ and expert patient⁹ are helping to mobilize the biggest resource available to tackle this problem, the public themselves. These reflect the growing adoption of partnership approach to healthcare between the patient and the healthcare system and will help shift the responsibility and control from the clinical practitioner to the patient/individual.

One of the observable issues currently taking place across Europe is the struggle to develop and implement national patient databases fed by primary, secondary and community care systems. These are ambitious and challenging programmes requiring an enormous investment of resources over many years. At the same time technology developments are being harnessed in small but innovative ways to bring quick beneficial results improving care processes and the lives of patients. These require relatively small amounts of resources and increasingly employ current consumer equipment such as mobile phones, SMS and the existing skills and knowledge of the patient/individual in using these devices.

The key attributes of SMS applicable to health promotion are identified in Table 1, categorised into receiving and sending attributes, and these are then highlighted with reference to innovative uses of SMS in section 2. These applications are smoking cessation programmes in the UK, sexual health advice in Australia and weight loss and nutrition guidance in the UK.

Key Receiving Attributes	Key Sending Attributes
K1 Widespread ownership of mobile phones and SMS usage.	K5 Speed of transmission
K2 Convenience and Storage ability	K6 Low cost to send message
K3 Personal and Private	K7 Ease of Administration
K4 Social Communication	K8 Ability to integrate with applications
K5 Speed of transmission	K9 Ability to target population segments
K6 No cost to receive message	

Table 1

Characteristics of SMS for use in Health Care promotion K1 Widespread ownership of mobile phones and SMS usage.

Mobile phone Ownership

Whilst it is known that some people have more than one phone it is clear for the figures in table 2 that in the developed world the vast majority of people own and use one. Table 3 shows the staggering number of mobile phones in existence.

	UK	France	Germany	Italy	USA	Japan
Mobile connections per 100 pop	108	77	96	123	70	71

Table 2 Source: Ofcom Office of Communication The International Communications Market Report 2006 2 Telecoms

	UK	France	Germany	Italy	USA	Japan
Mobile phones (million)	69.657	51.662	84.3	71.5	233	101.7

Table 3 Source Central Intelligence Agency The World Factbook

Given the widespread ownership of mobile phones the equally impressive figures on the use of SMS is possibly not surprising. In the UK in 2006, 41.8 billion text messages were sent and on New Years day 2007, 214 million were sent. 2006 saw a 38% increase on the previous year and whilst the forecast for 2007 had been 45 billion text messages, the latest estimate is now 52 billion. In September 2007 texts were being sent at the average of 4000 every second.¹⁰ All across Europe the statistics for SMS growth are very similar. Table 4 shows the SMS figures for Finland (where in 1987 Nokia produced the first mobile phone blueprint).

Year	Short messages, thousands	Change, %	Short messages/ subscription
2002	1 324 668		293
2003	1 647 218	24,3	347
2004	2 193 498	33,2	439
2005	2 728 230	24,4	507
2006	3 087 998	13,2	544

Table 4. Numbers of outgoing short messages from mobile phones and short messages per subscription on average from mobile phones in 2002-2006
Source: Telecommunications 2006, Statistics Finland

SMS usage has surpassed all expectations and is now one of the most widely used methods of communication in the developed world and an essential personal item for all age groups. According to Statistics Finland, in 2004 only four out of a hundred 15 to 64 year olds did not have the use of a mobile phone.

Mobiles and SMS are used across all social levels but the age range is skewed towards the younger ages which have advantages for certain types of health promotion such as sexual health. In London the strategy is to reduce smoking prevalence, paying particular attention to achieving a reduction in those groups most at risk (unemployed people, manual labourers, pregnant women, younger people and specific communities with high incidence). Text messaging is an excellent method of uniformly addressing a population across different socio-economic strata since ownership of mobile phones is evenly spread across these groups.

K2 Convenience and Storage – given the portability of mobile phones the receiver of the message can be located anywhere at any time and this increases efficiency by the fact that individual can be reached directly. The phone can be on silent in certain situations eg at work and the SMS can still be read. The message can be stored for reference and the content retrieved many times at the user's convenience. Furthermore, messages sent to a mobile phone that is switched off are stored at an SMS Centre and delivered when the handset is switched on again. Until mobile internet devices are more advanced and widespread health programmes employing only websites will need to have a computer switch on and this will be a barrier to usage. In the Australian Sexual Health campaign young people are encouraged to send an SMS message "sexinfo" to the number 19SEXTXT. They receive a menu of sexual health topics from which they can then select to receive information. Alternatively they can skip the menu by text the choice directly.

In the UK the one Mobile program allows weight watchers to keep food diaries and find healthy alternatives to food items by typing in part of the product's barcode. It links to a database containing nutrition information on 30,000 food items and products and retrieves the fat and calorie content of the item. The system helps users to track their weight against a target and can be downloaded onto compatible mobile phones by reverse-billed SMS. The system has been given clinical guidance by Dr Campbell who emphasizes the motivational aspect of SMS in that "*When trying to lose*

weight, it's very hard to maintain that initial motivation. The mobile system makes weight loss easier because it's always there and always ready, keeping you on track; a bit like a weight loss coach in your pocket."

K3 Personal and Private – a mobile phone belongs to the individual and increasingly is an essential item that people carry with them. From a privacy perspective the owner can ensure that no one else reads the message. SMS messages can be sent anonymously to further protect the confidentiality of the individuals involved. In Australia an initiative of Marie Stopes International has developed sextxt™ to provide accurate information and advice for youth on sex, sexually transmitted infections (STIs), contraception, sexual health services. Sexual health information is delivered via SMS text message in a private and timely way. The sextxt™ website provides additional information on sexual health topics to ensure young people are fully equipped with the facts they need. Sextxt™ aims are to educate young people on sexual health issues and to reduce rates of unplanned pregnancy and STIs. The Royal Free Hospital in North West London implemented an “Out-of-Hours” booking service for their Genito-Urinary Medicine (GUM) and Sexual Health clinics to provide a 24 hour appointment service that is totally confidential. Previously clients were unable or unwilling to call or visit their local clinic during working hours and faced long queues if they phoned the hospital. In response to the problem the hospital in partnership with an ICT company implemented the use of SMS for appointment. Clients are given a specific number to text and are offered appointments by text. Patients respond by selecting the most convenient time and their phone number is used as a temporary identifier. The appointment is confirmed by text with a booking reference.

K4 Social Communication - The Social Issues Research Centre in the UK carried out an interesting piece of research into how mobile phones contributed to social communication. The main conclusion was that texting helped restore our sense of connection to a community re-creating the brief, frequent, spontaneous 'connections' with members of our social network that characterised the small communities of pre-industrial times.

*In the fast-paced modern world, we had become severely restricted in both the quantity and quality of communication with our social network. Mobile gossip restores our sense of connection and community, and provides an antidote to the pressures and alienation of modern life. Mobiles are a 'social lifeline' in a fragmented and isolating world.*¹¹

Texting was identified as having particular importance in maintaining contact with a wide social network allowing us to maintain social relationships when we do not have the time for phone calls or visits. The report found that texting helps people to overcome their inhibitions and

develop communication and social and skills. Individuals communicate with more people, and more often, than before mobile phones. Text message is often used as a 'trailer', alerting friends to the fact that you have something to say, but saving the details for a phone call or meeting. These characteristics add an interesting dimension to SMS that can be exploited by Health promotion. Some people often distrust messages from 'official sources' and are more likely to listen and respond to the same message when received from a more culturally familiar source.¹² In addition health promotion using this vehicle for non-sensitive general material may have the additional advantage of being shared with friends increasing the number of people receiving the message.

K5 Speed –SMS messages usually reach the recipient within seconds and a delivery receipt can be added to the message to confirm that delivery has taken place. The recipient can also respond quickly vastly speeding up feedback loops. In North London a GP Practice manager said *'Many of our own surgery staff was amazed at the rapid response, as the majority of patients responded within minutes. If we had run the same campaign using letters we would generally have to wait a few days to get any response.'*¹³ Using text messaging the response rate was reported to be six times more effective than traditional methods.¹⁴

K6 Cost – Texting is relatively cheap compared with land mail and increasingly in the UK service providers are offering large number of free texts as part of the contract. It is even more cost-effective when the administration and material costs associated with sending a letter are taken into account. Text messages also have the comforting feature of being fixed in price, whereas phone calls are usually charged by time units consumed

K7 Application Integration – SMS messages can be integrated with other computerised applications and messages can be sent computer to person and vice versa. The restrictions of SMS, which are a function of its size, are almost an advantage in simplifying the programming task. A survey conducted by SMS is almost forced to simplify requests to 'Yes/No' answers and simple numeric data entry and this has the benefit of minimising the burden on the respondent. In the London area covered by the City and Hackney Primary Care Trust the SMS messaging system is integrated with the GP electronic record system enabling them to target patients who smoke to obtain updates about patient's smoking habits, invite them to stop smoking clinics, and provide on-going support. In Manchester¹⁵ health authorities have used SMS text messaging campaigns to increase accessibility to the Stop Smoking service. People can now contact the service outside normal working hours and receive information immediately. They can send an SMS message to the Stop Smoking Service

and then receive a call advising them of various support options such as the nearest drop-in session and pharmacies able to offer advice. There are different mediums used to promote the service including the Galaxy radio station and using beer mats in pubs. By asking people to text a key word such as 'Galaxy' the health authorities are able to analyse the success of each method of promotion.

K8 Ease of administration -The 'one-to-many' feature of SMS systems allows messages to be sent to many recipients simultaneously and potentially could be in different languages for areas with multi-ethnic populations. These messages can also be from a pre-written list, reducing administrative time and effort but bespoke messages can also be sent. The London Practice Manager quoted in K5 also said: "*Using letters and even calling up patients to invite them to the surgery is a huge drain on surgery resources and staff time... we can contact hundreds of patients instantly without having to stuff a single envelope..*"¹⁶

K9 Targeting – The ability to integrate with software applications enables effective targeting of certain health promotion campaigns. The primary care system supplier, In Practice Systems, has software that allows patient databases to be searched for particular demographics, such as new mothers. A sub-search in the results can then be done for those with mobiles. The patient list can be reviewed manually and a text message can then be sent to each mother alerting them to services such as post-natal clinics.¹⁷

A recent study concluded that SMS is an acceptable medium for targeting young people to receive sexual health information. The majority of participants considered it as a very good or good communication method.¹⁸

Conclusion

An observation has been made that '*Human biology is ill-equipped to cope with twenty-first-century lifestyles*'¹⁹ It is widely recognised that action is required to deal with this, '*Objectives to improve health outcomes and tackle key risk factors, such as smoking and obesity, need to be given equal weight*'²⁰.

One method that can be employed is to use the strengths of twenty-first-century lifestyles to overcome the health issues arising from twenty-first-century lifestyles. Many individuals carry their mobile phones 24/7 and it has been stated that whilst in the US, a mobile phone is considered to be just a tool by contrast in Europe, a mobile phone is a lifestyle and that many people look to the mobile as a central source of innovation.²¹

Speaking about the unprecedented increase in obesity the World Health Organisation said that, '*The epidemic now emerging in children will*

markedly accentuate the burden of ill health unless urgent steps with novel approaches are taken ...'.²² Whilst there are many innovative uses of SMS in health promotion there are still major benefits to the health of the population to be achieved but to realise the potential SMS communication needs to be embedded within a far greater range of applications. As recommended by Atun and Sittampalam, '*... the policy assessment should include consideration of how to introduce promising SMS applications at scale and in a systematic way, in order to ensure that their fullest potential is realised*'.²³

Health authorities alone are unlikely to have the necessary skills and resources for this, '*Member States' failure to achieve nutrition and food safety goals is due to a lack of resources, expertise, political commitment or intersectoral coordination preventing proper implementation of action plans.*'²⁴ To tackle the problem stakeholders outside the health arena need to be actively encouraged to develop innovative systems as stressed by the Health Select Committee in the UK, '*...future healthcare will be underpinned through working in partnerships – between individuals, communities, business, voluntary organisations, public services and government.*'²⁵

SMS Applications

Smoking Cessation programmes in:

Islington PCT - www.islingtonpct.nhs.uk

City and Hackney PCT - www.chpct.nhs.uk/index.asp

Manchester PCT - www.manchesterpct.nhs.uk/health/stopsmoking

Nutracheck www.nutracheck.co.uk

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TEMOS – Integrated Services for the Medical Support of Travellers and Expatriates

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Abstract: The TEMOS project tries to reduce the lack of information about good medical care when staying abroad as traveller or expatriate by developing an international database on hospitals, by certifying hospitals and other medical institutions abroad which provide medical care at the state of the art and by offering second opinion and teleteaching services by international medical experts on a telemedical platform. Internet based communication turned out to be most cost effective when no guaranteed broadband connection is necessary [8]. The costs for telemedical expert consultations have been analysed in this study. The results demonstrate that the cost-effectiveness of the provision of medical expertise in a telemedical environment among other factors highly depends on a sufficient workload of the telemedical expert centre.

Introduction

In the last 60 years the number of person arrivals is growing continuously from 25.3 millions in 1950 to 802 million in 2005. Forecasts expect 1 billion person arrivals in 2010 and 1.5 billion in 2020. Furthermore 36 million expatriates live and work in foreign countries. 1% to 5% of these need medical support during their stay and 0.1% to 1%, respectively, are repatriated by air each year. When visiting countries with special health risks and/or cultural differences, travellers often lack of information where to go in an emergency case, whether the diagnosis of the foreign doctors is reliable, whether the quality of treatment is all right or whether repatriation is necessary. Usually assistance companies involve contracted physicians to get into contact with the medical staff on site to discuss the further treatment of a patient abroad. This approach is mostly sufficient, but in complicated cases patients and / or the treating physicians desire a second opinion of a medical expert. TEMOS tends to provide such expert second opinion services. But only little is known about the costs and cost-effectiveness of telemedical second opinion processes. Whitten et al. [1]

stated that there is no persuasive evidence proving telemedicine to be cost effective in delivering health care because of the small number of health economic studies on telemedicine and their quality. The results of Jacklin et al. [6], Sicotte et al. [2], Davis et al. [4] or Chua et al. [5] for example showed an increase of costs for telemedical in comparison to conventional care. Davis et al. [4] pointed out that to be cost effective the minimum case number of their teleneurology service should have been 247 instead of the 52 cases observed in the study period. Sicotte et al. [2] could demonstrate a decrease of patient travels to tertiary care centers causing savings for travel costs which were however completely consumed by costs for the telemedical equipment and its operation. In [5] Chua et al. determined higher costs for teleconsultation even without including the costs for the technical equipment. The reason was an increased number of additional investigations in the telemedical group. In comparison to a second opinion service in TEMOS all projects cited here replace conventional with telemedical consultation and analyze the cost-effectiveness from a socio-economic view. TEMOS' second opinion service however is an additional service for travelers and medical institutions abroad.

Objective

To develop a cost-calculation scheme to determine the costs of telemedical second opinion services to be offered by TEMOS.

Methods

In a first step, during the pilot operations of TEMOS, we performed a comparative analysis between ISDN-, satellite- and Internet-based communication costs to determine the most cost-effective platform [8]. Internet based communication turned out to be the most cost effective tool for each participating site when sufficient bandwidths are available and guaranteed bandwidth is not mandatory. In a second step we compared the costs for teleconsultations provided by TEMOS using the different telecommunication technologies. Only costs relevant for the TEMOS Telemedical Reference Center (TTRC) at DLR and for the TEMOS Telemedical Expert Center (TTEC) have been included into the calculation. Costs arising in hospitals or clinics abroad don't make part of the calculation.

Results

The TEMOS second opinion service is requested by foreign hospitals via a medical communication platform. Physicians specify the medical

discipline of the specialist needed for consultation, express the medical problem and upload relevant medical data to the platform. A physician at the TTRC coordinates the appointments. The session results are documented by the participating physicians. Sessions are accompanied by technicians who perform user training too.

cost entries	costs/year	cost entries	costs/session
work station TTEC	7340 (6340)	technician TTEC (1.5 hrs)	15
work station TTRC	4365 (3365)	technician TTRC (1.5 hrs)	23
satellite terminal	1190	Medical coordination TTRC	30
service work stations	1300	administration/billing	14
room charges	1800	Medical expert (1hour)	67
room cleaning	60	SatCom	35
power consumption	200	ISDN (384 Kbit/s)	33
basic fee SatCom	600	ADSL	0
basic fee ISDN	600	Medical platform (per case)	10
basic fee ADSL	400	Telephone	4
user training TTEC	2000		

Table 1: Cost entries for the TEMOS second opinion service

Table 1 lists all relevant cost entries. On one hand annual fixed costs make part of the calculation. On the other hand costs per session are listed.

Depending on the communication platform used the telemedical work stations enter the calculation with or without the multichannel ISDN video conferencing equipment of about Euro 4,000 each. The work stations are charged off after 4 years. Fixed costs per session are €163 (Internet), €196 (SatCom) and €198 (ISDN), respectively. The part of yearly costs decrease with the number of cases.

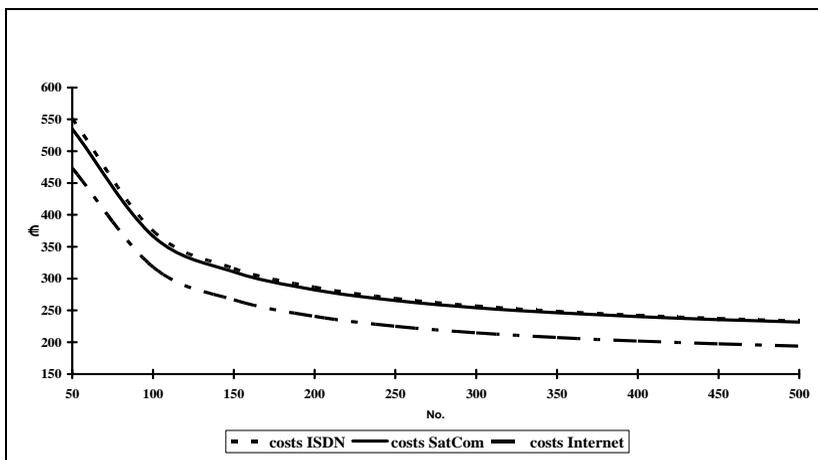


Fig. 1: Comparison of costs of teleconsultations in relation to number of cases and communication platform used

Figure 1 shows that Internet communication is the most cost effective platform, about 40 Euro cheaper than ISDN or SatCom. After reaching a number of about 250 consultations the costs for each consultation are almost stable. (€267 ISDN, €265 SatCom, €225 ADSL/Internet)

Discussion

The analysis documents on one hand that the major fraction of the costs for telemedical second opinion services is consisting of the session related costs like personnel or communication costs when having reached a minimum number of 200 cases per year. At this point high end / high cost equipment does no longer influence the costs per session significantly. But this also implies that teleconsultation services can only be offered to customers at an interesting and stable price once a critical mass has been reached.

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The Digital Life Centre: a Living Lab for Education in Real World Situations

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Abstract: This paper presents two projects in the field of care and technology in which students are trained in real environments.

Introduction

ICT is entering our daily life with a tremendous speed. Look at new multimedia communication and entertainment, home intelligence, digital care and mobile information systems. Our life is getting 'digital', and many business opportunities show up.

Research institutes and laboratories of large companies develop a great deal of knowledge in this domain. Unfortunately much of this knowledge is not used in novel innovations in companies, especially small and medium size companies miss good contacts with large research institutes.

At the Institute for Information Engineering in Almere, part of the Professional University of Amsterdam, the educational concept is focused on 'learning in practice'. Students spend 60% of their time in companies and 40% of their time in school. Twice a year the students start a new project in which the company defines the end products, the student finds its educational path and the institutes guards the level of the educations. Such a project is called a 'Comakership'.

Recently we started the 'Digital Life Centre' in which we carry out research projects in the field of Digital Life and Domotics. We have two main lines: entertainment and media, and care. In this paper we briefly illustrate two care projects.

Skillslab

The Skillslab project was set up to come to a better cooperation between the care institutes (the professionals working in the care institutes as well as the end users/patients), the different institutes for vocational and higher vocational education (nursing, technology and ICT), and the technology companies involved in home automation.

A ‘physical’ lab was planned in Amsterdam-West within one of the larger care centers. The aim of the lab was

- To develop and implement domotics systems for care in joint collaboration between companies, care institutes and students from different education
- To test these systems with the end user/patient
- To develop systems for practical exercises for students from care educations

Although we started with a setup within the care institute (a home for elderly persons), it appeared to be very difficult to get students (especially lower level vocational training nursing and technology) to spend independently doing research within the care institute. Therefore we decided to make systems for practical training within the educational institutes. In collaboration with ‘Smart Homes’, a knowledge centre for domotics special ‘building block systems’ were made for the vocational schools (see Fig. 1).



Figure 1. Left: example of building block system for training with ‘domotics systems’. Right: Students nursing and ICT at the kick off of the joint program

Apart from setting up a physical lab, we also started educational programs to bridge the gap between technology and nursing students. In the context of the minor Digital Life (a minor is a 30 ect program of courses at the Professional University Amsterdam) we defined 5 collaboration projects where students from ICT collaborated with students from occupational therapy or nursing. One of those projects (‘Paladijn’) will be discussed in the next section.

The students worked for 20 weeks on projects involving ICT in care applications, such as a sensor network for monitoring elderly with

beginning dementia, video communication with a care centre, or a wayfinding system for elderly. The collaboration was very good for most of the groups. All projects were application driven: all of the research questions came from companies or care institutes. In the evaluation students indicated that they learned a lot about the other field.

Paladijn

Paldijn is an apartment building where 12-19 young adults with a cognitive handicap live under limited supervision. A project group of students and an advice company studied the safety in the building. For the caregivers it is not always possible to see who are in the building, where somebody is located, whether there are visitors and whether the visitors were invited or uninvited. The study was divided into two parts: a technical study and a user study. The first was focused on existing technology for observation system and was mainly carried out by the ICT students. The user study was carried out by the students occupational therapy. They specifically focused on the limitations and possibilities of the inhabitants, and which ICT applications can be used by them. The study was finalized with an advice report.

Conclusions

In our experience, short applied research projects in which students participate and take place in companies or institutions are a very efficient way for knowledge transfer. The 'comakership' format as used in the Digital Life Centre of the Institute for Information Engineering in Almere is a perfect implementation of such novel educational methodologies. Multidisciplinary teams are a prerequisite for running complex projects as care and ICT, and have to be formed during education.

Acknowledgment

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Chapter 11

Efficiency in eHealth

Implementation and Maintenance Costs for a Telehealth System in Brazil

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***Abstract:* The operation of Minas Telecardio Project for 18 months and the implementation of the National Telehealth Project gave the opportunity to evaluate the economical feasibility of telehealth systems in Minas Gerais, Brazil. The preliminary results have shown that the savings resulting from a 1,5% reduction on the number of treatments outside the village is enough to cover the operational cost of the system.**

Introduction

The State of Minas Gerais in Brazil has a large territorial dimension (586.528 km², equivalent to France territory) and a population of 19 M inhabitants living in 853 cities (60% with less than 10,000 inhabitants) with a wide social, economical, cultural, geographical and infra-structural contrasts. The average HDI is 0.718, but with values as low as 0.568 in the north and northeast regions, far from specialized medical assistance. Within this context, it is proved the necessity to deeply use information and communication technologies in health care with two main objectives: (i) to bring adequate medical care for the population living in remote villages and, at the same time, (ii) to support the professionals that are settled in distant and poor regions in the state. By other side, financial resource in Brazil, as a developing country, is highly demanded and consequently its application must highly be optimized

The challenge for implementation of a telehealth system in such conditions was addressed through the Minas Telecardio Project[1,2], implemented with the financial support of Fundação de Amparo a Pesquisa de Minas Gerais (FAPEMIG) and the State Department of Health of Minas Gerais. It has been operating since June 2006 in 82 remote and isolated villages in the state.

Based on successful telehealth experiences in Brazil, in particular the Minas Telecardio Project, the Ministry of Health through its Office of Labor and Education Management in the Health System (SGTES), decided to implement the National Telehealth Project[3], with 900 points in nine Brazilian states, to support the primary care. In Minas Gerais the Telehealth Center of the University Hospital of UFMG was responsible for 50 points. For these projects a fundamental financial question is addressed: “what should be the reduction of the number of patients sent to be treated at the secondary level in order to compensate the operational cost of such projects”.

Economical Analysis

Project's Economical Sustainability

Of course the main motivation for the government to implement telehealth systems in Brazil are the social benefits they bring to the population. Although the government presently supports financially these projects, in the future they must be sustainable economically by promoting cost reductions sufficient to cover their operational costs. The experience on Minas Telecardio implementation and operation since June 2006 allows measuring the costs for implementation and maintenance of telehealth systems in remote and isolated areas in Minas Gerais. In order to evaluate the economical sustainability of the system it is necessary to measure the impact on municipal finances where the project is implemented, i.e. to measure the costs related to patient sending to secondary level prior the project implementation. The implementation of the National Telehealth Project was an excellent opportunity to evaluate these costs in villages where the project was going to be installed.

The adopted model for assistance in both projects consists of a telecardiology duty service responsible for an immediate analysis of electrocardiograms sent electronically and teleconsultations, on line and off line, involving some specialties. The system is also used for training primary care professionals.

Implementation Cost

The structure of the Minas Telecardio Project consists of the Telehealth Center of University Hospital of UFMG acting as a coordination pole and four other university centers located in different regions of the state acting as regional poles. The implementation phase consisted of formation and training of the teams at the five poles, specification and purchase of equipments and software, technical visits to all villages and training of

clinical and technical local teams on system operation. The costs for implementation of the project are shown on Fig.1

Maintenance Cost

Once the system is installed, the maintenance costs consist of those related to operate the system, i.e. telecardiology duty services, specialized medical services for teleconsultation and teleconferences, technical and administrative staffs and travel expenses. To have an idea of the size of operational cost, the accumulated numbers reached by December 2007 by the Minas Telecardio Project are 33,702 electrocardiograms, 1,029 urgency support services to local doctors and 385 teleconsultations, serving 428,141 inhabitants. Maintenance costs are shown in Fig.2.

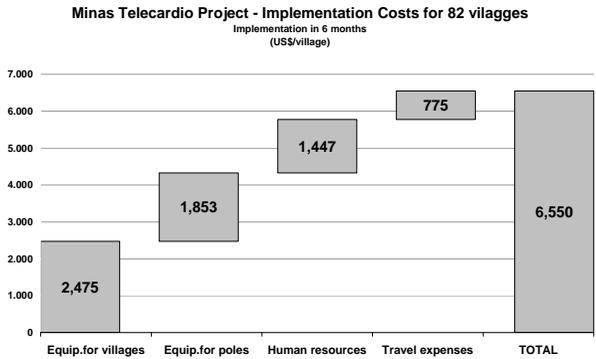


Fig. 1 – Implementation cost deployment for Minas Telecardio Project

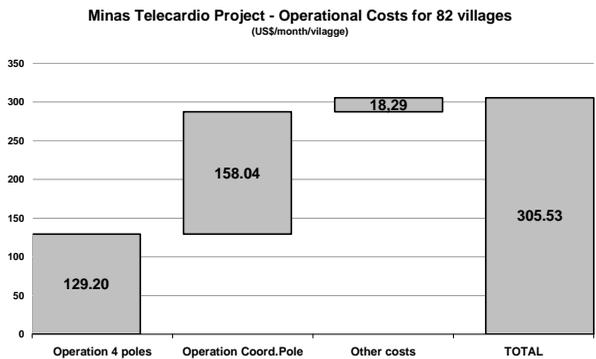


Fig. 2 – Operational cost deployment for Minas Telecardio Project
Patient Sending Cost

The numbers shown below are preliminary values of a cost study related to patient directed to secondary care outside four villages in Minas Gerais (out of 40 to be studied). Table I shows averaged values related to transferring costs of patients to secondary care level in these villages.

Average monthly number of patient transferred per 1,000 inhabitants	33
Average distance (km)	183
Average cost per patient (US\$)	85.41
Average monthly operation cost of the project per village (US\$)	305.53
Necessary reduction on the number of patients transferred to cover operational cost	3.58

Table I – Transferring costs of patients to secondary care level

Conclusion

Based on Table I and considering the operational cost as 305,53 US\$/month, for the four villages analyzed the average % of reduction of number of patients sent for outside treatment necessary to pay the operational cost is 1.5%.

As a preliminary analysis, considering the smallest village in the project (2,140 inhabitants) has, extrapolating the results found for the analyzed villages on Table I, $2,140 \times 33 = 70$ outside treatments per month. For this village, if the project reduces the number of patients sent for outside treatment by 5% ($3.58/70$), the saving will be enough to cover the operational cost. Villages with larger population will require smaller % of reduction to make the project economically feasible. The present results of the Minas Telecardio Project, with average 30 ECG/month/village, with 70% outside treatment reduction[4], demonstrate largely the economical feasibility of the telehealth system for villages with similar characteristics as the ones shown in Table I in the State of Minas Gerais.

Acknowledgment

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The Implementation Experience of a Telehealth Center in a Brazilian University Hospital

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Abstract: HC Telehealth Center (Brazil) implementation history and experience on developing a large scale telehealth system (159 villages) with focus on telecardiology (43,999 ECGs) are described. Also lessons learned from in field work are commented in order to understand the successes and failures of telehealth applications.

Introduction

The objective of this work is to describe the implementation history of the Telehealth Center of the University Hospital (HC) of UFMG in Brazil and its experience since the first activities in 2001. The first steps in telehealth at HC started as part of the Information Technology Center, responsible for all IT activities at the hospital. The objective was to develop a telehealth model able to connect the university to the public primary health care system, using low cost technology and with large social impact.

The first phase, starting in 2001 and until 2003, consisted of training the team about the concepts and technologies applied to telehealth systems, in a partnership with the Centre Hospitalier Universitaire de Rouen (France). The main activities to development a telehealth model consisted, at the beginning, of evaluations of different types of telecommunication networks and softwares. Simultaneously the development of specific software for teleconsultation management had begun.

These initial concepts were then applied to a project coordinated by the Municipal Health Department of Belo Horizonte (the state capital) to support professionals of the city's primary care system in 2004, having as partner the University Hospital [1]. The BHTelehealth Project was initially sponsored by European Commission (until 2006) as part of the @LIS Project HealthCareNetwork and after by Brazilian Ministry of Health [2].

After this initial experience and recognizing the importance of ICT to help the HC to fulfill its mission, in 2005 the hospital administration

decided to create a specific sector to deal with all its telehealth activities and to be named “HC Telehealth Center”. In this same year, the State Department of Health of Minas Gerais and Fapemig (*Fundação de Amparo a Pesquisa de Minas Gerais*) decided to financially support a larger scale project of telehealth, with focus on telecardiology, involving 82 isolated and remote villages in the state: the Minas Telecardio Project coordinated by the HC Telehealth Center[3,4].

In sequence other projects based on the model were implemented, such as the National Telehealth Project (2006)[5]. Supported by the Brazilian Ministry of Health, this project increased the activities of the HC Telehealth Center, expanding its geographical enclosed area.

Presently the Center has 22 collaborators and in January 2008 was connected to 135 villages and towns in the State of Minas Gerais, 10 towns in the State of Ceará and 14 Municipal Health Centers in Belo Horizonte.

Telehealth Model

In view of the large territorial extension of the state, the HC Telehealth Center established a partnership with four other universities along the state and their respective school hospitals: Federal University of Uberlândia, Federal University of Triângulo Mineiro, Federal University of Juiz de Fora and State University of Montes Claros, establishing a Telecardiology Network in Minas Gerais [6]. The system links academia to primary care through teleconsultations, second opinion, analysis of electrocardiograms by distance and permanent education. The focus is on telecardiology, however other medical specialties are involved, as well as nursing and nutrition.

The criteria considered to choose the participating villages involves localization (remote and isolated areas), low HDI, explicit interest of the municipal management, real necessity of the Telehealth system, level of implementation of the Family Health Program (PSF) and a reasonable internet connection. All participating villages receive a set of equipment composed by microcomputer, webcam, printer, digital 12-lead ECG and digital camera.

The implementation process is executed in 8 phases [7]:

1. General motivational meeting at the Telehealth Center involving all municipal management and clinical staff,
2. Planning of implementation, time and team requirements,
3. Specification and purchase of software and equipments,
4. Tests and technical support to improve internet connection quality at the villages,
5. Visit to all villages,

6. Training technical and clinical local staff on the system at the Telehealth Center,
7. Equipment delivery by the end of the training section.
8. Start up of activities.

The clinical Telehealth activities started in June/2006 consisting of:

1. Duty service in Telecardiology: three cardiologists stay on duty for 12 hours a day at the university centers to receive and analyze the ECG sent by local doctors in the villages. The specialists in duty discuss, when necessary, the clinical case with the local doctor using the Telecardiology system, supporting them mainly in the conduction of urgency cases.
2. Teleconsultation or second opinion on other specialties: the local doctors can discuss a specific clinical case with a specialist of the university centers. The system permits both on-line and off-line teleconsultations.
3. Educational support to the Family Health Program (FHP): lectures are delivered by the universities specialists, discussing on line with the local doctors specific subjects previously defined with them.

Results

From June 2006 to January 2008 the accumulated numbers reached 43,999 electrocardiograms, 1,275 support to urgency clinical cases and 519 teleconsultations, serving 1,486,465 inhabitants in 159 villages and towns, through 392 duty services. The evolution of the results can be observed in the figures below.

Besides these numbers, the financial and social impact of such telehealth experimental activities on these villages resulted in the decision by the State Health Department of Minas Gerais to transform them in a telehealth service with focus on primary care in the state. For 2008, 97 additional villages have already been selected to be implemented in order to reach a total of 500 points along the next two years.

Conclusion

The main lessons learned from these first eighteen months of operation of the Telehealth Center are:

1. Telehealth systems should be implemented in regions that have a real demand for such services, i.e. remote, isolated and poor villages (those should be the priority criteria),
2. Patience and persistence are the most important ingredients to convince people to adopt a new way of working,

Telehealth Center
Villages and Towns connected

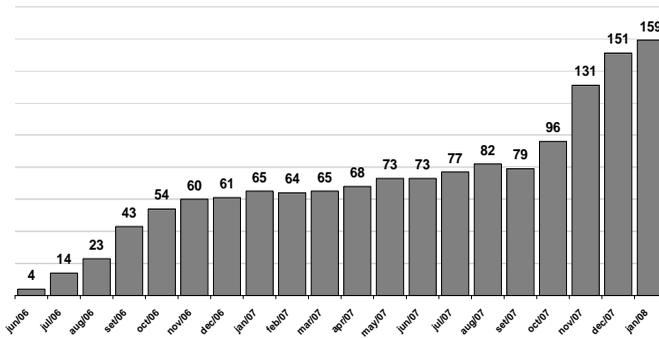


Fig. 1 – Number of Villages connected

Telehealth Center
Served Population x 1.000

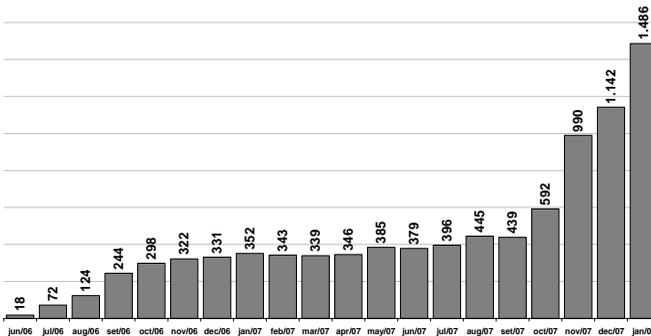


Fig. 2 – Number of served population

3. Local managers and clinical staff accept the teleassistance when they realize that it will solve their daily public health problems,
4. The system operation should be as simple as the local users,
5. Technology is the way of doing not the objective itself, consequently it should be according to the real local conditions,
6. Face to face meetings are necessary activities before virtual ones to establish confidence and friendly relationship,
7. To keep the results, an efficient management system is essential.

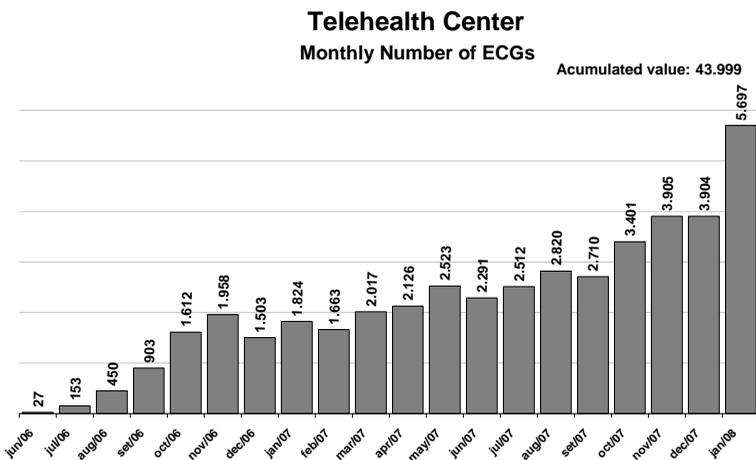


Fig. 3 – Monthly number of ECG

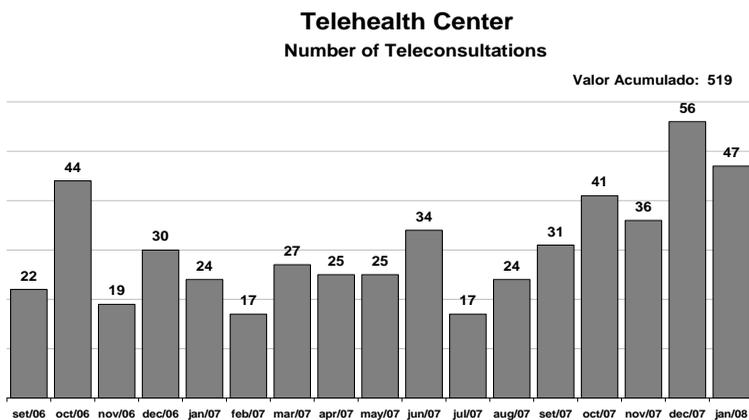


Fig. 4 – Number of teleconsultations

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The Implementation Experience of the National Telehealth Program in Brazil

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***Abstract:* The implementation of a telehealth program in a complex country like Brazil, with large regional contrasts, has been an excited experience which has given important and practical lessons that can help similar initiatives.**

Introduction

The Brazilian National Telehealth Program to support primary care was launched in 2006 as a structural project, coordinated by the Secretariat of Work Management and Education in Health (SGTES) and by the Secretariat of Health Care (SAS), from Brazil's Ministry of Health, and articulated with other Brazilian ministries, public universities, and health and education institutions [1]. Together with other projects in the same direction, telehealth is expected to offer a more favorable environment in order to allow health professionals setting themselves in remote and difficult access areas. It focuses mainly on the process of permanent education by training the Family Health Strategy teams in their own workstation. Simultaneously, teleassistance is largely employed in order to increase the level of resolution on the Primary Health Care and to make easier the access to specialized services within the Unified Health System (SUS), reducing the costs related to the transport of patients for outside village treatment.

The project started with the implementation of nine eHealth Centers in public universities along the country (states of Amazonas, Ceará, Pernambuco, Goiás, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina and Rio Grande do Sul). Each of them is connected to 100 stations in its own state preferably Primary Health Care Centers, located in remote areas, to support about 2,700 Family Health Teams. The nine eHealth Universities' Centers integrate areas such as medicine, nursing, and dentistry, as well as the Unified Health System (SUS) Technical Schools [2].

Implementation Methodology

The implementation of an eHealth pilot project in Brazil to support the Primary Health Care was a great challenge and demanded detailed planning, a strong methodology and a lot of effort. Initially, the Ministry of Health constituted a Central Executive Committee and regional groups of coordination in order to establish an eHealth network in the country. The criteria to choose the villages were defined by the Ministry of Health, prioritizing remote areas with low HDI and villages which had the Family Health Strategy implemented. Workgroups were also created to nationally increase the discussion on the fundamental points: Technology, Educational Content, Evaluation and Regulation.

Technology Group

The role of this workgroup was to analyze and suggest the technology to be adopted, although each Center could choose the most appropriated to a specific situation. All the University Centers had previous experience in telemedicine and the necessary infrastructure, such as video conference equipment with dedicated bandwidth for online interaction. An internet based system was adopted in each Center as a low cost solution with less bandwidth requirements to be implemented in the remote areas. The necessary equipment includes at least a microcomputer, web cam, printer and a digital camera.

Educational Content Group

Interactive tele-education was adopted, combining resources of distance learning with those for virtual clinic, learning object (The Virtual Man) and unit of knowledge (videos scripted to address relevant topics to the clinical practice) [3]. The development of educational contents follows a methodology that allows for based on scientific evidence training, according to SUS Health Care characteristics and aligned with the Department of Health Policies. A Virtual Library specialized in primary care is being developed with the support of Bireme/OPAS, (www.telessaudebrasil.org.br), one of the references used for the educational second opinion.

Evaluation Group

This workgroup defined the base line evaluation at national level, formed by primary and secondary data. Currently, the data collection forms are been applied to all Family Health professionals participating of the Telehealth system. An instruction manual to collect data in the national database of the Ministry of Health was also developed. The process

indicators are been discussed and finally the impact evaluation will be defined.

Regulation Group

This workgroup has as objective to guarantee that the teleconsultations and second opinion system are according the principles of the Brazilian Primary Care and national health policies.

The implementation

Along 2006, the first year of the project, the activities consisted mainly of a careful planning and a long political articulation. In 2007, when the financial resources were made available (around 1 Million US\$ per Center for two years), the planed implementation started: selection/training of technical and clinical central staff, political articulation in each state, selection of villages/towns in agreement to local State Health Departments, definition and purchase of equipments and finally the installation of the central technology acquired (servers and softwares). After that, the implementation of the points (villages and towns) started according to the following steps: motivational meetings with local managers and clinical staff, connectivity tests, technical visits to all municipalities and training of the local teams on the system. Although all centers use the same basic methodology, the implementation activities are at different stages in each state as consequence of the different level of infrastructure and structuralization of each center.

Results

Teleassistance activities (teleconsultations on line and off line, electrocardiogram analysis and support to urgency clinical cases) started in August 2007 in some states and since them they are gradually increasing, with the best results in telecardiology (Minas Gerais) [4] followed by teledermatology (Amazonas) and teleophthalmology (Goiás) [5] besides teleconsultations in general themes of primary care (Rio Grande do Sul). Teleducation activities started in November 2007 with distance courses about hypertension and diabetes (Santa Catarina) for Family Health teams and lectures about subjects previously defined by users in medicine, nursing and dentistry. The national coordination group defines priority themes and regional focal points. Many activities have already been planned and some are in progress such as use of learning tools (i.e. Virtual Man), scientific videos, virtual library for Primary Care, broadcasting scientific events and others (São Paulo)[6,7,8].

The global project numbers, until January 2008, are shown on Table I.

Table I – Project’s implementation situation until January 2008

Number of selected villages/towns	608
Number of villages/towns in activity	127
Number of teleconsultations	332
Number of digital electrocardiogram analysis	7,931
Number of support to urgency clinical cases	153
Number of villages/towns participants in teleeducation activities	50
Number of participants in distance courses	399

A partnership between the Ministry of Health and the Ministry of Science and Technology allows the implementation of a few number of points in non participating states, bringing telehealth to all states of the country.

Conclusion

A reflection about the rich experience in the last two years along the implementation process of the National Telehealth System in a complex country like Brazil, with large contrasts, brought important conclusions about success factors such as:

1. The importance of a political articulation at the three levels of government: Federal, State and Municipality. The long process of articulation strengthened and optimized the initiative, allowing the implementation in the most needed areas and integrating the eHealth to the local health systems,
2. The close interaction between government and university brings the academia and university hospital experience to the primary care level,
3. The coordination methodology used, with central and regional levels, results in common procedures and organization, respecting at the same time regional differences,
4. The working groups, coordinated by experts, were responsible to keep a discussion about fundamental points, constructing in a democratic way the most appropriated solution,
5. Considering that each region in the country has different health problems, when each center concentrates its efforts on that, regional expertise is developed and transferred to others regions with important economy of resources,
6. One of the most important definition, which allowed the implementation in large scale in remote and health care deficient

zones of the country, was the use of a low cost simple technology able to work at low bandwidth (as low as 128-256 kbps), bringing an enormous social impact to these regions.

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Transition to Quality at Medical Device Manufacturers in Turkey and Ce Marking

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Abstract: A new change period that we call Industrial Revolution started after thousands years of agricultural life period. In health sector, new surgical technologies integrated with artificial drugs and modern hospitals have developed in this period. Transition to quality in this sector would be nearly mandatory because medical devices to protect our health are used not only in hospitals but also at home. Because every group from manufacturer to final user have to meet specific conditions. Besides, pressing of regulatory requirements for applying the quality standards to medical devices manufacturers accelerate the transition to quality in sector. Manufacturer meet the quality standards for the first time with applying of ISO 9001 standards in Turkey. EN 46001, ISO 13488 standards followed ISO 9001 in turn and ISO 13485:2003 standard issued with the revision of ISO 13488 standard sector oriented. Completion of this transition and providing of compliance were not easy for manufacturer. This transition is completed by applying of different stages and problems confronted this transition and still existing barriers in front of manufacturer are presented in this paper. The most popular regulatory requirements for pressing manufacturer about applying quality management standard are applications of directives about medical devices. As known, regulatory requirements and their applications getting by three directives are mandatory. Required regulations started with studies made by Ministry of Health with European Union compliance frame in our country. Application of medical devices directive has become mandatory since 01.01.2004. CE marking would be mandatory as result of medical devices directive applications. According to directive, establishment of quality management systems is mandatory for certification of products having risk factor. Medical device manufacturer are applied ISO 13485:2003 standard in this condition. Certification of product and product documentations prepared and audited in this system scope with ISO-13485:2003 applications is necessary. Establishment of ISO 13485:2003 quality management

systems is not enough for certification. In addition to that safety product has to be manufacture and product with the documentation have to presented to relavant authority. The intervention of notified body authorised by EU Comission is necessary for certification of products having risk factor. There is no notified body in Turkey now and this conditon presses manufacturer. Manufacturer problems are reflected in this paper. Besides, Turkish medical devices manufacturer's gains and some mistakes in applications gotten by application of ISO 13485:2003 are presented in this paper.

Introduction

Developed Technologies and decentralization in the health sector have transformed central authorities into coordinators. At one hand hospitals are provided with modern diagnoses and surgical technologies, at the other hand health is tried to be controlled through the concept of preventive medicine. In the new economics, the approach of individual hospitals is solely related to conceiving the concept of molecular health adequately. We can summarize some developments which would form a ground for this concept. Still the opportunity to control our health without going to the hospitals has been engendered with non-invasive perception technologies. The entrance of the Non-invasive health diagnoses home devices to contemporary market emerged a significant increase.[1] To control our health, it become an obligation for that medical devices should be used not only in hospital but in our houses also to reach quality in the sector. Since all groups from manufacturers to the final user have to meet definite requirements. Moreover, the force to medical devices manufacturers about putting quality standarts into practice by laws has accelerated transition to quality. Manufacturers in Turkey got acquainted with quality management standarts by carrying out ISO 9001 for the first time as defined above.

Medical Devices Directive And Ce Marking

As mentioned above, the most current law which is on the agenda and forces manufacturers to apply quality management standarts is the one about exercising the directives about medical devices. As it is known, through three directives which are the medical devices directive, active implantable medical devices directive, In-vitro (used out of body) medical devices deirective, the new regulatory requirements and their exercise has been obligatory. The 93/42/EEC directive of EU dated June 14, 1993, brought regulatory requirements for medical devices and material manufacturer. The transition of the regulation starting on January 1, 1995 was completed on June 14, 1998. In our country required arrangements

have started with the activities done by Health Ministry in EU regulation framework, and the medical devices directive has become an obligation since 1 January 2004. Medical devices directive is an umbrella directive. Following the medical devices directive, two different regulations were also declared. Medical Devices Directive was written with strict limitations and conditions, yet still one of the rare regulations protecting human health at the highest level. The regulations about marketing medical devices have been harmonized in European countries (including EFTA) in accordance with EU regulations, and thus diminished the differences with national systems.

What is CE mark? CE mark confirms the suitability of the requirements determined by European Union such as health, safety, protection of environment and consumers; and also, provides free travelling among the member countries of EU. Hence, it is a sort of “Product Passport”.

Application of Medical Devices Directive

According to medical devices directive there are two ways that lead the manufacturers to the CE mark. First is to label products with CE to un-risky products (class I) and make their manufacturers responsible. Manufacturer determine the place of the products in which directive is or directives are suitable. While there is not a obligation to establish a quality assurance system, there is obligation of establishing internal-production control system. It must be known that the existence of quality management systems at establishing like ISO 9001:2000 includes this condition. The second way to CE is to documentation of risky products (Class I*, Class IIa, IIb, Class III), and this is a complicated and long-term process. For certification of a product, it is a must to establish quality assurance systems. In this circumstances, ISO 13485:2003 is used for medical device manufacturers. Together with ISO 13485:2003 application, all products and their documentation should be prepared; and documented by auditing in this system.

ISO 13485:2003 Quality Management System and Applications

There have been a mass who comments about the quality, unsafe, suitability, safety; decide to buy or not to buy; praise the product as qualified when got pleased, and go on buying and using. Moreover, ISO 13485:2003 has put an end to the mass who only expected as mentioned above by bringing about related basic quality approach with production of medical devices in the health sector. ISO 13485 Standard has been designed in accordance with ISO 9000:1994; yet still announced as revised ISO 13485:2003 by taking perfect instruments brought by ISO 9000:2000

into consideration. ISO 13485:2003 Standard engendered a perfect management underground which integrated ISO 9000 for the institutions which would manufacture medical devices. ISO 13485:2003 Standard will be the GUIDE of every manufacturer of medical device from now on.

As ISO 13485:2003 standard is applicable to the sector and requires specific needs towards medical device production, production of qualified and safe products have been carried out by the manufacturers. And thus the existence of the masses who think they produce the products fulfilling the expectations has been diminishing. Some specific requirements which are not suitable with other quality management systems and brought towards sector are being explained following. All different requirements are not stressed, but seemingly important differences are given below.

Starting from the beginning of the standard, it is seen to include the conditions of quality management systems which show the ability of meeting the conditions of regulation in the part of contents. At the part III, it was stated that in Turkey practicing of Medical Devices Directive is an obligation. Under these conditions, suggested quality management systems should be suitable to the regulation. As seen here, although standard is international, it has regional flexibility, still. It is not only a flexibility in the region but in itself also.

Another requirement that differentiate the standard from others is customer satisfaction. While other standard suggests limitless customer satisfaction, ISO 13485:2003 standard makes basic safety needs as pre-conditional[3], and stresses upon saying “no” to costumers whan necessary. Yet still the sustainability of the quality management system efficiency has been pointed in many places.

The standard has offered special working conditions especially for the sterile medical device manufacturers. Many articles are itemized starting from the cloth of personnel , documented regulations of the conditions which may cause contamination with the product in the working environment has been arranged, the necessity of the educated personnels to observe other personnel has also been added. Manufacturers are hence have more possibilities to product more qualified and safer products. And these working conditions also brings extra financial costs such as employing qualified personnel or preparing special working environment for the products. But with these requirements, a legal way to prevent the products which are unsafe, and sold at the market.

With the requirement of this standard, manufacturer are offered to prepare risk management plan [3] , which is very different from other standards, and to update this risk plan by documenting activities of risk plan. It has been enabled to prevent unsafe products at on the markets by keeping the risks of

products at a level that is reasonable for ISO 14971-1:2000. For example, one of our manufacturers decreased risk level of 3 to a level at 2.25 by simply marking EN 980:2003 standard on an error done by the user and by providing an adequate handbook for the use. Similarly, a manufacturer succeeded to change level at 8, ALARP level (according to ISO 14971-1:2000), of the measure sensitivity which is caused by a washer of medical device with measure function, into an applicable level at 4.

ISO 13485:2003 standard aims to minimize risks caused by environmental conditions and surrounding situations by bringing about special requirements. For example, controlled environment conditions like clean room for sterile medical devices become obligatory. Validity of such environments should be enabled as through ISO 14644 or similar standards [3]. Through that, all the risks which may endanger product safety has been aimed to decline. From the experiences I got, I can say that in Turkey, many manufacturers learned to carry out the support processes which effect product making activities in accordance with internationally recognized standards just after starting to practice ISO 13485:2003 standard.

Yet still, our manufacturers have been able to take over such difficulties with the help of systematic approaches in the transition process. From now on, these conditions make manufacturers selector among their competitors; and also all preparations at the transition process given for EU CE marking process.

It has been realized during the inspections we did in transition process that almost all manufacturers had not validate existent softwares on their products and there had not been any documentation towards this. During the meeting with manufacturers, we have been informed that inspite of validation of softwares [3], documentation could only be done through advisors. At these validation activity, manufacturers have determined lack of some softwares, and the necessity of changing them has been seen in manufacturers savings.

Manufacturers have to practice observation and measure activities in the cover of the transition to quality. The standard mentions about the necessities like customer complainments, recommendation reports, observing experiences which regulations ask and establishing a feed-back system. Furthermore, with the necessity of process and product observation, manufacturer have been forced to establish a measurement system. Manufacturers have started to behave according to quantitative datas with this established system. While it was only ISO 13485:2003 which was a target for the manufacturers during the first years of my audits, then manufacturers started to calculate how to achieve betterment and to what extent they can improve the production and institutional structure of their establishments by

strengthening measure systems. They have also activated the check system of the nonconform products; and involved in a process of consistent betterment in the correcting-preventing activations. But is should be kept in mind that manufacturers are forced to participate this process by legal and EU regulations. And thus how an important duty waits for the authorities and the concerned ministries has been revealed.

Conclusion

It is a necessity for our country to improve institutional betterment and to extend internationally-recognized documentations for being competitive in medical service and products at the global measures, and achieving sectoral improvements. Although this have been obligatory with CE marking in our country, it should not be forgotten that consistent betterment is the key factor. Our manufacturers have at least taken the first step since 2004. It should be noticed that the financial dimension of the quality and organizational maturation will turn into a beneficial advantage. Quality and betterment ought to be perceived as not sub-processes servicing for an aim but just a part of completing the work. Institutions which see quality as the target and seek for the quality criteria for the works expect to purchase products whose quality and safety have been notified; and also they want the firms they cooperate with to accomplish quality certification. These institutions are not even satisfied with the obligatory regulations, and they may require quality practices at higher levels in a consistent framework.

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Using SNOMED CT® in Casemix for Determining Costs for Pathology Services

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***Abstract:* Pathology Services in England and Wales consume over £4billion per financial year. Presently, there is no reliable cost data collection for pathology procedures. To capture more accurate data, a casemix tool was designed using SNOMED CT® (Systematized Nomenclature of Medicine-Clinical Terms). A Pathology Dataset was first created using SNOMED CT to map to existing diagnostic and procedural classification systems and, from that, a Complexity Matrix was designed to group pathology services by both the level of costs and technical skills required.**

Introduction

The United Kingdom (UK) National Health Services (NHS) in England currently uses ICD10 (International Statistical Classification of Diseases and Related Health Problems, Tenth Edition) [1] for diagnostic classification. The procedural classification system OPCS4 (Office of Population Census and Surveys Version 4) has been used since 1990, but despite several recent revisions, it is still inadequate [2,3,4]. Read Codes, which evolved into Clinical Terms (CTV3), the CT in SNOMED CT® (Systematized Nomenclature of Medicine-Clinical Terms), were created in the early 1980s for use in primary care [5].

Background

The NHS developed the casemix scheme HRG (Healthcare Resource Groups) in the early 1990s, which were similar to DRGs (Diagnostic Related Groups) except were driven by resource rather than diagnosis. A governmental costing review of healthcare services provided by the NHS produced the grouping scheme to determine the costs of services, which previously had not been monitored. A new initiative called Payment by Results (PbR) [6,7] is based on the most recent version 4 of HRGs. HRG4 was released in April 2007, with numerous problems, not the least of which was the poor procedural classification system and poor data quality [4,8,9].

Significance of the Problem

Pathology services in England (and Wales) consume over £4bn in a financial year [10]. Currently the funding for pathology services is ‘bundled’ with other services for inpatient and outpatient treatment. Creation of Pathology HRGs will enable the direct recognition of the volume and complexity of the analytical work being carried out in pathology. SNOMED CT-based HRGs will facilitate a clear link between funding and introduction of new tests, since SNOMED CT is updated every six months [11,12].

With the release of HRG, casemix groupings will be available for all clinical activities irrespective of diagnosis or healthcare treatment setting. HRGs are specifically designed to be able to support pathology services because they can be driven by either procedure or diagnosis, or both, even in the same clinical setting or specialty. This is important for pathology, because of its procedure-driven nature.

Presently, depending on the subspecialty, pathology data are inconsistently collected using a variety of coding and terminology systems. For example, Cellular pathology identifies diagnoses based on early versions of SNOMED v.2 or 3.5 [13] and collects no procedure codes. Biochemistry and Microbiology use terminology based on early versions of Read codes (2 and 4 byte).

Since 1991 there has been a system in use called WELCAN UK (Welsh-Canadian) Laboratory Workload Measurement System for Pathology [14,15,16,17] to determine laboratory activity units. Though this system has good potential for identifying costs, it is outdated and sparsely used. In spite of this, as recent as 2005, The Royal College of Pathologists Guidelines on Staffing and Workload [18], considers it the only valid system for reporting laboratory services workload measurements.

Another source of information used in the design of this tool was a National Benchmarking Service from Keele University [19], which is in place in England. This scheme looks at nationally recognized procedures in Cellular pathology, Microbiology, and Biochemistry, and identifies numbers of procedures carried out in the laboratories voluntarily involved in the scheme.

Methodology

Creation of the Pathology HRG Dataset

Considering the barriers for determining accurate pathology costs and the lack of valid data to drive Pathology HRGs, a Pathology Dataset was

created. The Dataset was based on existing schemes and SNOMED CT and from that dataset a Complexity Matrix was developed [20].

In order to find a relationship between costs and complexity of procedures, it was necessary to use collections of costs to identify bandings or a range of costs across pathology subspecialties. Using the WELCAN unit list of procedures, an attempt was made to correlate these to SNOMED CT terms. In addition, the National Benchmarking list of procedures was also applied in an attempt to find an HRG dataset of procedures relevant for the application of SNOMED CT terms as a financial services realm subset.

Additionally, in an attempt to find a common SNOMED CT term, it was necessary that the terms in the dataset could be mapped both 'forward and backward' in order to account for both historical data and the variety of codes and terminology systems being used (all Read code versions including CTV3 and SNOMED versions 3.5 and RT).

A list of diagnoses was also added to the dataset which are important for HRG validation of the Complexity Matrix. These diagnoses will be critical when carrying out more complex pathology procedures in terms of reagents used, methodology of the procedure, special complex manual processes, and specialist staff required.

Design of the Complexity Matrix

In developing the Complexity Matrix, the procedures in the dataset were first mapped to the WELCAN unit codes and terminologies. Although the UK SNOMED CT extension has cross maps to the Read-CTV3, some of the available Read codes were found to be only 'place holder codes', because in a cross-check to the separate Read-CTV3 database, some of the codes found in the SNOMED CT product did not show a term. Likewise, codes taken from the UK Pathology Bounded Code List (PBCL) of Read Codes for Pathology Report Messages [21], which is required for electronic reports, showed a similar problem in that there were no available terms and codes in the Read-CTV3 database. In those instances the SNOMED CT terminology and semantics were taken to find a match in the Read-CTV3 terminology database. A similar test was done on the codes of SNOMED RT offered in the SNOMED CT product in which the independent SNOMED RT database was checked to assure that the same terms and codes were available [22]. If no terms or codes were available in any other systems, the cross maps showed no match at all.

For the diagnostic section of the HRG Database, similar checks were carried out with ICD10. However, it was clearly evident that there would be instances of multiple matches of ICD10 codes versus a SNOMED CT term. Additionally these multiple matches were cross-checked with the updated

ICD10 set of codes and terms as offered by the World Health Organization (WHO) online [1].

The Matrix took into consideration the fact that in pathology laboratory work, previous clinical or pathological diagnoses as well as working diagnoses during a patient's hospital stay will influence the complexity of the laboratory procedures to be carried out on the incoming laboratory requests. In the design, an attempt was made to match known costs for pathology procedures based on SNOMED CT terminology with the different complexity of pathology procedures. All known costs were put into a banding to see if similar resources could be established for pathology procedures across all pathology subspecialties.

A flowchart was then created in order to identify nodes of decision making in order to group the procedures to the correctly-valued HRGs and validate them by queries to previous patient information. In formulating the flowchart, it was found that either previous laboratory procedures or previous preliminary working diagnoses documented in the patient record needed to be retrieved to support the nodes of decision making. The procedures were best expressed as SNOMED CT terminology, whereas the diagnoses could also be expressed using ICD10 codes. This was due to the fact that the HRG grouper would only recognize diagnoses or procedures in the HRG dataset and the appropriate cross-maps from SNOMED CT to the various terminologies and classifications systems.

Results

Although the pathology casemix tool described here using SNOMED CT has been validated and approved by a Pathology Expert Working Group [23], it has not yet been tested on a national basis. However, this validation signals acceptance across all pathology subspecialties. Also encouraging is the fact that SNOMED CT is presently being used as the basis of a UK National Procedures Catalogue which has already been created for Radiology procedures. Hopefully, these developments will encourage the use of SNOMED CT as a casemix tool for determining pathology costing.

Conclusion

The uptake of SNOMED CT in the NHS has been slow as there is still limited understanding of the system among clinicians and other stakeholders. Costing of healthcare resources will be unreliable for some time because of the patchy usage of earlier versions of HRGs. Until there is more focus on data quality and mandatory standardization, there will continue to be unreliable costing data.

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Chapter 12

Telepsychiatry: Why Not?

International Telepsychiatry, Patient Acceptability Study

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Introduction

Most of the mental health care towards cross-cultural patients in Denmark provides via interpreters, due to extreme shortage of professional resources with cross-cultural background. The hypothesis behind the Danish National Telepsychiatry Pilot Project follows from the assumption that the large majority of cross-cultural patients would prefer contact by mother tongue even when it is via telepsychiatry rather than interpreter provided face-to-face contact with the doctor. The first international telepsychiatry service established between Denmark and Sweden occurred over a period of 1 ½ year, since April 2006. It served primarily cross-cultural patient population groups such as asylum seekers, refugees and migrants. During the survey, the involved patients received videoconference provided mental health care via respective mother tongues, without assistance of interpreters. The **aim** of the survey was to explore patients' attitudes toward telepsychiatry based on their own experiences with the technology.

Methods

30 patients were included in the survey, 21 man and 9 women. Mean age for man was 42,5 and for women 41,7 years. Patients' educational level, residency status, countries of origin and previous experiences with the mental health system in respective country of origin and/or in Denmark were registered. All patients received written and spoken information about the telepsychiatry. Total number of provided telepsychiatry sessions were 203 (range 1-22; average 6,8 sessions per patient). After the end of the telepsychiatry contact all patients were asked to complete a satisfaction questionnaire, for this survey designed self-report instrument seeking their views on the quality of the communication and care provided by videoconferencing.

Results

The psychiatric interview disclosed wide range of psychiatric disorders. There was 95% admission to assessment and continuously treatment /follow-up sessions under the survey. 23 percent (n=7) of the entire number of the patients was not able to fulfil the questionnaire due to illiterate and/or psychotic condition. The rest of the sample (n=23) reported a high level of acceptance and overall satisfaction with telepsychiatry as well as willingness to use it again or recommend it to others.

The patients perceived advantages, primarily, regarding direct contact via mother tongue that allows them to express exactly what they wanted to and, secondarily, no need for travel in order to meet the doctor who speaks the same language.

Disadvantages by telepsychiatry were addressed to physical environment (videoconference offices were small and used for other purposes).

Conclusions

Used as a supplement to existing mental health system, telepsychiatry can ease the access to scarce health care resources with diversity of special expertise.

Positive responses from the patients within the first international European telepsychiatry service encourage us to think in terms of enhanced international telepsychiatry collaboration within EU. The vision for the future is developing of a European Telepsychiatry Network capable to link clinicians and patients from different European countries and consequently maximize access to expert skill resources. However, such network needs a great deal of juridical, ethical and regulatory guidelines, although some setting standards and establishing guidelines for treatment providers are already made.

Key words: Telepsychiatry, cross-cultural population, mother tongue, international collaboration.

Posttraumatic Stress Disorder and Telepsychiatry

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Abstract: **BACKGROUND AND AIMS:** This study was examination by Telepsychiatry and E-consulting (telecommunication technologies with the aim of providing psychiatric services from a distance) of war related posttraumatic stress disorder (PTSD). **METHODS:** Many patients with PTSD have different symptoms. The authors' objective is to analyze component of symptoms in PTSD. The subjects were 60 male psychiatric patients by Telepsychiatry and e-consulting with war-related PTSD by videoconferencing via broadband ADSL and WADSL by 768 kbps. Posttraumatic stress syndrome-PTSS scale and 20-item Zung self rating scale was used to assess state measures of symptom severity. **RESULTS:** The symptoms of prolonged PTSS (posttraumatic stress syndrome) with duration between six months and two years had been founded at 46 (76,7 %) and 14 (23,3 %) of patients had no PTSS: symptoms of depression had been found at 41 (68,3 %) patients. The enduring personality exchange after catastrophic experience (with duration more than two years), had been found at 11 (18,3 %) patients ($P < 0.01$); symptoms of depression had been found at 22 (36,7 %) patients after two years.

CONCLUSIONS: Evolution of PTSD symptoms and continued examination and follow-up by Telepsychiatry service and e-consulting may be important in predicting the eventual development of depressive symptoms and precipitation of F 62.0 enduring personality exchange after catastrophic experience in the war related PTSD. Consequently, Telepsychiatry service and e-consulting it is able to serve not only PTSD but also wide range of other patient population.

Keywords: PTSD, Telepsychiatry, E-consulting, psychiatry, disorders, war

Introduction

Telepsychiatry and e-mental health services primarily involve videoconferencing over high speed (broadband) networks to enable natural

interactions between patients and providers. The term “telepsychiatry” refers to the use of telecommunication technologies with the aim of providing psychiatric services from a distance. Telepsychiatry connects patients and mental health professionals, permitting effective diagnosis, treatment, education, transfer of medical data and other activities related to mental health care. Traditionally, this has required leasing specialized high speed telephone circuits that were dedicated for videoconferencing. Telepsychiatry can be quite helpful in providing this type of service for patients with PTSD. A telepsychiatry service, using wireless technologies (WADSL) was established in order to provide psychiatric assessments and/or treatment for patients with PTSD. A telepsychiatry service providing mental health care by videoconference in real time on patients` own language was realized.

This study was examination by Telepsychiatry and E-consulting (telecommunication technologies with the aim of providing psychiatric services from a distance) of war related posttraumatic stress disorder (PTSD), there is preliminary evidence to support the use of telepsychiatry for PTSD specialty care among combat veterans. The subjects were 60 male psychiatric patients by Telepsychiatry and e-consulting with war-related PTSD by videoconferencing via broadband ADSL and WADSL by 768 kbps. Posttraumatic stress syndrome-PTSS scale and 20-item Zung self-rating scale was used to assess state measures of symptom severity. Telepsychiatry and e-mental health services could improve the quality and efficiency of mental health services delivery. Furthermore, other clinical needs could be addressed by telehealth using the same infrastructure. This type of service E-consulting include items F43 Reaction to Severe Stress, and Adjustment Disorders (ICD-10) F43.0 Acute stress reaction,

- F43.1 Post-traumatic stress disorder,
- F43.2 Adjustment disorders,
- F43.8 Other reactions to severe stress,
- F43.9 Reaction to severe stress, unspecified

This category differs from others in that it includes disorders identifiable not only on grounds of symptomatology and course but also on the basis of one or other of two:

1. Causative influences:

- An exceptionally stressful life event (e.g. natural or man-made disaster, combat, serious accident, witnessing the violent death of others, or being the victim of torture, terrorism, rape, or other crime) producing an acute stress reaction
- Significant life change leading to continued unpleasant circumstances that result in an adjustment disorder

2. Stressful event is thought to be the primary and overriding causal factor, and the disorder would not have occurred without its impact.

Posttraumatic stress disorder (PTSD) is a delayed and/or protracted response to a stressful event of an exceptionally threatening or catastrophic nature. The three major elements of PTSD include

1. Re-experiencing the trauma through dreams or recurrent and intrusive thoughts (“flashbacks”),
2. Showing emotional numbing such as feeling detached from others,
3. Having symptoms of autonomic hyper arousal such as irritability and exaggerated startle response, insomnia

Commonly there is fear and avoidance of cues that remind the sufferer of the original trauma. Anxiety and depression are commonly associated with the above symptoms. Excessive use of alcohol and drugs may be a complicating factor. The onset follows the trauma with a latency period, which may range from several weeks to months, but rarely more than half a year.

A telepsychiatry service test methods include different scales: Self-reported scales: Beck scale for depression & Zung scale for depression, Interview with physician: Hamilton scale (HAMD) & Posttraumatic stress syndrome scale (PTSS).

There can be several potential barriers to the diffusion of telepsychiatry, e consulting and e-mental health. Some of these are concomitant with the adoption of any new technologies and practices in health care, licensure, identify technology infrastructure need, equipment purchases etc. An activity that is never free. It requires money to begin services for telepsychiatry, money to continue and has as a goal the making of more money.

Discussion, results and conclusions

Many patients with PTSD have different symptoms. The authors' objective is to analyze component of symptoms in PTSD. The subjects were 60 male psychiatric patients by Telepsychiatry and e-consulting with war-related PTSD by videoconferencing via broadband ADSL and WADSL by 768 kbps. Posttraumatic stress syndrome-PTSS scale and 20-item Zung self rating scale was used to assess state measures of symptom severity. Telepsychiatry, as suggested by this review, is a growing field with the potential to deliver high-quality, much needed assistance in a variety of settings to persons in need of mental field of telepsychiatry will keep up with this moving target. The symptoms of prolonged PTSS (posttraumatic stress syndrome) with duration between six months and two years had been

founded at 46 (76,7 %) and 14 (23,3 %) of patients had no PTSS: symptoms of depression had been found at 41 (68,3 %) patients. The enduring personality exchange after catastrophic experience (with duration more than two years), had been found at 11 (18,3 %) patients ($P < 0.01$); symptoms of depression had been found at 22 (36,7 %) patients after two years.

Evolution of PTSD symptoms and continued examination and follow-up by Telepsychiatry service and e-consulting may be important in predicting the eventual development of depressive symptoms and precipitation of F 62.0 enduring personality exchange after catastrophic experience in the war related PTSD. Telepsychiatry patients appear to be satisfied with the service, equipment, and setting. All participants reported a high level of acceptance and satisfaction with telepsychiatry. Patients also prefer telepsychiatry to in-person appointments, because travel time, time off from work, and child care is not an issue with telepsychiatry. Consequently, Telepsychiatry service and e-consulting it is able to serve not only PTSD but also wide range of other patient population. Telepsychiatry is currently one of the most effective ways to increase access to psychiatric care for individuals living in underserved areas Continued follow-up by Telepsychiatry service will address the evolution of PTSD symptoms in war related PTSD.

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Telepsychiatry in Assessment and Treatment of Asylum Seekers (Patient-Satisfaction Survey)

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Abstract: We conducted a qualitative pilot study to assess users attitudes toward telepsychiatry service established between Psychiatric Center Little Prince in Copenhagen and Asylum Seeker Center in Jelling, 250 km away. The aim of the service is to provide remote mental health care via mother tongue as previously care was only provided via interpreters. In period October 2006-October 2007, 12 asylum seekers, all from ex-Yugoslavia, were referred to assessment and treatment via telepsychiatry. The clinician affiliated to Psychiatric Center Little Prince spoke several ex-Yugoslavian languages, which made the use of interpreter unnecessary. All participants referred to telepsychiatry accepted remote consultations. Due to illiteracy and/or psychotic condition 4 of them were not able to fulfill special designed questionnaire regarding advantages and disadvantages perceived under telepsychiatry contacts. The rest of the sample reported overall a high level of acceptance and satisfaction with telepsychiatry. As the most important is by participants reported preference of telepsychiatry versus interpreter provided mental health care.

Keywords: telepsychiatry, mother tongue, asylum seekers, refugees, ethnic minorities, ethnic matching, mental health care, Denmark.

Introduction

Telepsychiatry in form of video conference is the most sophisticated way to provide psychiatric services from a distance. High user- acceptances as well as high reliability of telepsychiatry are well documented [1-5]. Surprisingly, there are only few published reports describing the use of telepsychiatry in order to provide mental health care toward ethnic minorities [6-8]. Nevertheless, mental health care needs of cross-cultural patient population and number of difficulties in their treatment are obvious and still often discussed issues [9-12]. Particularly relevant issues perceived as major obstacles to providing cultural appropriate mental health care are lack of language abilities and lack of confidentiality when using

interpreters. Complexities of the psychopathology in combination with patients' ethnic diversity necessitated development of novel strategies within mental health care. Ethnic matching and cultural-competency training emerged as prevalent strategies to address the issues mentioned above [11].

Mental health system in Denmark faces a huge resource shortage in the field of cross-cultural expertise. As few bi cultural clinicians are spread around the country, it can be time consuming for either the patient or the doctor to travel in order to see each other. Consequently, the use of interpreters became common "therapeutic culture" within mental health services toward ethnic minorities with limited Danish language abilities (e.g. asylum seekers, refugees and migrants). In such situation a number of limitations regarding development of confidentiality and therapeutic alliance might occur. One solution to this problem is the use of video conference in real time in order to increase access to culturally appropriate expertise spread around the country. Telepsychiatry has been established in Denmark since 2004, as the result of the National Telepsychiatry Project, designed and led by the author of this article [7,8]. Psychiatric Centre Little Prince in Copenhagen is the first and still the only place in Denmark to offer telepsychiatry service on patients' respective mother tongues.

Danish Red Cross that is taking care about 6 asylum centres around the country faced resource shortage in one of the centres, located 250 km away from Copenhagen. In October 2006 Danish Red Cross accepted the offer to collaborate in the National Telepsychiatry Project, which led to establishing of telepsychiatry-link between Asylum Seekers Centre in Jelling and Psychiatric Centre Little Prince, with the aim of assessment and treatment of asylum seekers from ex-Yugoslavia. This paper describes attitudes toward telepsychiatry reported by the patients referred in period October 2006-October 2007.

Material and Methods

Participants involved in the project were mentally ill asylum seekers from ex-Yugoslavia (Kosovo and Bosnia-Herzegovina). Total number of referred participants was 12 (6 men and 6 women). Total number of telepsychiatry provided consultations was 88 (range 3-17) with an average of 7,3 consultations per participant. Duration of participants' education was as followed: 0-4 years (25%); 5-8 years (42 %); 9-12 years (33 %). There were no participants with university education (over 12 years of school). All participants in the project received written information about telepsychiatry. They all undersigned consent before or after the first telepsychiatry session. After end of the telepsychiatry-contact, they were asked to complete the 10-

items questionnaire in order to determine satisfactory level, advantages and disadvantages by telepsychiatry.

Most of participants (92%) did not have any contact to mental health system before arrival to Denmark. 75% of participants were in contact either with psychiatrist and/or psychologist in Denmark before being involved in the project. The psychiatrist affiliated to Psychiatric Centre Little Prince speaks participants` mother tongues, which made the use of interpreters unnecessary. The video conferencing system links Psychiatric Centre Little Prince in Copenhagen with Asylum seeker centre 250 km away from Copenhagen. Videoconferencing is via broadband sHDSL by 2Mb/s. Survey period: October 2006-October 2007.

Results

All participants referred to telepsychiatry assessment and treatment agreed to participate in the survey. Diagnostic assessments disclosed expected psychiatric disorders (Figure1).

33% of participants were not able to fulfil the questionnaire due to illiteracy and/or psychotic condition (n=4). The rest of the sample (n=8) reported a high level of acceptance and satisfaction with telepsychiatry regardless degree of mental illness or previous experiences within mental health system(s) (Table I).

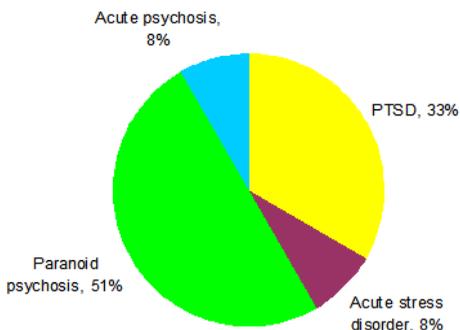


Figure 1. Diagnose distribution

Safety has been perceived as maintained as well as feeling of comfort in participants` ability to talk via videoconference. Finally, high preference to using telepsychiatry via mother tongue rather than interpreter provided mental health care has been reported.

Most frequently reported advantages were possibility to communicate without translators, no need for transportation and “*the feeling of being fully understood by the person with same cultural background*”. Nevertheless, some participants mentioned “*bad experiences with interpreters*” and/or expressed open resistance toward interpreter provided communication with psychiatrist (“*One can never know whether they are translated correctly or*

not”; “One can never trust them”). Identified disadvantage was addressed to the “little consultation office that provokes claustrophobia”.

	Yes, in high Degree (%)	Yes, in some Degree (%)	No, only in less degree (%)	No, not at all (%)
1 Did you get enough information about telepsychiatry?	87	13		
2 Do you perceive "contact via TV" as uncomfortable?			38	62
3 Did you feel safe under telepsychiatry contact?	87	13		
4 Have you been satisfied with sound quality?	87	13		
5 Have you been satisfied with picture quality?	75	25		
6 Did you achieve your goal via telepsychiatry / could you express everything you wanted to?	100			
7 Would you recommend telepsychiatry to others?	100			
8 Would you prefer contact via translator in future?			38	62
9 What advantages did you perceive by telepsychiatry contact?	<i>(see the text)</i>			
10 What disadvantages did you perceive by telepsychiatry contact	<i>(see the text)</i>			

Discussion

To our knowledge, no previous surveys have addressed the use of video conference in delivering of mental health care toward such specific patient-group as asylum seekers. Asylum seekers that participated in the survey were very much focused on the role of interpreters especially regarding confidentiality and trust. However, the importance of the linguistically and cultural references in such situation and their influence on therapeutic relations are not to be underestimated.

Namely, some of the participants reported that previous contact with interpreters, created serious problems in privacy and confidentiality. Of that reason some participants asked to be referred to telepsychiatry via mother tongue. Not surprisingly, the most important in this qualitative survey is participants` preference of telepsychiatry via mother tongue versus interpreter provided contact. Nevertheless, it occurs despite the fact that

none of participants were previously exposed to video conferencing. Individual's comfort with video conferencing and perceived safety are some of critical determinants of potential success of telepsychiatry. None of these issues were of concern for any of participants, possibly due to the fact that they received full information followed by reassurance that no one is listening, watching or video-recording the sessions and that setting is absolutely private and confidential. Individuals' level of comfort with new technologies is often related to previous experiences and exposure to such technologies [13]. Reasons for identified satisfaction that occurred despite participants' low exposure to telepsychiatry might be found in perceived importance of mother tongue rather than in comfort by the technology in nevertheless, the impact of negative interpreter related experiences within existing mental health service as mentioned above, should not be underestimated. Clinicians need to be aware of potential difficulties connected to interpreter provided mental health care, and whenever possible offer an alternative. In some cases patients might be offered to travel in order to meet bi cultural doctors. However, telepsychiatry should be mentioned as equal possibility to provide relevant mental health care and build sustainable therapeutic relationship, as these goals are difficult to achieve when communication is provided via interpreters.

In our survey, telepsychiatry-provided assessments disclosed expected psychiatric diagnoses. Even if assessment via interpreter could results equally, the question is whether the level of satisfaction and perceived level of safety and comfort will remain the same as by telepsychiatry via mother tongue. As 75% of all participants had previous experiences with interpreter provided mental health care and after all would prefer telepsychiatry, one may assume that they perceived interpreter provided consultation as less satisfactory on certain levels.

Conclusions

Ethnically diverse patient population have specific needs based on cultural determinate understanding and expression of mental illness. Culturally appropriate mental health care is of overall importance regarding assessment, treatment and outcome. Helping asylum seekers requires attention to their special cultural needs. Asylum seekers, often torture survivors, are significantly under served on their mother tongue wherever they are hosted. The commonly used strategy of ethnic matching between clinician and patient was found to be difficult to effectively apply especially in Denmark that struggle with persisting shortage of bi cultural resources. The limitations of existing mental health system necessitate development of novel strategies. Telepsychiatry provided ethnic matching is one possibility.

Despite the fact that investigated cohort is relatively small, the results might give some hints regarding future development and research in this very specific field. Results of the survey as well as previous published encouraging experiences within Danish National Telepsychiatry Project may increase attention to cross-cultural psychiatry and use of new technologies regarding improvement of cultural appropriate care delivery. However, increased knowledge might lead to changes in mental health policy where present treatment of ethnic minorities is strictly provided via interpreters. Aside from efforts in order to increase cultural competence among Danish clinicians, future changes may include implementation of telepsychiatry via mother tongue at least as supplemental tool to personal visits. Further research is needed to determine effectiveness and identify barriers to using of telepsychiatry among cross-cultural population.

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Telepsychiatry: A New Tool for Remodeling Mental Health Assistance in South Brazil

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Introduction

The Brazilian policy for the management of mental health diseases is moving toward the establishment of a communitarian outpatient approach. A limiting factor to the widespread implementation of this public strategy is that a significant number of small Brazilian cities have a lack of local psychiatrists. The present project aims to overcome this barrier through the establishment of a telepsychiatric network in the region of Sao Lourenco do Sul, in south Brazil.

Objectives

1) To establish an e-health pilot project for the tele-assistance of mental diseases in the city of Sao Lourenco do Sul, Brazil; 2) To decrease the average time for the diagnosis and to improve the therapeutic approach of psychiatric diseases in both basic outpatient units and in general hospitals; 3) To achieve a better standard of operational activities among the multidisciplinary psychiatric team through the use of IP based videoconferences; 4) To be a starting point for the implementation of a telepsychiatric system in Brazil, in agreement with the national policy for mental diseases.

Methods

1) The infrastructure for the tele-assistance of mental diseases was established in the following institutions: Santa Casa Hospital, Centre for Psychosocial Attention “Nossa Casa” (CAPS) and outpatient units of the “CARETA” and “SACI” Projects; 2) Use of audio and videocommunication via Internet, including: ADSL Internet, a desktop, a laptop for the remote psychiatrist, an integrated webcam/microphone device, multimedia devices and a Skype software; 3) Establishment and operation of a multidisciplinary



Figure 1. Multidisciplinary Telepsychiatric Session

service with the participation of psychiatrists, general practitioners, social assistants, nurses, psychologists, undergraduate students, through a joint and active participation of patients and their relatives (Figure1).

Results

The first experience on 12th September 2007 was a videocommunication session between the Centre of Psychosocial Attention and the residence of the psychiatrist, located 70 km away. Since then, the telepsychiatric assistance has become routine with the participation of patients and their relatives, nurses and psychiatrists (Figure 2). Rapidly, the staff that works with mental health diseases overcame their initial skepticism and the method was validated through daily practice. The decisions about the therapeutic interventions could be adopted immediately, avoiding unnecessary hospitalizations.

Conclusions

The preliminary results of this Pilot Project established in Sao Lourenço do Sul has shown that telepsychiatry can play a significant role in the management of mental diseases. The suggested model can be a first step to help overcome a lack of public psychiatric



Figure 2. Psychiatrist: Remote Videoconsultation

assistance throughout the country. It can also be considered as a starting point for the adoption of psychiatric e-Health strategies, which will be in agreement with the new Brazilian policies for a more communitarian approach to mental health disease management.

Chapter 13

Telenursing and Nursing Informatics

International Telenursing: a Strategic Tool for Nursing Shortage and Access to Nursing Care

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***Abstract:* The goal of this paper is to inform, discuss and advance the international practice presence in Telenursing that includes a highly visible role for nursing. Select findings of the 2004-2005 International Telenursing Survey will be presented. As telemedicine, telehealth, and telecommunications technologies continue to flourish, the practice of telenursing will continue to expand to include valuable telehealth tools such as monitoring devices, video and Internet-based care and services. There is a rapidly emerging role of International Telenurses, accompanied by the regulatory requirements, competencies, and issues that physicians, nurses and healthcare administrators should be aware of regarding the practice of Telenursing**

Introduction

Florence Nightingale, known as, “The Lady with the Lamp” was an international nurse pioneer, mentor, writer, and leader over 150 years ago. Nightingale established nursing school programs, improved health care in the military, developed standards of hygiene, and reorganized hospitals and patient care. Nightingale, gifted in mathematics, was a noted statistician, who documented her findings by hand. Publication and dissemination of her epidemiological findings were delayed by years. Today, with the availability of electronic data, telemedicine technology, the Internet and use of computers for healthcare applications, we are able to collect results and health outcomes and disseminate these data to healthcare colleagues and scientists around the world at the click of a button. Ultimately, the use of telehealth applications to gather a patient’s physiologic data, including capturing heart or lung sounds and sharing video images of skin lesions, optical blood vessels or retinal images, can be remotely acquired and transmitted.

Telenursing Defined

Today's nurses in many countries are continuing with Nightingale's work by embracing the use of telemedicine and technology tools to support and extend nursing practice via telenursing. Telenursing is defined as "the use of telemedicine technology to deliver nursing care and conduct nursing practice" [1]. According to the International Council of Nurses (ICN) in Geneva, Switzerland, representing nurses in 128 countries around the world, telenursing is the use of telecommunications technology in nursing to enhance patient care [2]. Through telenursing, a nurse can provide remote monitoring, education, follow-up, data collection, interventions, pain management, family support, and multidisciplinary care in an innovative fashion. Other terms used internationally that also denote telenursing include telehealth nursing and nursing telepractice. Regardless of the term used, the reality is that the use of telehealth, ehealth, telemedicine, informatics and telecare technologies can provide nurses with new methods of providing patient care and collaboration with medical specialists and interdisciplinary healthcare providers. Telenursing has been in practice since the telephone provided a tool for nursing care to be provided and coordinated over distance. The increase in ubiquitous access via the Internet, as well as the prevalence of increasingly low cost remote sensors, transmission and monitoring capabilities now provides the opportunity for a major restructuring of the way nursing care is delivered both within countries and among countries.

The Telenursing Imperative

The ICN has extensively researched the "global shortage of nurses" and recognizes that the nursing shortage predicted for 2020 in many countries will create an "adverse impact on health systems around the world" [3]. The looming nursing shortage is attributed to the increase in the aging population and chronic diseases. Telenursing provides nurses with new methods of extending their reach to support and deliver patient care, patient/family monitoring, education and support. To this end, and to advance the use of Telenursing, the ICN recently published International Competencies for Telenursing [4], detailing the requirements for safe and effective Telenursing practice.

The 2004-2005 International Telenursing Survey

Recognizing the emerging role of Telenursing, iTelehealth Inc. cosponsored* and conducted the 2004-2005 International Telenursing Survey [5] to identify 1) telenurses' satisfaction with their current

telenursing role 2) specific telenursing knowledge and skills 3) perceptions about effectiveness of telehealth as a nurse extender 4) demand for telenurses worldwide 5) types of knowledge and skills needed by telenurses. Excerpts from the convenience sample of international telenurse respondents provides insight into the future of telenursing:

“80% of care is done in the community not the inpatient setting. Telehealth is the only way to make this work!”

“E-health business will be booming in (the) next few years in Korea. Therefore the need for telenurses who can understand the health and IT will be definitely increased, I believe”

“...there will be an increased demand for nurses who have the skills required to integrate this technology into practice.”

“In the Netherlands we are at the beginning but prognoses show that the demand for telemedicine will increase the next years because of shortage of personnel and increase of chronic illnesses”

“In Australia telenursing is in its infancy. Gradually the benefits of telenursing and telehealth services is being recognized and the potential scope of these services and their benefits for the health of the general population are being investigated and realized’

Methods

The International Telenursing Survey was hosted online from September 18, 2004 to January 31, 2005. Online invitations were sent to those in key international telehealth organizations and key nursing groups as well as individual points of contact. Over 2000 invitations to participate were emailed. Professional organizations that were instrumental in distributing the survey included The International Council of Nurses (ICN), the International Medical Informatics Association (IMIA), the Telehealth.net listserv, the Canadian Society for Telehealth (CST), American Nurses Association (ANA), American Telemedicine Association (ATA), Association of Telehealth Service Providers (ATSP), the National Association for Homecare (NAHC), the Capital Area Roundtable on Informatics in Nursing (CARING), the American Medical Informatics Association (AMIA), the American Association of Ambulatory Care Nursing (AAACN).

Select Findings

There were 719 nurses (628 women and 89 men and 2 gender not stated) from 36 countries who completed the survey. Table 1 depicts the telenurse participant countries.

Table 1. Countries of International Telenursing Survey Respondents

Country	Number	Percentage
Greece, Congo, Korea D, Chile, Afghanistan, Ireland, Luxembourg, Uganda, Cuba, Germany, Israel, Ukraine, Croatia, Armenia, South Africa, China, Jordan	1	.1
Hong Kong, Panama, Taiwan, Republic of Korea, India, Argentina, Philippines	2	.3
Puerto Rico, Italy, Netherlands	3	.4
Iran, Finland	4	.6
Sweden	7	1
New Zealand	8	1
Norway	25	3.5
United Kingdom	29	4
Australia	35	5
Canada	72	10
United States of America	489	68

Telenurses' ages ranged from 22 to 84 with a mean of 48.27 (n = 699; SD = 8.35). The most frequent basic nursing education included Bachelor's degree (n = 285; 39.6%) followed by Diploma (n = 249; 34.6%) and Associate's degree (n = 138; 19.2%). Seven respondents indicated that they received their basic nursing education in high school. Close to half the sample (n = 338; 47%) indicated they had received additional formal education for advanced practice nursing, to include nurse practitioners, clinical nurse specialists, and nurse anesthetists.

Where telenurses worked varied widely, with the most frequent being a hospital (n = 195; 27.1%), college (n = 82; 11%), community (n = 70; 10%), call center (n = 64; 9%), government/national health (n = 59; 8%), clinic (n = 32; 5%), military, private company, insurance company, software firm (n = 12-15; 2%), ambulatory care, self employed (n = 9; 1.3%). Forty-one percent of telenurses worked fulltime in telehealth (n = 292). Those who worked only part-time were asked what percentage of their time was

spent in telehealth. Answers ranged from 1% to 95% (n = 328) with a mean of 32.3%

The overwhelming response to the types of populations that would best benefit from telehealth was those with chronic illness needs. Those populations included: elderly (N=93); chronically ill (N=79); diabetes (N=20); pulmonary-including COPD; (N=18); CHF (N=16); mental health (N=14); disease management (N=10); cardiac (N=9); disabled (N=9); palliative and hospice; (N=6) and stroke (N=4). [Total =276]. The other prevalent theme were those who live in rural areas (N=60); those who are poor (N=20); those who live at a distance (N=13); those who are underserved (N=12); and those who are under educated (N=2). Other types of populations identified as benefiting from telehealth were those with more acute care needs such as those requiring wound care (N=12) or asthma patients (N=3). [Total = 106] Other types of populations followed a theme of populations in need, but not chronic or acute. Those populations included: parents (N=17); families (N=13); mothers (N=10) and newborns (N=3). Finally, the specific function of telehealth seemed to imply the type of population who would benefit, examples of those populations included: community (N=13) and those who need monitoring (N=10).

Respondents were asked what their perception of the current and future needs for telenurses. While they saw a moderate demand at present, they perceived a sharply increasing need in the future (n = 410; 57%). The most frequent answers clustered around two distinct but related themes: budgetary cuts in health care (N=56) and the respondent's specific view of plans for growth or expansions of their current program (N=43). Other themes that emerged were the specific populations in need such as: aging population (N=24); those without access to care (N= 18); patients in rural areas (N=19) and those who are chronically ill (N=10). There were 26 responses that indicated that telehealth would *not* increase or would stay the same in the next three years. The reasons offered related to the length of time and onerous cost of starting telehealth/telemedicine programs.

Eighty-nine percent of respondents believe that telenursing should be a part of basic nursing education and that education should specifically include telenursing clinical experiences. There were 370 narrative responses describing opinions about the importance of telemedicine/telehealth certification for telenurses. Ranging in degree from somewhat important to crucial 125 respondents indicated that certification in some form would be important. The positive response regarding telemedicine/telehealth certification corroborates findings from the quantitative data in which 75.5% had an interest in achieving telemedicine/telehealth certification. The most dominant theme was that certification would offer a set of

standards for the field of telenursing. This theme was reinforced by several other respondents noting certification would benefit training and formal education for telenursing. Another supporting theme centered on the ways that certification could legitimize or offer increased status to both the field of telenursing and to those who practice telenursing.

Conclusion

The 2004 International Telenursing Role Survey examined numerous aspects of the emerging role of telenursing. These data have prompted initiation of the process to form a Telenursing Working Group within the ISfTeH and a Nursing Network for Telenursing, Technology and eHealth within the ICN. The authors invite nursing leaders who are in a position to be telenursing change agents, innovators, educators, and mentors to their nursing colleagues to join in these efforts. Advancing telenursing will take time, effort, and intra/interdisciplinary collaboration as nurses adapt their work flow and learn to leverage telehealth technologies to extend their reach to patients. It is critical for telenurses to be involved to insure success of telehealth programs.

Many issues remain to be resolved such as nursing education/preparation for telenursing, international nursing licensure, clinical nursing practice scope and standards, ethical, cultural, language, research, administrative, costs, reimbursement and policy challenges. While challenges may seem formidable, future growth and development of the telenursing role is certain.

Acknowledgments

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Research Project: A Remote Oncology Nursing Support at Hospital Sírio Libanês, São Paulo – Brazil

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Abstract: This paper is a description of a research project being conducted at a philanthropic private hospital called Sírio Libanês, located in São Paulo City in Brazil. The cited hospital has a well-structured Oncology Center with a very demanding public and also a Telemedicine Center as part of its Teaching and Research Institute. This context contributed to first start a research on Medical Oncology Monitoring in December 2006, using computer based technology through the Internet. The conclusion of that pilot brought us a new challenge, changing both technology and focus no longer on physicians, but on nurses, and also increase the sample of patients [1]. This report will explore some aspects about the new research project.

Introduction

The advances in computer technologies and telecommunication provide the identification of new services such as long-distance education, collaborative research and new possibilities of distance health support [2]. Some types of patients, cancer carrying for instance, have strong need for constant support and can benefit from these new possibilities.

The main objective of this study is to verify the effectiveness of the use of audiovisual system through Internet – called eHealth application from now on in this paper – to support patients in oncology treatment in comparison to the telephone. Secondary: check the adhesion of the patients supported by the new resource. Compare their satisfaction and the nursing people in both kinds of support. The mentioned Hospital counts on a telephone service support as an attendance differential for the patients in treatment at the Center. Such conduct is necessary due to the complexity of the procedures demanding constant care. The dissemination of the use of the Internet can take an important role to spread eHealth applications and provide a new communication channel to increase the satisfaction of the patients, especially those who need continued support, as stands in oncology specialty.

Methodology

Taking into account a degree of satisfaction of 50% for telephone from the nursing evaluation and 70% from the evaluation for the eHealth application, we applied 95% reliability interval and estimated that with 121 patients in each group will give us 90% of statistical power. $n = [70 \times (100-70) + 50 \times (100-50)] / (70-50)^2 \times 10.5 = 120.75$ patients.

Criteria of Inclusion: a) patient in oncology treatment, with some specific chemotherapy drugs and systemic therapy with infusions; b) man or woman; c) aged between 30 - 77 years old; d) capacity of deambulation and verbal communication through the camera; e) phase of the treatment cycle that allows 4 follow-ups; f) who already possesses computer and a broadband connection to the internet. After identified, the patients of the research receive explanations both orally and through a document called Informed Consent. At the end all the patients will fill out a questionnaire of satisfaction-evaluation. At the hospital, nurses will use the same script for both groups with specific questions about the health conditions of the patient. After health follow-up, they will evaluate the technology also by filling out a questionnaire.

Preliminary Results

The research is just in the middle, but we expect to verify whether or not the hypothesis of eHealth application is 20% more effective than the telephonic nursing support, as well as the level of satisfaction with the eHealth application greater than the telephone. Small data are posted in the Table 1 and Graphic 1 below.

Table 1. Technologies Evaluation - by the Nurse Team

	TELEPHONE GROUP - Hear the patient is enough to proceed your nursing support?	WEB GROUP - See &Hear the patient is more effective than only hear the patient to proceed your nursing support?
1 - Don't know		
2 - No		3
3 - Maybe		3
4 - Yes	8	1
5 - Yes, very much	3	2
Total of evaluations	11	9

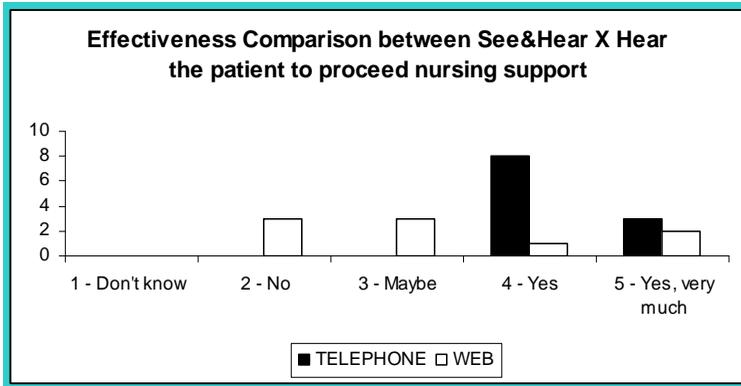


Fig. 1. Preliminary Result of Technologies Comparison

Conclusion

Until now, with such small sample it is difficult to say if we will be able to confirm the effectiveness of the eHealth because we have been facing some difficulties such as lack of available patient for the web group, nurses who are not fond of walking to the institute where place and infra-structure are prepared for the project. Some doctors do not allow their patients to get approached and some time and money restraints are pushing us to end the research until June 2008 latest.

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Telenursing Panel: Telenursing Implementation Strategies and Success Factors

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Abstract: As telemedicine/telehealth/telecommunications technologies continue to flourish, the practice of nursing is expanding to include valuable telehealth tools such as monitoring devices, video and Internet-based care and services. The rapidly emerging role of International Telenursing demands not only awareness of regulatory requirements, competencies, and practice guidelines, but also knowledge of key operational issues in the formation and sustainment of successful telehealth utilization. This paper details operational and strategic issues that physicians, nurses and healthcare administrators should be aware of regarding the practice of Telenursing and Telehealth-delivered care.

Introduction

According to Judith Oulton RN [1], The International Council of Nursing (ICN) has extensively researched the “global shortage of nurses” and recognizes that the nursing shortage predicted for 2020, both in the U. S and many other countries, will create an “adverse impact on health systems around the world”. The looming nursing shortage is attributed to the increase in the aging population and chronic diseases. Telehealth, ehealth, Telemedicine and Telecare Technologies can assist nurses with new methods of extending their reach to deliver patient care and conduct collaboration with medical specialists. For those intending to leverage new technologies to benefit more patients and provide more access to care, the primary objectives that will be detailed further in this paper is to provide key success strategies and tips for operational success in hospital-based Telenursing/Telehealth initiatives. Based on extensive design, implementation and hands-on training experience of the authors in assisting with the development of international telemedicine/telehealth/telenursing

efforts, this article shares lessons learned and key success factors and also barriers to success for hospital-based telehealth programs.

Three phases of telehealth implementation in hospital systems

Telehealth/Telenursing/Telemedicine can be successfully implemented within hospital-based systems in three main phases:

Phase One

Initially, it is critical to identify key people to establish and develop a success of the telehealth program. The Hospital Administrator and/or Chief Information Officer or Director of Information Technology can begin by exploring the possibilities and different types of telehealth/e-health/telemedicine applications for their facility. Selection of other team members, such as, a champion physician or nurse director/manager who can commit to the project from the beginning to at minimum the implementation phase would be desirable, ability to coordinate staff, initiate and manage the program and adapt telehealth schedules to the daily workflow processes is needed. A decision must be made regarding the type of telehealth/e-health/telemedicine program to fulfill the clinical needs, for example, teledermatology, telecardiology, telehomecare, telepediatrics, telepsychiatry, correctional telemedicine, teleophthamology, teletrauma or school telehealth.

The Telehealth team should constantly be aware of new telehealth applications and specialty areas that can assist patients. Basically, telehealth applications have no boundaries. The need for a patient care and lack of a physician specialist is what typically identifies the type of telehealth program that is initiated. The following action items are required:

- Identify a remote physician consultant and physician facility champion who are willing to accept, initiate and support the telehealth project;
- Identify a nurse director or manager who can be the initial “change agent” to promote the new processes/technology use;
- Appoint a “telehealth coordinator” who can manage the telehealth project, coordinate time lines with vendors, develop policies, procedures and permission forms prior to actual patient telehealth consults;
- Identify the members of the information technology team who are available to provide time and technical support for the project;
- Inform member of the biomedical department regarding new products that will be used for telehealth patient consults, the need to test and approve safety standards before equipment is used on patients;
- Select telehealth products and/or technologies according to need

- Select or designate and prepare the telehealth room, provide safe for storage of equipment;
- Meet standards and requirements for telecommunications installation in telehealth room, ask for technical support if needed;
- Organize and prepare needed equipment in telehealth room, i.e., non-latex gloves, gel, non-latex covers for camera tips, disposable measurement tapes, alcohol wipes, paper and pens and patient gowns and cover sheets;
- Train staff on telehealth equipment;
- Set-up and test equipment prior to telehealth consult.

Phase Two

The second phase typically is the installation, training and test phase. It is important to coordinate “vendor training and support” for installation and training of clinical staff. After installation and training are completed, then an equipment test and mock patient encounter using the videoconferencing unit, desktop software, or store and forward applications takes place. This should be followed by learning how to document, save, send or retrieve information stored on telehealth applications. Physicians and nurses need to identify the differences between a standard patient encounter and a telehealth encounter. They also need to understand how the technologies work and how they can be adapted for remote patient care.

Phase Three

The third phase is the implementation phase. The physician or telehealth coordinator identifies a patient who needs a teleconsult, and a scheduled date and time is organized among the healthcare providers, telehealth coordinator, and the patient. Once the telehealth program is well-established, other possible telehealth applications and future roles of telehealth nurses are opportunities that can be explored.

Successful implementation of telehealth programs

Telehealth/eHealth/Telemedicine initiatives, projects, programs large or small all have similarities of success and failure throughout their implementation. From the authors’ experience the following is a list of common success factors and barriers to successful implementation.

Key Success Factors:

- Administrator, physician or nurse administrator who has identified need for telehealth and displays ongoing strong support of telehealth program
- Enthusiastic physician or nurse who is identified as a project champion;

- Designated project manager or telehealth coordinator;
- Designated telehealth team;
- Sufficient funding available throughout implementation;
- Facility planned adequate network infrastructure to support telehealth and videoconferencing, desktop applications or store and forward applications;
- Facility included professional education courses and training classes;
- Facility held administrative meetings to support the program;
- Facility allowed time and funding to educate staff on the benefits of telehealth/ehealth/telemedicine ,either sent to conferences, provided speakers or access to telehealth information;
- Initiated telehealth program at main facility, then slowly introduced other facilities, such as, other hospitals, clinics, prisons or schools for teleconsults;
- Provided staff with learning tools, such as, charts, photos, manuals, descriptive pathways for initiating urgent or non-urgent telehealth consults;
- Organized scheduled dates and times for physician-patient follow up;
- Patient privacy and confidentiality forms addressed prior to program;
- Telehealth policies and procedures developed by telehealth team;
- Vendor demonstrations, product selection, and/ or usability testing done prior to installing and training;
- Staff educated and trained to make a videoconference calls to other telehealth sites;
- Staff trained on troubleshooting protocols for equipment challenges;
- Telehealth coordinators meet with telehealth team frequently to plan, implement, and evaluate the telehealth program;
- Telehealth consult room selected, equipment organized and tested for teleconsults;
- Facility dedicated technical support through-out deployment of program.

Barriers to successful implementation

Many organizations display similar weaknesses, however, some can easily be over come while other challenges need to be addressed:

- Lack of project manager, not dedicated to project or limited time allowed for project while doing other projects;
- Constant project delays, i.e., delayed products, delayed communication network installation, delayed products on back order;
- Funding limited;

- Poor or lack of communication between management and staff regarding implementation;
- Lack of a designated champion physician or nurse administrator;
- Failure to identify a remote consultant willing to provide telehealth consults, may be due to lack of understanding technologies;
- Poor selection of equipment, quality, need for equipment;
- Missing parts of equipment or supplies, i.e., cables, CD's, ear tips for otoscope;
- Unable to designate a telehealth room due to no extra room available;
- Ergonomically poor placement of telehealth equipment in telehealth room, i.e., poor lighting, limited power outlets, no cable management, no counter space, no storage cart for equipment, area not secure;
- No videoconferencing or desktop applications training prior to telehealth installation, healthcare providers not familiar with navigating applications;
- Not enough training time ordered or scheduled for telehealth staff;
- Poor to no staff interest in participation, staff complained no incentive or reason for them to participate in project;
- Evening or night shift staff had difficult time staying awake during training sessions;
- Frequent staff turnover, no knowledge transfer done;
- Poor communication, no announcement made of telehealth/e-health/telemedicine program availability;
- Difficulty testing network connections, no place to test with, may have firewall issues to deal with;
- Limited expert technical support, technical staff either too busy or unable to provide telehealth technology support 24/7;
- Staff resistance, staff angry for exclusion during equipment selection or project implementation;
- Staff perceive change as not needed, unable to see value of telehealth program;
- Staff unable to adapt workflow, unable or unwilling to change;
- Poor or limited network infrastructure, difficulty dialing out to another site, dropped calls or connections;
- Staff level of education not sufficient to manage telehealth program, or limited knowledge of medical device use.

Successful telehealth case studies

The following three vignettes identify successful telehealth applications:

1. Princess Margaret Hospital, Nassau, Bahamas – implemented a telehealth pilot project in 2008 from Princess Margaret Hospital in Nassau to a small clinic on the Family Island of Abaco. Emergency medicine physicians needed to assess and evaluate a critically injured or ill patient who is brought to the clinic and who would need a medical air transport to Nassau for further care and treatment. With limited healthcare funds, the high cost of medical air transport is a factor. The use of a videoconferencing system, telemedicine medical devices and telecommunications network to send images and patient heart sounds over telecommunication network was initiated by the Ministry of Health.

2. Kimaw Health Clinic, Hoopa, California- for several years, the clinic has been using a videoconferencing system and hand held camera to consult remotely with a dermatologist for patient's skin problems. The clinic is located hundreds of miles away from a major medical center in Sacramento, CA. What is unique about this telehealth program is that although the clinic is only two hours away from a larger medical facility, because of difficult access is over high mountain elevations and winding roads, it is not easily navigated, and the telemedicine program is preferred.

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Late Submissions

Medical Service in Rural Areas of Germany by Telemedicine

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***Abstract:* Two concepts help to provide medical care independently on rural or municipal patient domicile. The concept TEMPiS from Bavaria encloses cross linking of 16 rural hospitals with two medical centers. The concept AGNES from Mecklenburg-Western Pomerania encloses work release of general practitioners by task transfer to local community nurses.**

Introduction

Continuously improvement of medical interventions increases the live quality of many citizens. Growing knowledge about diseases and its therapy causes progressive specialization of physicians, therapists and nursing staff. Deep specialization becomes a main issue of medical care. Sparsely populated areas deprive specialized physicians of sufficient patient numbers to maintain their expertise. Additionally demographic changes and unresolved structural transformation in rural areas intensify migration of physicians. Consequentially number of practitioners decreases there and distances increase between locations of patient's residence and medical attendance. Large quality differences in medical care and its outcome arise finally considering citizens of municipal and rural areas.

Telemedicine could be suited to provide medical care with similar high quality independently on domicile of all patients. Supporting this statement, two concepts and its perennial results are presented.

Concept TEMPiS

The concept TEMPiS from Bavaria encloses organizational and technical components of cross linking 16 rural hospitals with two medical centers of maximum reputation. Implementation and technical furniture were adapted

to praxis since four years. Today it provides measurable benefit for patients and network participants in well defined medical branches. To improve outcome of stroke patients more qualified stroke centers were developed and ways were searched to get patients faster to those centers. However, in regions with wide geographical distances between community hospitals and experienced stroke centers, tele-medical networking might be a timesaving alternative to improve stroke treatment. Key treatment is administration of thrombolysis in community hospitals advised by immediate neurological tele-consultation. TEMPiS was founded by 2 academic stroke centers to provide specialized stroke care in a nonurban area of eastern Bavaria, where no stroke units existed. 16 regional hospitals are participating in the project, including 2 hospitals with neurological departments and 10 hospitals in which stroke care is provided by the internal medicine departments.

TEMPiS consists of four elements [1]:

(1) Setup of specialized stroke wards in each hospital with 24-hour availability of diagnostic procedures including CT scan, laboratory exams, and Doppler sonography. Stroke teams were formed with doctors, specialized nurses, physiotherapists, speech therapists, and occupational therapists. Stroke treatment is based widely on standardized stroke care protocols.

(2) Comprehensive and continuing stroke training for all medical staff members including training in National Institutes of Health Stroke Scale (NIHSS), implementation of a thrombolysis algorithm, and disposition of its protocols.

(3) Implementation of a telemedicine network with daily 24-hour service using a high-speed data transmission for digital brain images and real-time clinical examination of patients via video-communication (fig 1).

(4) Central organization of emergency interhospital transfers, including interventional treatment of hemorrhagic complications.



Fig. 1: TELEDOK provides remote consultations near hospital bed

Concept AGNES

The concept AGNES from Mecklenburg-Western Pomerania encloses work release of general practitioners in rural areas by task transfer to local community nurses and their technical equipment. A feasibility study was conducted to elderly patients who would otherwise have been receiving monitoring home visits from their general practitioner [3]. A specially trained community medicine nurse visited now the patients instead of the physician. She was instructed to report important changes in health status of a patient during her home visits immediately via her communication equipment (fig. 2) and to install telemonitoring devices according to the patients' needs. Data were transmitted automatically to general practitioner. Patients were trained to use the devices independently in their homes. As devices ECG meter, electric scales, blood pressure meter, blood glucose meter and eye tonometer were used.

All activities of the nurses are documented detailed and standardized. In addition, the participating general practitioners, community medicine nurses and patients are regularly interviewed with standardized questionnaires. The results of the projects are positive and indicate a high acceptance of the concept community medicine nursing with the participating general practitioners, nurses and patients [4].

Based on these results and experiences, an experimental, learning curriculum was developed, which is currently followed by a first group of nurses.



Fig. 2: Communication equipment for community nurse

Conclusion

Medical video communication acts as the main component in both concepts and should fit all requirements for medical inspection as one of the most basic diagnostic method. Certain temporal, spatial and spectral resolutions of transferred video stream have to be ensured regardless of restrictions in transfer channel band width. Furthermore the user interface of technical aids (see VIMED® - products) and the complete organizational environment determines jointly the acceptance of telemedicine.

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Telemedicine Challenges in Africa

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Abstract: The South African Department of Health seek to harness the benefits of ICTs in its policies and strategies in order to promote equitable healthcare to all. The National telemedicine pilot project introduced new technologies and some of the experiences and lessons learnt from this project are discussed. An innovative telehealth case study is described which provides additional recommendations for telemedicine implementation in rural areas. Telemedicine is not only a technical development but also includes social, cultural and behavioural aspects. Recommendations for implementation are made.

Introduction

African health authorities are faced with major challenges in providing healthcare to its people particularly in the rural areas. This is compounded by a number of factors including a growing burden of disease, skills shortage, poor infrastructure, and high telecommunication costs. There is a real danger that Africa will not achieve the Millennium Development Goals in healthcare. Through the use of telemedicine well resourced medical centres can provide expertise and technical support to primary rural health care communities across borders in different parts of Africa enabling access to healthcare for anyone anytime and anywhere.

eHealth Policy in South Africa

The South African Health White Paper on eHealth 2007 [1] describes a vision that creates an accessible caring and high quality health system. Government has addressed Information Communication Technology (ICT) challenges in their legislative processes including the drafting of strategic priorities for the National Health System (2004 – 2009) and part of this plan is to implement phase two of the telemedicine programme [2].

Telemedicine in South Africa

In 1999 the department established 28 pilot sites in six provinces. The initial applications were teleradiology, teleultrasound for antenatal services, telepathology and teleophthalmology [3]. By 2007, South Africa had 72

telemedicine sites with the majority of sites providing applications on teledermatology and distance education.

The Eastern Cape Province was one of the National pilot telemedicine sites [4]. Poverty and the rurality of the Eastern Cape create a high dependency on public health services. This situation is due to poor infrastructure and isolation of rural clinics. The workload is also increasing due to HIV/AIDS epidemic and thus the need for specialized advice or consultation or second opinion. Lack of telecommunication makes proper referring of patients difficult and lack of access to training and Continual Medical Education (CME) keeps also healthcare workers away from the rural health centres.

Specialized care is very scarce, with only 2 dermatologists, 4 radiologists, 2 oncologists and no oral health specialists in the public service. A major challenge is the drainage of healthcare professionals from the rural communities to the more developed urban centres; this situation is due to poor infrastructure and isolation of rural clinics. Professional isolation from their peers contributes to the difficulty in attracting and retaining qualified staff in rural areas.

Tsilitwa rural telehealth case study

The Tsilitwa rural telehealth project [5] demonstrated how teledermatology and teleconsultation could be implemented in a deep rural clinic. The project used an innovative communications infrastructure based on the use of satellite (VSAT) and wireless technologies. The 11 Mbps wireless technology provided point-to-multi-point connectivity within the village linking a rural clinic to a community hospital 10 km away. The wireless technology provided voice (VoIP) and video over internet protocol.

Experiences and lessons learnt

South Africa has eleven provinces and responsibility and accountability for telemedicine was devolved down to the provincial level. For many provinces this resulted in a number of new challenges.

In the Eastern Cape for example, the telemedicine co-ordinator also had a full-time job as medical superintendent at a large hospital and major challenges emerged in managing both jobs. The lack of authority was a key issue expressed by the co-ordinator as well as the lack of management buy-in to the telemedicine programme. This resulted in delays to the budget process and allocation of resources and personnel.

The lack of management leadership and vision resulted in the demotivation of the project team. With respect to the hospital staff experience has shown that doctors and nurses regard telemedicine as an

additional job or an extra burden. Many lack the skills and training necessary for telemedicine. This results in the lack of use or misuse of equipment [6].

Once the Tsilitwa/Sulenkama pilot was in place, the department saw the implications for a wider implementation of the telehealth solution and started the process of possible replication. Telehealth enabled nurses to learn how to treat a wide range of problems locally and prevent unnecessary travel by sick patients to the hospital and simultaneously lessen the workload for the doctors at the hospital.

The telehealth projects indicated that it can take a long time and a lot of effort before health officials adopted ICT technology into their daily routine. The evidence also showed that it was necessary to provide a competent support person in the community itself to support the nurses, doctors and health administration staff to use IP-based communication as a part of their everyday work processes.

Recommendations

Experience shows that for the successful implementation of telehealth it is essential to have buy-in from top management with a clear vision and shared strategic intent. Lines of responsibility and accountability need to be defined. Following the strategic plan there should be the required allocation of resources including budgets and personnel. The telemedicine co-ordinator should be a full-time position with support staff.

An effective telehealth solution depends on the commitment of the entire chain of command in the health environment to use it, from clinic to specialist. Telemedicine needs to be integrated with the mainstream activities within the hospital.

Capacity building for effective ICT use starts at the clinic level, but needs to be combined with orientation of all the people involved in the medical and administrative chain to get the commitment from each node to prevent a break-down in communication. Training needs to be conducted prior to service delivery and a separate facility needs to be allocated to do this.

Healthworkers need recognition for their participation and contribution to telemedicine and their job descriptions should clearly state responsibilities and accountability. Healthworkers should also be supported and encouraged to use telemedicine.

The Tsilitwa case study demonstrates how technology and skills training can enhance healthcare in a rural environment. Despite poor infrastructure the technology demonstrated how low-bandwidth can support solutions for teleconsultation and teledermatology. A well-maintained core ICT infrastructure is the foundation for demand-driven scaling and replication.

However, telehealth should be more than technical development it should also consider the social, cultural and behavioural aspects of healthcare [7].

Conclusion

A review of these pilot sites in the Eastern Cape has shown that the implementation of telemedicine is not only about technology but also about change management and the commitment of the entire chain of users.

Many of the benefits of technology have been illustrated in the case studies including earlier diagnosis of the patient, less travel time and cost to the patient, better utilisation of resources, empowerment of clinical staff through specialist consultation and the ability for doctors to receive ongoing training in remote areas. The above research findings provide important inputs into the roll-out of telehealth services in rural Africa. This paper highlights the need for innovative ICTs to be deployed in rural areas and forms the basis for new research in developing the “African clinic of the future”.

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