Preface

Dear Reader,

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

With 105 papers from 34 countries (Fig. 1), the book presents a collective experience of experts from different continents all over the world. Papers reveal various national and cultural points of view on how to develop and implement Telemedicine/eHealth solutions for the treatment of patients and wellbeing of citizens.

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

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

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

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

- The content of the book is divided in chapters covering various areas of eHealth;
- Chapters, and papers in each chapter, are listed alphabetically;
- The original style of the authors was respected as much as possible;
- In the content, after the title of papers, a maximum of 3 co-authors are listed, while the rest are marked as “et al.”;
- “How”, “Where”, “When” and especially “How Much” – are only part of the questions that authors are trying to answer.

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

Enjoy your reading!

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Editors gratefully acknowledge the work of all reviewers that dedicated lots of efforts, time and high expertise, and with their valuable advice, supported both authors and editors in the process of selecting, correcting and preparing for publication all papers included in this book.
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Disease Management and
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Audit of Emergency Electrocardiograms from a Brazilian Large Scale Telecardiology Service

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Abstract: The Telehealth Network of Minas Gerais (TNMG) is a public telehealth service that assists the primary care of 722 cities in Brazil. Our aim was to investigate the reasons for the primary care practitioners to send a high number of emergency electrocardiograms (ECGs) and to implement corrective actions. This is a quasi-experimental study. In the 1st phase, all ECGs performed in the primary care units that sent >70% of ECGs as emergency from February to March 2014 were selected. The 2nd phase consisted on telephone calls to the 63 telehealth sites selected on the 1st phase to investigate the criteria adopted to classify a case as an emergency. Primary care practitioners were informed about the criteria to define an ECG as an emergency. In the 3rd phase, the proportion of ECGs sent as an emergency 1 and 2 months after the intervention was assessed. The main results were: 50% of the practitioners did not know the proper definition of an emergency; 67% of the cities had a significant reduction of the proportion of ECGs sent as an emergency 1 month after the intervention; 17% had a significant reduction after 2 months. This study demonstrated that many primary care practitioners are not aware of the criteria to define an emergency, and that a simple intervention may be effective in reducing the proportion of ECGs incorrectly classified. This may be a topic for future training and tele-education activities performed by TNMG.

Introduction

Telehealth has emerged in Brazil as a strategy to improve the quality of care by supporting primary care professionals in remote or isolated cities [1]. The Telehealth Network of Minas Gerais (TNMG) is a public telehealth service that assists 722 municipalities in the State of Minas Gerais, providing telediagnosis and teleconsultation for 877 telehealth sites in
primary care units (PCU) and 7 Emergency Care Units. More than 2 million electrocardiograms (ECGs) have already been analyzed since 2006, which currently corresponds to a mean number of more than 2,000 ECGs analyzed daily [2]. The ECGs may be classified by the healthcare practitioner who records the ECG as emergency, priority or elective. The emergency ones are assessed immediately, and the cardiologist provides the report in just a few minutes. For the elective ones, the healthcare practitioner gets the report back in average in 4 hours.

An assessment of the system from 01/10/2013 to 31/12/2013 showed that 27.6% of all ECG exams performed by the primary care telehealth sites were sent as “emergency”. As it is not expected that these units attend such a large number of emergencies, the hypothesis was that a great number of ECGs were incorrectly classified. This is potentially harmful, as it delays the assessment of the real emergency ones.

The objective of this study was to investigate the reasons for the primary care telehealth sites to send a higher number of emergency ECGs than expected and to implement corrective actions in order to reduce the proportion of ECGs incorrectly classified.

Methods

This is a quasi-experimental study. In the 1st phase, the proportion of emergency ECGs per telehealth site from February to March 2014 was assessed. The telehealth sites in primary care units that sent > 70% of ECGs as emergency were selected. Emergency Care Units and telehealth sites that performed < 15 exams during that time period were excluded. A protocol was elaborated to establish the methodology to approach the healthcare professional who was responsible for the tele-ECG in each telehealth site, in order to investigate the main causes for sending the ECGs as emergency. As the hypothesis for the large amount of ECGs sent as emergency was that primary care professionals were not aware of the correct criteria to classify the exams, corrective measures were developed: it was elaborated a document to the professional who is responsible for performing ECGs with information about the use of the system and the definition of emergency according to the Brazil’s Board of Physicians (Conselho Federal de Medicina) [3].

In the 2nd phase, the healthcare practitioner responsible for the ECG in each selected telehealth site was contact via telephone. Telephone calls were performed by trained undergraduate medical students, under the supervision of a coordinator from the TNMG. The occupation of the responsible for performing the ECG recording and how long he/she was responsible for this task were registered. An open question was made to
investigate the criteria adopted to classify the exam as an emergency. In the same contact, primary care professionals were informed: (i) the criteria to classify an exam as emergency, according to the definition of emergency from the Brazil’s Board of Physicians; (ii) that all the exams are analyzed in the same day, independently of the ECG classification. At last, an e-mail was sent to reinforce the criteria to classify the ECG as an emergency.

In the 3rd phase, a new assessment of the proportion of ECGs sent as emergency by each telehealth site was performed, 2 months after the first contact. The proportions on baseline and 1 and 2 months after the intervention were compared using the Chi-square test. Statistical analysis was performed using the software SPSS version 19.0 and p-values less than 0.05 were considered significant.

**Results**

In the 1st phase, 63 telehealth sites were selected. The majority of primary care practitioners responsible for the ECG recording were nurses or nursing technicians (92.1%), and 58.7% were working on this task for up to 2 years. The reasons given by primary care practitioners for classifying ECGs as emergency are shown in Table 1. All exams were sent as emergency by (15.9%) of primary care professionals.

In the 1st month after intervention, 66.7% of the 63 PCU had a significant reduction in proportion of ECGs sent as emergency (p< 0.05), 9.5% had a trend of reduction in the proportion of ECGs sent as emergency, 3.2% had no reduction in that proportion, 12.7% had an increase in that proportion and 7.9% PCU did not send ECGs in the period (Figure 1).

**Table 1 – Reasons for classifying electrocardiograms as emergency**

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<tr>
<th>Reasons</th>
<th>N (%)*</th>
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<td>Medical request</td>
<td>33 (52.4)</td>
</tr>
<tr>
<td>Chest pain</td>
<td>28 (44.4)</td>
</tr>
<tr>
<td>Abnormal blood pressure</td>
<td>14 (22.2)</td>
</tr>
<tr>
<td>Preoperative assessment of elective surgery</td>
<td>6 (9.5)</td>
</tr>
<tr>
<td>Patient that needs to leave the PCU quickly</td>
<td>4 (6.3)</td>
</tr>
<tr>
<td>Medical consultation scheduled</td>
<td>3 (4.8)</td>
</tr>
<tr>
<td>Investigation of myocardial infarction</td>
<td>2 (3.2)</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>2 (3.2)</td>
</tr>
<tr>
<td>Others**</td>
<td>8 (12.7)</td>
</tr>
</tbody>
</table>

PCU: primary care unit.
* More than one reason can be given for classifying ECG exams as emergency.
In the 2nd month, when compared to the first month, 17.4% PCU had a significant reduction in the proportion of ECGs sent as emergency and 23.8% had a trend of reduction; 4.8% had a significant increase in the proportion of ECGs sent as emergency although the proportion was significantly lower than the baseline; and 39.7% PUC showed a trend of increase in the proportion of ECGs sent as emergency (60.0% of them remained with a significant reduction compared to baseline). Among the 5 who have not sent in the first month, 4 did not send in the second month and one of them showed no significant reduction in the proportion of ECGs sent as emergency when compared to baseline.

Discussion

This study showed that the majority of the primary care practitioners who are responsible for the ECG recording in the PCU, were not aware of the criteria to classify the ECG as an emergency, confirming our hypothesis. Preoperative assessment of elective surgical patients, patient that needs to leave PCU quickly, medical consultation scheduled and other reasons cannot be considered for this purpose. This misclassification may adversely
impact the response time of the real emergency ECGs, with negative effect on the conduction of the critical clinical cases.

Additionally, this study also showed that a simple intervention may have a significant impact reducing the misclassification. The majority practitioners responsible for ECG recording were nurses and nursing technicians. However, it is important to promote an intervention which impacts the physicians, as sometimes they are also not aware of emergency criteria and how the misclassification can impact the telehealth service. As it was observed in this study that the most common reason for sending an exam as emergency was medical request, the intervention on physicians is expected to improve the results.

In conclusion, this study demonstrated that many primary care practitioners are not aware of the definition of emergency, and that a simple intervention as a telephone call and an email may be effective in reducing the proportion of ECGs incorrectly classified. This may be a topic for future training and tele-education activities performed by TNMG.

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Blood Glucose Level Prediction for Mobile Lifestyle Counseling

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Abstract - We propose a combined absorption - blood glucose control model to predict the blood glucose levels. Our method takes nutrition, applied insulin, and initial glucose level into account during the calculations. The models have many parameters, which suits the high natural variability of the patients. In order to personalize the model, i.e. to train the parameters, two parameter identification algorithms, the Brute Force Algorithm (BFA) and Genetic Algorithm (GA), were used. The results show a significant improvement with the trained parameters. The method is currently being validated in a clinical study with 20 patients. The integration of the algorithm into the telemedical lifestyle support system Lavinia is expected later this year.

Introduction

Diabetes mellitus is one of the modern age diseases, spreading widely and causing critical problems in health care. Our aim is to help diabetics calculate their insulin need by predicting short term blood glucose courses with an efficient algorithm. Different factors affect the blood glucose level. Most obvious are diet and insulin dosage, these are the factors that the patient can control to act on the blood glucose level in short-term. Other valuable factors are the glucose metabolism, body mass index, insulin sensitivity, physical activity and stress.

This paper focuses on the prediction of blood glucose levels using mathematical model simulating the glucose and insulin absorption taking into account the initial glucose values. For the model personalization we use different parameter identification algorithms (Brute Force and Genetic Algorithm). For the testing and validating we use real life patient data series from clinical trials results logged in Lavinia [1] Lifestyle Mirror mobile application.
Method

Our method uses the combination of two state-of-the-art models reflecting the real process happening in the body. We split the whole procedure in two parts. The first part is insulin absorption, which is simulated with differential delay equations. This model includes two subcutaneous insulin depots. These depots simulate subcutaneous insulin absorption. For further details of this model and the parameters see [2].

The second part of our combined model describes the glucose absorption from meals [3]. It is a two-compartment model based on mass balance equations. The model divides the digestion into two parts; stomach and intestine. The model takes protein, lipid, monosaccharide, fiber, and starch intake as input, with each one having its own effect during the absorption. This method can deal with mixed meals with components of different Glycemic Indexes (GI) and takes into account the effect of fiber. Moreover, digestion overlap between two consecutive meals can be handled properly. For more details about the model and the parameters see [3].

Our combined model simulates the real life process efficiently, therefore has large parameter sets. The results of our tests showed that there are 3 parameters which have a remarkable impact on the results: the disappearance rate for insulin, the glucose uptake by insulin-dependent tissues, and the distribution volume for insulin. To train these 3 parameters, we used two parameter identification algorithms. The first one is the Brute Force Algorithm (BFA), which means a full search of parameters in a specific range. The other method is Genetic Algorithm (GA) that simulates the process of natural evolution. For the other parameters, we used an average value suggested by the literature [3].

We had 10 different data sets of 7 patients, one type 1 (T1D) and six Type 2 (T2D) diabetes, each one including at least 3 days of logging and 12 meals. We had a total of 200 meals and 40 days of input data. The collected data consists of blood glucose measurements, taken at every five minutes by a Medtronic Continuous Glucose Monitoring (CGM) system, and the corresponding daily meals and applied insulin doses were logged through Lavinia. We asked the patients to avoid physical exercises during the experiment, thus we ran the calculations without it.

Results

First we performed meal wise tests in which the meals were treated as separate tests. This means zero startup blood insulin level and the model starts without any glucose absorption. In this phase, 2 hour, 4 hour, and 6 hour meal wise tests were made to measure the correctness of the model in short-term and in long-term as well. We also made daily tests; one without
model restarting and one with model restarting. This means that the predicted blood glucose levels have been set back to the measured value before each meal. This approach is a transition between meal wise and daily tests, because the insulin and glucose absorption calculations are continuous, but the blood glucose levels are corrected to avoid errors accumulation.

We performed model training, i.e., parameter identification. We made whole day tests with restart using the BFA method and the GA. We observed that 3 datasets are more precise than the other hospital patient; therefore, we found it useful to divide it in two categories; all patients and most accurate dietary log data sets. Results are shown in Table I.

Table I: Average and Maximum Error Values in mmol/l. (Mela wise: 2h, 4h, 6h, Whole day: No restart, Restart, BFA, GA)

<table>
<thead>
<tr>
<th></th>
<th>Without training</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2h</td>
<td>4h</td>
</tr>
<tr>
<td>All Patient</td>
<td>Average error</td>
<td>5.05</td>
</tr>
<tr>
<td></td>
<td>Max error</td>
<td>10.62</td>
</tr>
<tr>
<td>Accurate log</td>
<td>Average error</td>
<td>4.26</td>
</tr>
<tr>
<td></td>
<td>Max error</td>
<td>8.10</td>
</tr>
</tbody>
</table>

In the case of the most accurate data sets the results were ca. 20% better on average. The all-day tests with restarts show a significant improvement in all of the results and the maximum error is also decreased by at least 3 mmol/l. With model training, the results show a nearly 25% improvement in average error, but the maximum error remained almost the same when model restarting was applied. The reason is that the model does not handle the long-acting insulin properly.

Conclusions and Future Work

In the light of the results our method cannot reliably predict hypoglycemia because the maximum error exceeds 5 mmol/l, but it is competent to predict hyperglycemia symptoms. Since we can give an immediate feedback on the meal impact on the blood glucose level, it can be a perfect tool for learning a healthy lifestyle.
As for the difference between the most accurate and all the data, we can state that accurate logging is very important. To support this, we plan to create detailed manuals about the important events that should be precisely logged. Our clinical study involving 20 diabetic patients is now in progress. Using a longer CGMS data for training may bring better result as well.

Future research is needed for training the model with other parameter identification algorithms e.g. multifaceted genetic algorithm, extending the model to support physical activity, stress, and weather changes, and better modeling the action of long-acting insulins. The final aim is to decrease the average error under 1 mmol/l during the first hour and under 3 mmol/l during the first 4 hours.

Acknowledgment

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CLICT: A Scheme about the Completeness of Layers towards Integrated Care Enabled by Technologies

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Introduction

We explore the relations between Integrated Care and Technologies by assuming that Horizon 2020 targets require a joint evolution of organizational models and technological deployments in order to assure a holistic approach to the citizen’s health.

The innovation of care and cure services, enabled by telemedicine and eHealth solutions, is mostly fragmented in a number of silos. Each silo involves a commitment by policy-makers, the deployment of organizational changes, and the implementation of specific technological components.

Those silos should represent different action lines of a Roadmap where the technology–aware care and cure services will fit into a pre-defined comprehensive framework as the pieces of a jigsaw puzzle, according to local cultural economic and structural constraints.

We present a scale on the systemic completeness towards Integrated Care, reflecting: (i) the distribution of roles among communities of practice with strategic, clinical, organizational, educational and technological cultures; (ii) the way in which the innovation is interpreted; (iii) the drivers for its deployment; (iv) the type of technology involved.

Summary of the CLICT Scheme

The CLICT scheme considers six layers of completeness (see Fig.1), divided into three groups; the progression from the lower layers to the upper ones reflects the way in which the innovation is interpreted and the main drivers for its deployment, namely technology, organization and strategies.

In the lower layers 1 and 2 the prevalent focus is on technological investments and technological competences, and it is weakly connected with the care and cure processes and settings; in the intermediate layers 3 and 4 the technology is increasingly being acknowledged as an enabler for the redesign of complex and coordinated care and cure services, and the organizational competence prevails; finally in the upper layers 5 and 6 the
focus is shifted toward the strategic change processes within the health system, according to regional policies. Even if the various kinds of competences are present in all the layers, at various degrees, their reciprocal relevance depends heavily from the degree of overall completeness reached towards the Integrated Care paradigm, i.e. on the specific challenges faced by each innovation programs.
Discussion

The six layers of the CLICT scheme could suggest an Adoption Model: an adequate deployment of each layer –as a whole– is a prerequisite for the full exploitation of its upper layer: the maturity of a layer serves to support the widespread evolution and scale up of the solutions of its upper layer [1].

The two lower layers are the support for the eHealth scenarios so far promoted in most countries. They reached a high level of adoption, whether for the natural evolution of the market, or as a result of European and national programs (e.g. the Digital Agendas). Usually decisions are taken at national/regional level, with adoption plans and supporting regulations.

Usually the decisions about the Layer 3 may be taken among individuals or within a local facility, whereas the ones about the Layer 4 may typically involve organizational issues and change management capabilities in one or more local healthcare districts and/or municipalities.

The introduction of infrastructural solutions of the Layers 3i and 4i, will not change – per se – the way of working of the professionals; the expected level of spontaneous adoption is probably low and thus it could yield only a limited impact on the care provision. Additional activities are needed by clinicians to develop the info-structure, and suitable agreements among the users are required to put it in practice in a given locality, unless there is a regional program with proper regulations [2].

Layer 5 stems from the willingness to introduce innovative management systems and care models about Chronic Care Model, Long-Term Care, disease-related networks, frailness management, patient engagement, etc., according to a strategic approach to a health condition or to one particular level of risk/complexity according to the Kaiser Pyramid. It could imply a bottom-up approach, to identify and scale up good practices coherent with the strategic objectives (e.g. a regional plan on diabetes, or about frail elderly people), supported by earmarked interventions on regulations.

Layer 6 brings to the full deployment of Integrated Care, by interlinking a wide range of Action Lines into a comprehensive Action Plan covering an adequate number of health conditions, healthcare/social facilities and citizens. It is the realm of regional policy makers, to envisage large-scale, multi-annual top-down roadmaps, with explicit milestones and measurement criteria to assess the progress of the initiatives [3].

This Adoption Model can support regional and local authorities to assess and compare the level of adoption/readiness of the components within each
layer, as well as the support to the change management processes about the co-evolution of care models and technological solutions.

Conclusion

The complexity of the joint evolution of organizational and technological components increases from Layer 1 up to Layer 6, even if in the short term isolate deployments of some scenarios across multiple layers could be successfully performed.

However, past experience of a spontaneous and patchwork growth of eHealth and Telemedicine systems shows the huge costs of the efforts to rebuild a posteriori an appropriate level of organizational synergy and technical interoperability across several partial and independent care models and technological solutions: a proper co-evolution of care models and technological solutions can be crucial in all the above contexts.

Integrated Care should correspond to an appropriate management of Integrated Information.

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Introduction

The European Society of Cardiology, as one of the world’s largest professional bodies, is involved in e-Health on many different levels [1].

There are several definitions of e-Health. e-Health is a broad term encompassing the use of information and communication technologies (ICT) in support of health and health-related activities, including healthcare services, health surveillance, education, knowledge management, ‘analytics’, and research. There are several e-Health domains, including: Telemedicine and Telecare; Clinical information systems; Integrated regional and national information networks; Disease registries and other non-clinical systems used for education, public health, and healthcare management; ‘Mobile’ health (m-Health) and ‘Personalized’ health (p-health), including mobile applications (‘Apps’).

E-Health can provide innovative solutions addressing problems in ageing societies as increasing numbers of citizens living with chronic diseases when health budgets are under pressure and health professionals are in shortage. Arguably, e-Health could also support the strong political drive to move care closer to the patient’s home and to empower patients giving them control and shared responsibility to manage their disease.

Both e-Health and m-Health are already used (or have a potential for application) in practically every aspect of cardiac healthcare such as prevention, diagnosis, risk assessment, monitoring, education, counselling and treatment [2]. For these reasons, the interest in e-Health and m-Health is rapidly increasing. It is estimated that in 2017 50% of smartphone users will have at least one m-Health app. The use of such innovative solutions will hopefully restrain the escalating costs of healthcare. E-Health and m-Health are considered not only the first-line but sometimes the only chance for a
large number of patients to access professional medical help, particularly in countries with large rural areas and few doctors or nurses.

A number of these domains are tackled in our project of integration of data of cardiology patients on telemonitoring with a clinical information system. Remote follow-up of implantable cardioverter defibrillators (ICDs) may offer a solution to the problem of overcrowded outpatient clinics, and may also be effective in detecting clinical events early. Data obtained from remote follow-up systems, as developed by all major device companies, are stored in a central database system, operated and owned by the device company. Another example is that of heart failure patients, who are monitored remotely by having the patients sending various data on their health status to a central database. The problem now arises that the patient’s clinical information is partly stored in the local electronic health record (EHR) system in the hospital, and partly in the remote monitoring database, which may potentially result in patient safety issues.

To overcome this problem, we have integrated the data from remote monitoring and telemonitoring systems with our Cardiology Information System, based on international data standards, resulting in one integrated platform that contains all relevant data on the patient’s disease status [3].

Implementation

All major device companies have developed a remote follow-up solution. At regular intervals (depending on the setup of the specific remote monitoring system) the implanted device will connect to a receiving system at the patient’s home, and then send data on the status of the device and of the patient to the central database system, operated by the device company. The physician can log into a secure website and check the data from the remote follow-up for each patient. However, until now it is not possible to integrate the data from remote monitoring system into the local electronic health record (EHR) system. In other words data are stored on different systems and may not be accessible for all healthcare providers. This may potentially result in patient safety issues as it may be difficult to keep track of all information available and information which may be only accessible for certain doctors of technicians. Ideally all information should be available in the EHR system.

Therefore there is a need to be able to import data from the remote monitoring database system and to integrate the data into the local EHR. To obtain this goal there is a need for a standard set of observations, communicated in standard messages, such as: therapy settings, events, device self-monitoring. Furthermore, there should be a consistent presentation of data from all devices.
IHE (Integrating the Healthcare Enterprise) is a shared initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. Systems that support IHE “Integration Profiles” ideally work together in a standardized way, are easier to implement, and help care providers to use information more effectively. In various domains, IHE integration profiles specify how, for that specific domain and topic, data can be exchanged based on existing standards. Therefore, IHE is not a standard; it merely specifies which standards should be used in a certain domain, and how they should be used.

To address the requirement of integrating remote monitoring data in the local EHR, the IHE Implantable Device Cardiac Observation (IDCO) profile has been developed. The IHE IDCO profile defines a standards based transfer of device interrogation information from the interrogation system in to the information management system. Strong device vendor participation in the IDCO profile development is an acknowledgement of its importance. The IHE IDCO profile is part of the IHE Patient Care Devices (PCD) domain. See figure 1 for a schematic overview of the IHE IDCO system model.

An important part of the IHE-PCD IDCO profile is the nomenclature, the definition of the variables that are exchanged. Companies that implement the IHE-PCD IDCO profile not only need to exchange data in a standard way, but they also should make the data available using uniquely defined data definitions. The IEEE Standards Association is defining sets of terminology for ‘point-of-care’ medical device communication. One of these sets is IEEE 11073-10103 which supports terminology for implantable cardiac devices. A draft version of this standard is available, but still subject to change. All large cardiovascular implantable device vendors are involved in the development of the IHE IDCO profile, and in the development of the IEEE 11073-10103 nomenclature standard. All companies have already partially or completely implemented the IHE profile and IEEE standard and have a hardware/software solution available which can be used to communicate with an EHR.

The software tools for specific IDCO implementation are freely available from Biotronik, Boston Scientific and St Jude Medical, but Medtronic has only implemented the IHE IDCO profile to communicate with their proprietary solution Paceart™. Boston Scientific, Biotronik and St. Jude Medical have also implemented the possibility for the data exchange between their programmer and the EHR.

In our department (LUMC Cardiology) we have implemented the IHE IDCO profile to import data from the remote databases from two device
vendors into the departmental Cardiology Information System (EPD-Vision™, version 10.3, Leiden University Medical Center).

![Figure 1: IHE-IDCO system model](image)

A new software module has been developed in EPD-Vision to import data from the remote monitoring databases from Biotronik and Boston Scientific. Data can also be imported directly from the ‘programmer’, the system that is used to query and program the device during an in-clinic follow up visit. Data is exchanged via a HL7/XML communication protocol, as defined in the IHE IDCO profile. Data from the remote monitoring database is transferred either automatically by querying the remote database (Boston Scientific) or manually by exporting data from the remote monitoring database or programmer (Biotronik). In both cases, the data is available in the format as defined in the IEEE 11073-10103 standard.

**Discussion and Conclusions**

The growing number of recipients of ICD’s and more complex devices are leading to a rapidly increasing workload with respect to follow-up of these patients. To amend this problem, all major device companies have developed a system for remote monitoring of these devices. Remote monitoring will lessen the burden of follow-up’s on the clinic and staff, and it will improve the efficiency of patient care. It is also attractive from a
patient’s perspective, since it may lead to greater reassurance and prevents long and timely trips to the hospital.

However, as a result, part of the patient’s clinical information is now stored in the local electronic health record (EHR) system in the hospital, while another part is only available in the remote monitoring database. From the perspective of patient safety this is not an ideal situation.

The IHE IDCO profile has been developed to bring a solution to this problem. Implementation of the IHE IDCO profile also allows for transfer of data from the interrogation device (programmer) to the local information system, which overcomes the need for manual entry of the in-house follow-up data.

In our hospital, we have implemented the IHE IDCO profile to store data from the remote monitoring database and programmers in our local Cardiology Information System (EPD-Vision™). In this way, remote follow-up data can be viewed in the same way as data acquired during in-house follow-up.

An important part of the IHE IDCO profile is the nomenclature, the definition of the variables that are exchanged. The IEEE 11073-10103 standard terminology set as developed by the IEEE Standards Association is a prerequisite for the implementation of the IHE-PCD IDCO profile. With the IEEE 11073-10103 standard set of variables, the hospital only needs to do the mapping between the data set of the vendor and the data set of the local Electronic Health Record system once, instead of devising a different mapping for each vendor.

The IEEE 11073-10103 standard terminology would also be very beneficial to implement in national and international cardiovascular registries, since it will allow for easy data transfer from a local EHR to a national registry, and for data exchange between national and international registries.

Future Developments

It can be expected that remote monitoring systems will develop into dedicated monitoring and therapy platforms. Data retrieved from these systems should form an integral part of the electronic patient record as more and more out-patient clinic care will shift to personalized care provided at a distance, in other words at patient’s home. To accomplish such solutions data exchange between all systems involved is of utmost importance. The first steps have been taken but the ultimate solution is still far ahead.

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Introduction

The introduction of electronic prescribing has already led to a systematic change in the organizational processes of the Veneto Region healthcare system. For both pharmaceutical prescriptions and electronic referrals, the digitalization of these documents has made it necessary to manage their lifecycle and the steps related to their workflow. In the first phase, General Practitioners and Pediatricians were involved, subsequently also the pharmacies, that are key players in this cycle prescriptive because they administer the steps ranging from the distribution of the drug to reporting to the local health authorities and the Ministry of Economy and Finance. The role of the pharmacist, especially, is critical to a successful medications management outcome for the patient. Pharmacists are receivers of an electronic prescription. Through their comprehensive knowledge of the safe and effective use of medications, they have the skills to manage the clinical aspects of medication therapy [1]. In addition, the way how the communicated message is presented and made available to the pharmacists in their dispensing systems, affects the overall communication quality [2].

The technological synergy that has been created within the infrastructure allows achieving the integrated care approach. On top of this, the opportunities are shared among all the actors which are involved in the process. Moreover the interoperable infrastructure of the regional EHR will provide the background and the tools in which the developments of health app, smart alert, digital television channels or applications and any telemedicine solution are made possible.

The main outcomes till now are based on the wide involvement of healthcare professionals (more than 1,000 taking part into the working groups) that are activating co-production paths inside the regional healthcare system.

Methods

The electronic prescribing life cycle process is divided into two phases. Each part reflects, respectively, the objectives of the Ministerial Decree and those under the regional EHR project “FSEr” (Fascicolo Sanitario Elettronico regionale). The first consists of legacy transactions which are
defined by the degree and the guidelines of the MEF (Ministry of Economics and Finance). In the second part, the transactions consist of standardized messages according to IHE (Integrating the Healthcare Enterprise). This kind of transactions represents the messages related to FSER.

For the implementation of the Ministerial decree, the Veneto Region has adopted a Regional Service System (SAR: Sistema di Accoglienza Regionale) which replicates the services exposed by the National Service System (SAC: Sistema di Accoglienza Centrale). The main reason of this choice is to allow the achievement the most homogeneous development of applications for every software houses operating on the whole national territory. The electronic prescribing software will then use the same services that are provided by the SAC. At the same time, these services are exposed directly by the SAR, which is in charge to replicate the messages to the SAC. In this way, the XML (eXtensible Markup Language) data which compose the electronic prescription and its management trace are processed by the SAR in order also to be collected for the regional EHR. The electronic prescriptions in fact are considered of significant clinical importance for the patient's EHR.

In this scenario, all electronic prescribing, pharmacy, order filler and order placer softwares communicate directly with the SAR by using the correct transactions. These transactions, in their XML content, take into account the electronic prescription data along with the process details.

The electronic prescribing life cycle uses the following IHE profiles:
- XDS.b (Cross - Enterprise Document Sharing) [3];
- XDW (Cross - Enterprise Document Workflow) [4].

The three documents that contribute to the process within the EHR are the prescription XML document, the related CDA-2 (Clinical Document Architecture release 2) and the associated Workflow Document which tracks all the prescription history (e.g. creation, disposal, rectification).

The electronic prescription document management will be accomplished through the use of the following XDS.b transactions:
- [ITI-41] Provide and Register Document Set-b: the CDA-2 and the Workflow Document are provided to the LHA (Local Health Authority) repository;
- [ITI-42] Register Document Set-b: the metadata are indexed in the regional Document Registry;
- [ITI-18] Registry Stored Query: this message is used to query the Registry in order to find a specific prescription document’s information;
• [ITI-43] Retrieve Document Set- b: a specific prescription document is retrieved by a LHA’s healthcare operator by using the previously provided information.

In the Fig. 1 it is represented the pharmaceutical electronic prescription cycle. Similarly, the same infrastructure is used for the electronic referral cycle [5]. Besides the Ministerial’s decree and guideline, every detail and specification represents the technical and organizational outputs of the regional EHR working groups [6].

![Figure 1](image)

**Results**

The infrastructure represents the interoperability platform which is the key driver to increase the success and the use of several services related to the EHR, allowing a high engagement of users.

Within the EHR there are several services which are supported by the infrastructure: online access to medical information, online booking of diagnostic examinations and outpatient visits, online payment of services fees and notification reminders. Moreover, SMS (Short Message Service)
text messaging is another channel of the platform that will increase accessibility from the EHR to the PHR (Personal Health Record), by delivering mobile booking and online notification reminder for treatment compliance, availability of reports and appointments services.

Each actor is aware of the EHR project road map with periodic targeted training sessions. Furthermore, to accelerate citizens’ engagement, the future services will be customized on their needs thanks to the co-creation EHR’s initiative.

Acknowledgement

The author would like to thank all the LHAs (Local Health Authorities) and HTs (Hospital Trust) and many healthcare operators of Veneto Region for the cooperation.

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Integrate Care and IT Solutions as a Tool for Continuity of Care and Patent Safety

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Safe and high-quality care is inextricably linked with the development and implementation of eHealth services [1]. The term, eHealth was first coined in the 1970s. The key elements the term eHealth are: Its purpose is to monitor support requirements and provide clinical health care support remotely with the aim of reducing waiting times and improving communication and (patient) wellbeing and health outcomes. It involves the use of various types of telecommunication and information technologies (ICT). It is also intended to overcome geographical barriers, connecting users who are not in the same physical location.

Europe is faced with a rapidly ageing population accompanied by an increase of people living with long-term conditions, disabilities, non-communicable diseases (NCD) and chronic diseases [2]. This is matched with a decreasing percentage of the population active in the healthcare labour force to manage the delivery of patient-centric care [1, 3].

Policy-makers in Europe recognise that increased use of ICT in the health and social care sectors can help solve many of the challenges [4-5]. Innovative, high quality, safe and cost-effective national healthcare systems are dependent upon policy-makers and stakeholders developing and implementing high-quality eHealth services [6].

When appropriately supported with ICT based solutions, particularly telehealth and telecare, the delivery of innovative healthcare becomes sustainable and more effective [7]. Particular benefits are reported in areas of prevention and self-management of non-communicable diseases (NCD) facilitating the delivery of healthcare in communities and at home [8]. There is a prominent role for ICT in supporting the reorganisation of health services [9] towards integrated care and [10] building interoperability for patient safety.

ENS4Care is the result of a common willingness for fostering a common understanding and strengthened collaboration on how to cope with the societal challenges while making Europe’s health and social care systems more sustainable and of better quality. The main objective of the project is
the development of evidence based guidelines for the implementation of eHealth services in nursing and social care, building on existing good practices amongst the participants of the Network, sharing and transferring knowledge across European regions. The ultimate goal of ENS4Care is the establishment of a sustainable mechanism to support nursing and social care research in the field of ICT enabled integrated care. The guideline builds on the work of the ENS4Care network work stream ‘Integrated Care’ and is concerned with eHealth services to support the provision of integrated care of an individual, family or population in primary or secondary health and social care settings. It outlines key steps and considerations for the deployment of eHealth services for integrated care at different levels of enablement. It includes the scope of the guideline, deployment process, and key factors that can act as barriers or facilitators, outcomes and implications, relevant EU policy and legal context. In particular, analysis of the evidence collected and the extrapolation of the key elements of the practice examples amassed point towards a four-stage deployment pathway consisting of planning, implementation, evaluation and elaboration processes influenced by cross-cutting structural and procedural factors.

Integrated Care is a concept bringing together inputs, delivery, management and organization of services related to diagnosis, treatment, care, rehabilitation and health promotion, integration is a means to improve services in relation to access, quality, user satisfaction and efficiency [11]. ENS4Care Project definition describe Integrated care as essential to ensuring optimal outcomes are achieved for EU citizens and especially those burdened with chronic disease and complex care needs and who require attention from a range of professionals from primary and secondary health and social care sectors [12]. And e-health is a key enabler for Integrated Care, used here to refer to the management and delivery of health services so that citizens receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system’.

It is important to remember that introducing telehealth and telecare to clinical practice is not about replacing existing services, but instead using technology to enhance, improve access, triage and offer a wider range of choice in the services provided for patient care [13]. ENS4Care sees technology as a support for the needed variation in the way health and social work is organised and delivered in the hope to more effectively address health inequalities.

Across the different EU Member States, there is evidence about the willingness to move forward in order to develop guidelines for nurses on the deployment of telehealth services. There is a strong need at national level to
work on a harmonised approach to be able to come up with common frameworks. The deep experience of some countries will contribute to the effective delivering of common guidelines, from which several Member States will benefit.

Twenty-one (n=21) submissions were made for WP4 - Integrated Care. The submissions mainly represented examples of integrated care practices between hospitals and primary and community care services. These practices aim to improve the continuity of care for patients by breaking down any barriers between settings and in this way ensuring a smooth patient trajectory through the health service. Examples of this practice include discharge planning, information sharing and patient flow managing systems. Submissions were made from ten (n=10) countries and through the networks of twelve (n=12) ENS4Care partners. Seven (n=7) were examples of practices and processes designed to offer integrated health care to patients and citizens. There were examples of integrative care within the hospital, such as with integrated pain management services, and between the hospital and the community for such topics as e-referral, sharing of electronic records and e-communication. A further seven (n=7) practices offered interesting examples of team-based practice between nurses and other professions, mainly physicians and social workers. These included primary care clinics where physicians and nurses collaborated to ensure continuity of patient care, use of electronic notes in the neonatal intensive care to enhance inter-professional communication, and other specialist health services such as rehabilitation and intellectual disabilities. In addition, three (n=3) were examples of using various metrics and indicators to ensure provision of quality and safe care, although the extent to which these enable integrated care is questionable. Finally, two (n=2) submissions were innovative applications to support clinical workflow and patient records, one

![Fig. 1: The list of equipment used to provide e-services, the results of ERNs4CARE Project](image)
(n=1) involved the joint and integrated delivery of eServices through web-based solutions, and one (n=1) submission reported on the TSA Integrated Code of Practice for Telecare and Telehealth. Most submitted practices for Integrated Care appear to be fully implemented (n=11, 53%). Nevertheless, some newly developed practices are still in pilot and demonstrator stage (n=7, 33%). The geographical coverage indicates that over half of the practices are local (n=11, 52%), five (n=5, 24%) are regional, four (n=4, 19%) national and one (n=1, 5%) European.

Concerning the ICT devices utilised by these practices, internet connection (n=19) and electronic databases (n=18) were most frequently reported. These were followed by use of telephones (n=17), tablets (n=6), smart phones (n=6) and telemonitoring devices (n=4) (Fig. 1). Moreover, of the submitted practices, over half (n=12, 57%) engage with clinical data/information sharing while 62% (n=13) indicate being linked to an existing dataset.

Practices submitted under Integrated Care held potential to empower patients and citizens through receiving more accessible and integrated personal, safe care. Most practices however clearly identified potential for fostering continuity of patient care. This would be enabled though providing holistic health education and advice, and through improving inter-departmental communication and collaboration between health care professionals.

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Paul de Reave PhD, RN, EFN Secretary General, is an expert of European policy developments in the field of nursing education, workforce for health and healthcare quality and patient safety, and eHealth, holding positive outcomes and success in the lobby process to the EU institutions. He is a nurse and has a vast experience with an active and productive team being part of prior EU projects such as CALLIOPE, EUNetPas, eHGI, the Joint Action on Quality and Safety and the one on EU Workforce for Health. He is in a unique position to be the Project Coordinator of the project, providing crucial expert advice on the design and management of it.
Introduction

According to the WHO, cardiovascular diseases (CVD) are the leading causes of death worldwide. It is estimated that in 2012, 17.5 million people died from CVD - which accounted for 31% of all world deaths. Of this total, 7.4 million people died from coronary heart disease and 6.7 million as a result of stroke [1].

People with, or at high risk of, CVD (the presence of one or more risk factors such as high blood pressure, diabetes, hyperlipidemia) require early identification and assistance through consultation and, if necessary, medication.

The Concept of Cardiac Care

One of the conditions for effective cardiology service and the reduction of prevalence of CDV and mortality is the creation and application of new organizational and preventive medical technologies [2]. The concept of cardiac care includes the comprehensive systematic development of interconnected structural elements: outpatient care, in-patient care (cardiology and cardiac surgery), medical rehabilitation of cardiac patients based on quality management system and a unified ideological approach to diagnosis and treatment of cardiovascular diseases. Now, the leading principles of cardiac care are the stages of the management of patients with cardiovascular disease (primary - specialized - high-tech cardiac care), continuity in the provision of health care, preventive health care and
individual approach to the patient. The creation of cardiac care aimed at improving public health by reducing avoidable losses due to diseases of the cardiovascular system when providing highly available and high-tech cardiac care, including prevention of CVD, early detection, adequate diagnosis, timely treatment and rehabilitation, improve the efficiency of all stages of cardiac care through the development of resource-saving medical and organizational technologies. Emergency cardiac care is time critical and loss of time may be irreparable. An important area of emergency cardiac care is the active prevention of conditions requiring resuscitation and intensive therapy, which requires a traditional clinical approach.

In all cases, when emergency treatment is indicated, it should not be delayed, almost simultaneously with the diagnosis of acute circulatory disorders or detect evidence of a direct threat of its occurrence. The underestimation of the acuity and severity of the clinical situation is accentuated by delay, from which it is not always possible to recover. The overestimation of the severity of the clinical situation may lead to overly aggressive treatment, which may be more dangerous than the original condition, as well as being an inefficient use of health resources.

Telecardiology in the Nenets Autonomous Okrug

Telecardiology is the integrated use of telemedicine procedures (biotelemetry and telemonitoring, remote interpretation of diagnostic data, teleconsultation, and home telemedicine) for the prevention, emergency and routine medical care for patients with pathology of the cardiovascular system [3].

In terms of the remoteness and inaccessibility of most of the settlements of the NAO, the limited human resources in rural clinics of specialists from the regional hospitals have been developed with modern methods of carrying out emergency medical care to patients with acute coronary syndrome (ACS) and the subsequent dynamic monitoring of such patients on the basis of telemedicine technologies.

The developed system of organizational and therapeutic measures includes:

- Questionnaire used to collect anamnesis in patients with suspected ACS;
- The list of first aid mandatory measures;
- The clinical situation for compulsory registration of ECG and referral in the Nenets district hospital;
- The list of mandatory diagnostic measures;
- Indications for thrombolysis;
The mandatory list of medicines;
Assessment of pain algorithm (ACS).

The framework of the implementation of a system of early diagnosis and timely initiation of complex emergency drug therapy was provided by the equipment of the Nenets Autonomous Okrug medical institutions using:

- Modern electrocardiographs with the ability to transfer the results of research in an electronic form;
- Providing an opportunity for the test (Troponin-T) on the definition of troponin in the blood in medical institutions of Nenets Autonomous Okrug at all levels (district hospitals, dispensaries, and aid stations);
- Provision of Nenets Autonomous Okrug medical organizations with portable coagulometers for the monitoring of blood parameters during reperfusion therapy;
- Enabling remote consultations of patients in remote locations by specialists, and cardiologists of the Regional Hospital.

The choice of the means of unloading, remote transmission and subsequent ECG analysis from the wide range of equipment available on the market, was done by selecting the equipment that addresses all three requirements (unloading, transfer and analysis of ECG).

In the framework of the international Russian-Norwegian project "Quality improvement of the medical care of the indigenous population of the Nenets Autonomous Region" equipment was delivered in 3 pilot settlements.

Within 3 months of the installation of the hardware for health care workers in remote settlements provided by the Regional Hospital to telemedicine channels 20 ECG, held 23 telemedicine consultations, identified 1 patient with ACS, with urgent hospitalisation in the Regional Hospital.

For 9 patients with cardiac pathology remote recommendations were made for the correction of treatment.

The first results of the implementation of telecardiology in northern remote regions of Russia have shown the effectiveness of the integrated use of telemedicine procedures (biotelemetry and telemonitoring, remote interpretation of diagnostic data, teleconsultation, and home telemedicine) for the prevention, emergency and routine medical care for patients with disorders of the cardiovascular system.

References

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Realising the Potential of Information Communication Technology (ICT) to Support People Challenged by Illness or Disability to Maintain Their Independence

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2Medical University of Lodz, Poland
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4Irish Association of Social Workers (IASW), Ireland
5European Federation of Nurses Association (EFN), Belgium

ENS4Care (www.ens4care.eu) is a project funded by the EU for 2 years from December 2013 to engage social and health care practitioners in collaboratively addressing challenges arising from the ageing population and accompanying increase in the numbers of people living with long-term conditions and non-communicable and chronic disease in many parts of Europe.

Innovative, high quality, safe and cost-effective national healthcare systems are dependent upon policy-makers and stakeholders developing and implementing high-quality eHealth services. The EU project “ENS4Care” will share good nursing and social work practices in eHealth services (telehealth and telecare) and – through the evaluation and consensus building – will create a set of guidelines focusing on: healthy lifestyle and prevention (WP2), early intervention and clinical practice in integrated care (WP3), skills development for advanced roles (WP4) and nurse ePrescribing (WP5).

Guidance produced by the project focuses on healthy lifestyles and prevention, early intervention and integrated care and highlights the need for skills development for advanced roles such as those concerned with the protection of children and vulnerable adults, social and nurse prescribing and the urgent need to replace institutional service models with those that prevent illness and disability occurring and promote self-directed care and interdependence, realising the benefits of telecare, eHealth and other technological developments.

The submitted practices were analysed using a combination of standard tabulation, summary and content analysis techniques. The analysis process aimed to be objective and impartial; to this end an independent researcher assigned a 'CaseID' and anonymised the practices so that the researcher
undertaking the analysis remained blinded to the name and institution from which each submission was made.

Most of the submissions were made under the ENS4Care area Clinical Practice (n=40, 34%) followed by Integrated Care (n=21, 18%), Prevention (n=20, 17%), Advanced Roles (n=19, 16%) and Nurse ePrescribing (n=17, 15%). The area of practice is the key for further developments and therefore each is analysed in more detail in separate chapters (Fig.1).

Twenty (n=20) practices were submitted for WP2 - Prevention. The practices represented a range of interventions and programmes, including health promotion, counselling, social support and rehabilitation. All practices make use of a range of ICT such as telephones, internet, smart phones and tablets. Patient and citizen empowerment, through enabling self-monitoring and management in particular, appeared to be at the heart of all submitted practices, which many have demonstrated.

Clinical practices were submitted for WP3. The practices (n=40) represented a range of interventions and programmes including telemonitoring, telediagnosics, electronic documentation, telephone follow-up and support. All practices appeared to make good use of a range of ICT such as telemonitoring equipment, telephones, the Internet, smart phones and tablets. These practices targeted a range of citizen and patient groups with various health needs and requirements, although those groups suffering from chronic conditions such as chronic obstructive pulmonary disease (COPD), diabetes and chronic heart failure (CHF) appeared to require the most support and could see more direct benefit. Concerns with improving the quality and safety of care, time and cost efficiency and ensuring health services were accessible to patients and citizens appeared to be at the heart of all submitted practices, which many have demonstrated.

Advanced Roles are represented by nineteen submissions (n=19). The submissions mainly represented examples of nurses and social workers practicing in roles that delivered an advanced level of care to patients and citizens. These practices share a common concern with improving the
efficiency of health services, while at the same time improving the quality of health care that patients and citizens receive. Examples of these practices include telephone triage, advice or referrals, primary care case management and specialist services for people with chronic physical and mental health conditions such as COPD and diabetes.

Integrated Care submissions (n=21) mainly represented examples of integrated care practices between hospitals and primary and community care services. These practices aim to improve the continuity of care for patients by breaking down any barriers between settings and in this way ensuring a smooth patient trajectory through the health service. Examples of these practices include discharge planning, information sharing and patient flow managing systems.

Nurse ePrescribing submissions (n=17) were made for WP5. The submissions mainly represented examples of nurse prescriber practice and the associated database infrastructure to support audit of prescriptions. At the heart of these practices lay a concern with empowering patients to have access to quality and safe prescriptions while at the same time enabling cost efficiency and saving physicians’ time. Nurse prescribing, supported through ICT solutions, shows clear benefits for professionals and patients alike. Examples include prescribing in nurse-led warfarin clinics, community and hospital settings, and national databases to enable transparent reporting of prescribing practice.

Most of the submitted practices are fully implemented, Tab. 1.

Table 1: Current status of development of the submitted practices in the ENS4Care questionnaire

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrator</td>
<td>7%</td>
<td>9</td>
</tr>
<tr>
<td>Pilot</td>
<td>22%</td>
<td>27</td>
</tr>
<tr>
<td>Fully Implemented</td>
<td>60%</td>
<td>73</td>
</tr>
</tbody>
</table>

The responses made under geographical coverage indicate that most practices submitted are locally rooted (n=48, 39%); 24% (n=29) are at National level, 21% (n=26) at Regional level, 9% (n=11) at International level and 3% (n=3) at European level (Tab. 2).

Most of the practices require Internet Connection (n=92, 75%) and more than half (n=70, 57%) refer to Electronic databases. This is followed by use of telephone (n=42, 34%), tablet (n=33, 27%), mobile phone (n=33, 27%), telemonitoring system (n=21, 17%) and smart phone (n=21, 17%), Fig. 2.

Table 2: The Geographical coverage of the submitted practices in the ENS4Care questionnaire
Of the practices submitted, more than half (n=65, 53%) do not engage with clinical data sharing. In contrast, 57% (n=69) of the practices submitted are based on an existing dataset.

From the below graph (Fig. 3) it is clear that the most relevant competences required are the clinical ones (n=95, 78%), followed by the technical (n=75, 61%). Relevant diplomas/degrees are required by 53 practices (43%), academic competencies by 52 (42%) and 48 practices required an element of clinical leadership (39%).

Table 3: The sharing of clinical information in the practice in the submitted ENS4Care practices

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>53%</td>
<td>65</td>
</tr>
<tr>
<td>YES</td>
<td>39%</td>
<td>47</td>
</tr>
<tr>
<td>No response</td>
<td>8%</td>
<td>10</td>
</tr>
</tbody>
</table>

Fig. 2: Types of ICT tools used in the practices, submitted in the ENS4Care project
There is specific education/training that health care professionals/social workers received for the implementation of these practices; in 66% (n=81) of practices professionals receive specific education. This statistic is reversed in terms of patient/client education, whereby in 27% of practices patients/clients received some kind of specific education.

Concerning the division of tasks, in 76 practices (62%) this did not lead to a change in the division of tasks between departments. Very few of the submitted practices were located at EU level, with 11 (9%) indicated to have received EU funding; this suggests more efforts need to be made to ‘bring’ EU money to clinicians through the social cohesion funds. ENS4Care WP7 on Sustainability focuses on how to implement this recommendation once the project is completed (December 2015).

The overview of submitted practices demonstrates the richness, diversity and great potential that existing eHealth services hold for enabling the delivery of safer, more efficient, patient-centred and quality health service across the EU. All things considered, it is clear that nurses and social workers as the main proprietors of these practices of ICT use for prevention purposes hold the key to a healthier future for citizens across Europe.

While many of the practices submitted draw from different kinds of eHealth guidelines, there is a noticeable difficulty in maintaining a consistent approach. This relates directly to the lack of a solid body of guidelines for the implementation of eHealth services in nursing and social care at EU level.

The eHealth guidance that is being developed by the ENS4Care project will put up to date information at the fingertips of service users, carers and those professionals supporting them about the merits of different treatment options and the availability of specialised equipment that may enhance their well-being and keep them safe, enabling them retain or regain control over the services they are receiving and live as independently as possible.
Dorota Kilańska, PhD, RN, Head of the Department of Social Nursing and Management in Nursing, Medical University of Lodz. Past president of Polish Nurses Association. Prior experience include chairing of several national and international nursing committees, a membership of the Board of Directors at the European Nursing Research Foundation (ENRF) and a membership of the Social Council at the National Health Fund in Lodz. Her professional interests focus on promotion and development of e-health solutions. She has supervised several projects related to e-health, developing telenursing, creating evidence based guidelines for the implementation of eHealth services in nursing and social care, supporting health promotion for older people.

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The Remote Monitoring of Patients with Congestive Heart Failure: The Organizational Impact

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Introduction

The Veneto Region Social-Health plan quoted that it is necessary to pay more attention on the area of chronicity and there is, therefore, the need to define a new model of care characterized by an integration of health and social care. Following this the Veneto Region carried out a unique platform where the telecare and telehealth services are integrated. With this platform the clinical data and social needs of chronic patients are monitored directly from their home.

The patients are equipped at home with emergency button and portable devices for real time detection of emergencies and for measure their clinical data in agreement with plan of their clinicians. Clinical data are transmitted from patient’s home to eHealth regional centre and managed by trained operators. The operators detect the alarm and inform the clinicians when it is necessary. The telecare service monitor the patients for 24/7 real time detection of emergency situations at the patient’s home and makes scheduled control calls to monitor the patient’s life conditions and quality of life. The distress call is addressed directly to the Regional Centre, where operators manage the situation calling the patient or his caregiver and, if necessary, putting them in contact with the ER department or Social Services [1, 2].

During RENEWING HEALTH [3] European project, for the patients affected by Congestive Heart Failure a Randomized Controlled Trial is been performed in order to assess if the provided integrated service improves the clinical, economical and organizational outcomes in favor of the group of patients followed with the telemedicine services. The service impact was analyzed following the Health Technology Assessment (MAST – Model for assessment of telemedicine application [4]) methodology.

The study has demonstrated that the clinical and economic outcomes are improved for the patients followed with integrated service.

Methods
For the organizational domain, we have studied which is the impact of the management of the alarms on the clinical staff's work.

The alarms are distinguished in four types: white code, the patient has no critical values; green code: the patient has the clinical data slightly besides the normal range; yellow code: the patient has the clinical data besides the normal range and red code: this case falls in to telecare service and requires emergency intervention.

The eHealth regional center operators are the first filter of all alarms, that means that every alarms is checked by the operators before to be sent to the clinicians. In this way only the true alarms are submitted to the specialist.

The different colors of the alarms imply a different way to active the specialist. For the green true alarms, the eHealth operator sends an email to the clinician. For the yellow true alarms, the eHealth operator sends an email to the clinician and in addition contacts him by SMS or phone. When the true alarms arrive to the clinicians, the clinicians have to manage and close them indicating the actions undertaken on the specific session of the web portal. The actions undertaken are been coded with the following possibilities: no contact, patients contacted without actions, booking of specialist visit, change of therapy, contact with GP, Home Visit by GP, send to ER and other.

The clinicians can access to the web portal with their own credentials and they can check all alarms and the trend of the measurements of each patient. Each access to the web portal is tracked and also the time spent on it.

Results

The patients enrolled in the intervention group (patients followed with telemedicine services) were 229 and their follow up was 12 months long.

The amount of alarms received was 18.482, as reported in Fig. 1. 51% was false, 41% was true and 8% was measured by the patients out of time (when the eHealth centre not
For all the true alarms, we have collected the type of closure divided for green and yellow color. For the green alarms: 89% was closed with “no contact”, 7% with “patient contacted without actions”, 1% with “change of therapy” and <1% with “booking of specialist visit”. For the yellow alarms: 72% was closed with “no contact”, 16% with “patient contacted without actions”, 4% “change of therapy” and 2% “booking of specialist visit”.

Taking in account the color of each true alarm, the type of closure and the time spent by the clinicians on the portal, we have calculated an estimation of the time spent by the specialists/nurse in the management of the telemonitoring. The result is reported in Fig.2. The clinicians for the management of alerts, from notification to the action undertaken, spend about 97.6 minutes per patient/year.

Conclusion

The 51% of the alarms were false. This could be explained meanly because the patients enrolled were elderly (about 80 years old) and some of the devices used for the monitoring weren’t suitable for this type of patients. For example the pulse oximeter chosen wasn’t finger clip and this has implied many false alarms. The presence of the eHealth center have avoided that this false alarms go to the clinicians. In this way the specialist have managed only the true alarms. This integrated solution allows also that the emergency situation is not managed from the clinicians but directly by the staff of Emergency Room.

With this solution the cardiologists can monitor daily the patients affected by Congestive Heart Failure spending 97.6 minutes per patient/year improving the clinical and economical outcomes.

During the study is not been possible to explain for certain why a lot of true alarms were closed with no action. One possible explanation is that the
clinicians need to wait and check a trend of data and understand how the situation evolves before to take a decision.

Acknowledgement

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References


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eHealth Applications in Surgery, Emergency and Primary Care
Electronic Personal Health Records in Canada: An Exploratory Review of the Literature

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Introduction

An electronic personal health record (ePHR) is a technology that could facilitate information sharing, health professional-patient relationship as well as improving patient care. In Canada, stakeholders have shown interest in the implementation and use of ePHRs, but there is insufficient evidence about their benefits and potential effects on the health care system.

The aim of this exploratory review is to synthesize the literature on personal health records (PHR) and electronic personal health records (ePHR) in Canada, as well as provincial and federal policies that can influence these systems.

Methodology

We conducted an exploratory review, including published and grey literature, as well as key federal and provincial laws. We considered publications that were: 1) from Canada, 2) addressing benefits and challenges, 3) assessing responses to challenges, 4) published in English or French, published between January 1st, 2003 and November 31st, 2013. The following keywords and their variations in combination with each other were used: personal health record, patient portal, Canada. We used PubMed database and search engines (Google, Google Scholar). Relevant information was extracted by two individuals and revised by three other team members.

Results

We identified a total of 36 publications. While some systems were functional nationally, most of them were local initiatives affiliated to an
institution. A few provincial projects have been initiated, but no official documentation was available at the time of the search.

The benefits of ePHRs identified for patients were control (condition prevention, self-management) and access to education and care (access to reliable information, better understanding and adherence, better communication). For the health system, benefits were seen in the access to patient data, streamlining of administrative processes (scheduling, reduction of errors), research (interaction with patients) as well as public health and ease on the health system (time gains, lower costs, improvement on quality and efficacy of care).

One particularity of the health care system in Canada is the slow uptake of e-Health in many provinces. Consequently, authors often mentioned “potential” benefits. Other challenges to the implementation of ePHRs in Canada mainly concerned user adoption (trust issues with data, difficulties in seeing advantages, increased workload, reluctance in giving access to records) as well as security, privacy and confidentiality concerns. Table I presents a summary of the potential benefits and challenges found in the literature.

Possible solutions to these challenges can be found through stakeholders’ involvement (partnership between instances, physician involvement, patients with chronic diseases), system improvement (EMR as a prerequisite for ePHR, build to support the user) and organizational changes (shifts into perception of ownership, compensation for providers).

Additionally, the Canadian legislative and regulatory system does not seem well suited for handling some of the challenges arising from ePHRs. Current laws and norms are not designed to apply to ePHRs and rarely address appropriately challenges particular to ePHRs, notably on privacy and confidentiality, data usage, third parties and online communities. Federal and provincial legislation, as well as judicial decisions, deal generally with issues such as privacy and confidentiality, but their field of application does not explicitly include ePHRs, thus requiring adaptation to be truly relevant to the ePHR context. A more thorough analysis of the legal framework is underway. Finally, certifications available in Canada are still lacking for ePHR systems.

Conclusion

This review highlights the paucity of literature on the topic of ePHR and related policies in Canada. Most publications identified potential benefits for ePHR since there are few ePHR systems available for Canadians.
Table I. Summary of the potential benefits and challenges found in the literature

<table>
<thead>
<tr>
<th>Potential benefits</th>
<th>Potential challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
<td><strong>Implementation</strong></td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Slow uptake of e-health</td>
</tr>
<tr>
<td>Prevention of conditions</td>
<td>Imbalance in perception of benefits versus investments</td>
</tr>
<tr>
<td>Self-management</td>
<td>Lack of governmental support</td>
</tr>
<tr>
<td>Empowerment</td>
<td></td>
</tr>
<tr>
<td><strong>Access to education and care</strong></td>
<td><strong>User adoption</strong></td>
</tr>
<tr>
<td>Access to reliable and credible information</td>
<td>Reluctance of professionals in access to their record</td>
</tr>
<tr>
<td>Better understanding of health condition</td>
<td>Not widely adopted or known by patients</td>
</tr>
<tr>
<td>Improved adherence to health plans</td>
<td>Trust issues with information</td>
</tr>
<tr>
<td>Patient-physician communication</td>
<td>Increased workload for professionals</td>
</tr>
<tr>
<td>Chronic condition care</td>
<td>Patients overwhelmed with information</td>
</tr>
<tr>
<td><strong>Health system</strong></td>
<td><strong>Legislative and regulatory system</strong></td>
</tr>
<tr>
<td><strong>Access to patient data</strong></td>
<td>Not designed to apply to ePHRs</td>
</tr>
<tr>
<td>Complement information in electronic medical record</td>
<td>Does not address challenges particular to ePHRs</td>
</tr>
<tr>
<td>Data sharing</td>
<td>Privacy and confidentiality</td>
</tr>
<tr>
<td><strong>Streamlining of administrative processes</strong></td>
<td>Data usage</td>
</tr>
<tr>
<td>Scheduling</td>
<td>Third parties</td>
</tr>
<tr>
<td>Diminution of duplicate testing and errors</td>
<td>Online communities</td>
</tr>
<tr>
<td><strong>Public health and ease on the system</strong></td>
<td>Deals with issues such as privacy and confidentiality, but does not explicitly include ePHRs.</td>
</tr>
<tr>
<td>Reduce number of visits</td>
<td></td>
</tr>
<tr>
<td>Lower costs</td>
<td></td>
</tr>
<tr>
<td>Improve care</td>
<td></td>
</tr>
<tr>
<td>Maximize professionals time</td>
<td></td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td></td>
</tr>
<tr>
<td>Interaction with patients</td>
<td></td>
</tr>
</tbody>
</table>
Acknowledgment

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The authors acknowledge the support of the research team from Université Laval (Jean-Paul Fortin, Mathieu Ouimet), McMaster University (Norm Archer, Lisa Dolovich, David Price), McGill University (Gillian Bartlett-Esquilant) and University of Toronto (David Wiljer).

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**MediCloud – Telemedicine System Based on Software as a Service (SaaS)**

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**Abstract:** MediCloud is a robust, web-based (cloud system) platform for supporting medical interactions. In many situations, the discussion of a case among MDs from different profiles and locations is crucial for patient outcome. The concentration of specialists in big cities in Brazil is one of the causes of the lack of adequate medical diagnosis and treatment in underserved areas. MediCloud will allow general practitioners in remote or rural areas to discuss cases (rounds) and request second opinions to their expert colleagues located in reference hospitals. For validation purposes, it focus on dermatology and level 1 radiology medical specialties. A software framework was developed to support the telemedicine application, providing the basis for security communication and user's hierarchy. The software implements a hierarchical discussion forum to practitioners and specialists exchange information. The software algorithms enhance the medical discussion providing useful information to users such as photos, symptoms, treatments and applied drugs of previously discussed cases. The business model will be developed during the pilot phase of the project, when ISCMPA – Santa Casa de Porto Alegre hospital will be leading medical discussions as a reference center. ISCMPA will exchange medical information with three health care centers in the rural area of the Rio Grande do Sul State.

**Introduction**

In Brazil, as in many other countries, there is a concentration of certain medical specialties in big urban centers [1-3]. Thus, in small towns or even in poor quarters of big cities, medical assistance is provided by a limited group of isolated professionals.
This isolation is frequently compensated by the use of Internet communications tools like WhatsApp and Viber. Based on this observation was proposed the development of a new communication tool. This tool is being developed to provide an adequate structure for medical data exchange without losing the ease of use and familiarity those social networks and chat tools offer.

MediCloud operates under a Software-as-a-Service platform. MediCloud is a joint development by ISCMPA - Santa Casa de Porto Alegre Hospital Center, CETA- Center of Excellence in Advanced Technologies and the software house Infoldi. Santa Casa is a reference hospital for the State of Rio Grande do Sul, as well as for Brazil’s South Region. It is constituted by several specialized hospitals – chest diseases, cardiology, oncology, neurology, transplants, among others. The Dermatology Service has a qualified medical team offers both clinical and surgical assistance for skin diseases. Subspecialties have specific ambulatories for outpatient treatment of nail diseases, hair, oral diseases, psycho dermatosis, mycology, phototherapy, laser, Mohs micrographic surgery among others. CETA-SENAI is an R&D institution acting in several scientific and technological areas. Infoldi is a software house specialized in Software-as-a-Service development.

MediCloud features include a set of ancillary tools that represent a significant benefit if compared with usual Internet communication systems. It is deployed as a Forum where participants are segregated in up to three hierarchical levels (group, subject and posts). The system uses a methodology for knowledge acquisition based on natural language processing that creates a dynamic knowledge base. The software implements techniques like Natural language processing (NLP). The created NER algorithms use linguistic grammar-based techniques as well as statistical models (machine learning). The knowledge base reflects the Forum topics since it is created from user’s posts.

In its field test phase, MediCloud is in use by three municipalities in the State of Rio Grande do Sul and by Santa Casas’ medical team. This paper presents an overview of the process of development, the system’s main features, and its operation process, as well as the up to the moment obtained results.

Background

MediCloud’s inception followed an eight years period of experience with telemedicine software, partially funded by the European Commission (@LisT@lemed Project [4] and FP7 T@HIS and MedNet [1] Projects) in which CETA and Santa Casa were members of consortia leaded by Fraunhofer Gesellschaft Institutes IBMT and IGD. Infoldi had previous experience in
developing medical software. Infoldi developed a 3d scanner for static and dynamic (functional) optical measurement of the human back and spine, and also a full software suite for a myograph.

Based on the physician's interactions, it became evident for the Infoldi team the widespread use of applications such as WhatsApp and Vibe for communications between MDs and groups. The group leaded by CETA received a grant from FINEP, a Brazilian federal government funding agency of the Ministry of Science, Technology and Innovation.

System and Operation

The project has three small towns with partners: Lagoa dos Três Cantos (1,598 inhab.); Victor Graeff (3,036 inhab.) and Nova Araça (4,003 inhab. + circa 800 immigrants), all of them municipalities at Rio Grande do Sul State. MDs (general practitioners - GPs) in these towns had previous experiences in other projects with CETA and Santa Casa [3, 4]. These previously registered GPs access the system using a browser and add a new post (clinical case) with their remarks and demands and upload high-resolution images of the lesions through an HTTPS connection. These can be digital camera snapshots or digital X-ray images. The system does not provide support to video streaming. In compliance with Brazilian legislation and international best practices of ethics in research, all patients are required to sign a free and informed consent. Dermatologists and radiologists at Santa Casa receive an automatic warning of incoming posts by e-mail and have up to 48 hours to reply. Similarly, GPs receive mail warnings about incoming replies. Several specialists may reply to the same case, starting a round-like discussion. Users are grouped on the software by municipality and specialty. The operator makes registration of new users upon request from a municipal authority or by the Head of a medical Service. Feedback from the GPs and physicians is used by Infoldi for GUI improvement and for the development of extra functionalities.

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Reliability and Accuracy of Wound Surface Measurement Using Mobile Technology

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Introduction

As the population ages and the chronic diseases raised chronic wounds also increase, creating a huge burden on the health system. In outpatient care, the most common wound measurement technique remains the gradual ruler [1], which is a simple and fast but relatively inaccurate method. Mobile phones enable permanent access to a camera and the technology now integrates image processing. A mobile application that takes reproducible and reliable wound surface area measurements would help obtain useful indications on the prognosis and effectiveness of applied treatment. This also enables faster detection of complications and reduces healing time [2-4]. +WoundDesk® is a mobile application that enables to take photographs, define wound margins and make wound surface area measurements in a few clicks.

Aim

The study aims to assess the reliability and accuracy of digital semi-automated wound surface areas measurement using the mobile health application +WoundDesk® (version 0.06, digitalMedLab GmbH, Technoparkstrasse 2, Winterthur, Switzerland) compared to digital planimetry, which is one of the reference measurement methods [5].

Method

An experimental comparative non-randomized study has investigated the validity and the repeatability of wound surface measurement. 30 wound drawings were measured using two different methods, a) the mobile phone application +WoundDesk and b) digital planimetry as the reference method. The repeatability has been measured using the inter-rater and intra-rater reliability. The accuracy was assessed using Pearson concordance correlation and the standard error of measurement (SEM). To fully
appreciate the correlation between the 2 techniques, the graphical method of Bland and Altman was used.

Fig. 1: Measurement plot for each of the 3 examiners according to surface area

Fig. 2: scatter-graph of correlation between reference measure and +WoundDesk measures (with r = Pearson coefficient)

Results

The intra-rater correlation was good with an ICC (Intraclass Correlation Coefficient) at 0.99. Inter-rater correlation was also good with an ICC at 0.98. The Pearson correlation coefficient (r) was 0.99 (p <0.001). Compared to the reference measurement, +WoundDesk measurements represent an average overestimation of 13% of the surface.

Discussion

Under the study conditions, the use of the mobile Health application +WoundDesk® for wound surface area measurement was reliable and reproducible. With an intra- and inter-rater reliability values >0.98, the technique used by the application is equivalent to other methods for which an intra- and inter-rater reliability >0.96 is usually considered to be excellent [5-8]. With a Pearson coefficient of 0.99, the linear correlation is also good.

<table>
<thead>
<tr>
<th>Intraclass correlation coefficient (ICC)</th>
<th>Rater 1</th>
<th>Rater 2</th>
<th>Rater 3</th>
<th>Inter-rater reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICC single measures</td>
<td>0.9988 (CI 0.9977-0.9994)</td>
<td>0.9970 (CI 0.9945-0.9985)</td>
<td>0.9939 (CI 0.985-0.996)</td>
<td>0.9854 (CI 0.9741-0.9924)</td>
</tr>
</tbody>
</table>
However, the measurements made by the application shows an average variation of 13% compared to reference measurement. This result is in line with the literature; a variation of 21-28% is expected by photographic wound measurements [8].

The mobile application uses the ellipse formula to estimate the wound surface 
\[0.785 \times \text{height} \times \text{width}\] [1, 5]. According to Shaw and al. the ellipse formula used to measure wound surface areas causes an overestimation by 10-25% [9].

In our study, it appears that variations in surface measurement (overestimation or underestimation) are closely related to wound shapes. Indeed, the ellipse formula applied on rounded or oval wounds is relatively accurate, as the variation does not exceed 5%. In contrast, the variation may reach 25% for wounds of irregular or ellipsoid shape and 35% for large rectangular wounds.

According to the Wound Healing Society's guidelines, "if ulcer does not reduce by 40% or more after 4 weeks of therapy, re-evaluate and consider other treatments" [10]. Indeed, as described by Sheehan et al. [11], the percentage of wound surface reduction to 4 weeks is a strong predictor of healing at 12 weeks. The retrospective study by van Rijswijk et al. [12]
shows that the reduction of ulcer surface by 40% or more during the first 4 weeks is a positive predictor for healing. It’s accepted that a 50% decrease in size after 6 weeks is a sensitive predictor (93% sensitivity) to complete healing at 12 weeks [4, 8]. As the consecutive measurements are compiled in the application and available as a graphic, the mobile solution gives the care provider some critical information about wound healing evolution and prognosis.

Limitation of the Study

This is a first study being conducted on a relatively small sample of 30 wounds. They are flat artificial wounds with easily identifiable edges. In practice, wounds are rarely flat. They are often on body curvature causing additional error factor.

Conclusion

The wound surface measurements performed with the mobile phone application +WoundDesk are reliable, repeatable and reproducible. The accuracy is good for small irregular wounds, but decreases for large rectangular wounds. Further studies with real wounds are needed to confirm the first conclusion.

Conflict of interest: As one of the authors has developed the application, there is a risk of partiality.

References

After her medical studies, Patricia started her medical career in surgery departments where she has been practicing during 6 years. Her interest in technology and in new ways of providing care brought her to eHealth. She worked more than 5 years as physician for several telemedicine companies in Switzerland. Beside this, she also achieved a Master Studies in Public Health at the University of Geneva. Passionate about the revolution brought by mobile technology in the society, she associate with an experimented It entrepreneur and founded in 2012 digitalMedLab, a startup with the aim of developing mobile solutions for Health Professionals.

President, Swiss Association for Telemedicine and eHealth; Past President, European Health Telematics Association.

Martin has board certifications for General Medicine, Internal Medicine and Psychiatry/Psychotherapy, as well as Master Educations in Health Information Management and Executive in eGovernance (EPFL). He built the first Swiss online consultation platform at University Hospital of Zurich, then developed the eHealth Strategy for Switzerland and led patient-centered telemedical services in primary health. Currently, Martin Denz implements and professionalizes health and care services across sectors.
Remotely Supported Prehospital Ultrasound: Real-Time Communication Technology for Remote and Rural Communities

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Abstract: We aim to facilitate prehospital assessment of remote and rural patients using remotely supported ultrasound (US) and a novel communications device. Paramedics can function as remotely supported US operators, guided and advised by hospital-based specialists regarding diagnosis and treatment options. Novel communication technology can link these users in areas with low communications coverage by connecting to multiple cellular networks and/or satellites to stream live US and video images, plus two-way audio. A demonstrator system was used in locations around the Scottish Highlands to stream images to remote reviewers for image interpretation. Connections with live US and audio-visual transmission were successful, with appropriate views provided in 94% scans. This prehospital support US system could facilitate early diagnosis and streamlining of treatment pathways for remote and emergency patients. It could be particularly applicable and useful in rural areas worldwide with poor communications infrastructure and extensive transport times.

Introduction

Prehospital diagnosis can save time on arrival at hospital, and if early treatment can be given, it can potentially save lives and help improve patient outcomes. This is particularly true for patients who live a considerable distance from major centres of care, such as in the remote Scottish Highlands. Ambulances are currently limited in their diagnostic imaging capacity, and providing this facility raises questions about training in technology use and image interpretation. One solution would be to send experts out as part of the ambulance team, and this option is used in some countries, particularly in major cities. However, in remote and rural areas it
is not feasible to staff ambulances with specialists and so diagnosis often must wait until the patient reaches a hospital. We are proposing a remotely supported system, where experts in ultrasonography support novice scanners in the prehospital situation using communication links. Scanners can receive guidance on the recording of images and their interpretation while in the field from hospital-based experts through the use of cellular and satellite networks to transmit live images and data, even in areas with variable bandwidth availability. This means that remote scanners need only basic training in how to use the equipment and diagnosis can be performed by the same people who would be consulted upon the patient’s arrival at hospital. This could potentially save time and help streamline the patient’s care pathway, because even if treatment cannot be given in the ambulance, the hospital can be alerted to the patient’s needs and prepare for their arrival.

Ultrasound (US) is routinely used to assess emergency trauma patients, where it can help locate bleeding within the body, and we think it could also be useful in less routine scans, such as transcranial imaging to look for bleeding in the brain in stroke or traumatic brain injury. In stroke in particular it is vital to diagnose the etiology (blood vessel blockage versus bleeding) because early intervention with ‘clot-busting’ (thrombolytic) treatment can significantly reduce disability and lower mortality [1]. However, thrombolysis cannot be given to patients with a haemorrhagic stroke as it can worsen outcomes. We suggest that US could be used to gather early diagnostic information in stroke and other conditions, where access to computed tomography is limited and/or delayed through remoteness. We have created a remotely supported prehospital US imaging system and this paper reports on the initial field testing.

Methods

Ten healthy volunteers without previous US experience received basic training with the US machine (Sonix Tablet, Analogic Corporation, USA) and were asked to perform three scans that form part of a routine trauma assessment: Morison’s pouch to visualise free fluid around the liver and kidneys; the aorta, looking for any enlargement indicative of an aneurysm; and the lung, looking for signs of pneumothorax. Volunteers also attempted to image the brain, looking for the third ventricle position relative to the midline, following the procedure described in Stolz et al. 1999 [2].

Scanning was performed in an ambulance parked at 16 different sites around the Highlands. Live US video streams, plus audio and video (AV) from a fixed camera, were transmitted via an Omni-Hub™ communications system and bandwidth management device (Tactical Wireless, UK) using
bandwidth from a combination of 2G and 3G cellular networks. Two trials were transmitted via satellite. Images were transmitted to clinical assessors in Inverness for review and were given a rating for their quality and diagnostic utility on a five-point scale from 1 = poor to 5 = good. Data transfer rates and any equipment or connectivity problems were recorded.

Ethical approval for the study was provided by the North of Scotland National Research Ethics Service committee (ref: 14/NS/0087).

Results

Of the 16 sites where transmission was attempted (see Fig. 1), there was one where there was not enough signal and the attempt was abandoned. Transmission rates ranged from 22–1900 Kbps, with a mean of approximately 1250 Kbps. Higher rated AV quality (rated 4/5 or 5/5) was associated with a higher mean upload rate (1021 Kbps, range: 336–839), compared with AV rated 1/5 or 2/5 (553 Kbps, range: 447–1657).

The mean latency of the transmission was 300 ms (114 ms with cellular networks and 2072 ms with satellite), which was not considered to be a limitation by participants at either end of the communication.

Figure 1: Locations of the field test scans and transmissions. The blue dot indicates the unsuccessful transmission site

Table I: reviewer ratings of the transmitted ultrasound images
<table>
<thead>
<tr>
<th>Median rating (range) (Scale: 1 = worst; 5 = best)</th>
<th>Cellular network (n=21)</th>
<th>Satellite network (n=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications adequacy for diagnosis</td>
<td>4 (2–5)</td>
<td>3 (3–3)</td>
</tr>
<tr>
<td>Communications quality</td>
<td>2 (1–5)</td>
<td>3.5 (3–4)</td>
</tr>
</tbody>
</table>

Reviewers’ ratings of the images are summarized in Table I, and show that they found the transmitted images suitable for diagnosis in the majority of cases when cellular networks were used, although the communications quality (e.g., stability, reliability) was not always good. Overall, 94% of the thoracic images were recorded and transmitted successfully, as were 67% of the brain midline images.

Conclusions

This study shows that remotely supported prehospital US is possible even in the variable connectivity of the Scottish Highlands, and has the potential to be used in rural emergency care. System optimization is ongoing and ideally it should be tested with real patients; this will be the next stage in the project. The study was not powered for statistical analysis, so conclusions risk type 1 error. This system could facilitate early diagnosis and streamline care pathways for patients, particularly in areas worldwide with poor communications infrastructure and extensive transport times.

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Teaching Video Otoscopy Using Telementoring: A Cost Effective Method to Support Training Partnerships in Developing Countries

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Introduction

Otological disorders are a common problem for emergency or primary care providers worldwide [1-3]. Training in otoscopy is a cornerstone of medical education. This project utilized a telementoring link between the University of Nebraska Medical Center and Hanoi Medical University in Hanoi, Vietnam to train medical students in the use of a video otoscope.

Methods

An audiovisual consultation link was established between the University of Nebraska Medical Center (UNMC), Omaha NE and Hanoi Medical University, Hanoi, Vietnam using Vidyo (Vidyo Inc., Hackensack, NJ). After IRB approval, medical students at Hanoi Medical University were instructed in performing otoscopy using the Karl Storz USB Video otoscope (Karl Storz, Tuttlingen, DE). Students were telementored in performing the otoscopy using a best practice algorithm to standardize the training. Students completed a post training questionnaire to measure the perceived value of the training (Table 1).

An example of the tele otoscopy training is presented below:

- Attach teleotoscope to the C HUB, which is attached to a computer linking the spoke site to the hub site;
- Gently pull the auricle upward and backward to move the acoustic meatus in line with the canal;
- Hold the teleotoscope like a pencil with a finger against the patient’s head to move the otoscope away from them if they move suddenly to prevent injury;
- Watch the monitor with the telementor, as the otoscope is inserted into the ear canal, inspecting the external auditory canal as it is advanced;
- Observe the tympanic membrane, noting the color, translucency and position of the drum;
- Identify the pars tensa with its cone of light, the handle and short process of the malleus and the anterior and posterior folds of the pars flaccida and position of the malleus handle;
- Air inflation otoscopy may be performed to evaluate middle ear disease. Assess the mobility of the tympanic membrane by applying positive and negative pressures with the rubber squeeze bulb;
- After the examination is complete, gently retract the otoscope from the ear canal.

**Results**

Seven medical students participated in the otoscopy training. Responses to the post training questionnaire are shown in Table 1 below.

**Table 1. Responses to the post training questionnaire**

<table>
<thead>
<tr>
<th>Question</th>
<th>% Yes</th>
<th>% No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to today's training have you used an otoscope for examining the ear?</td>
<td>72%</td>
<td>28%</td>
</tr>
<tr>
<td>Did the training with the video-otoscope help you learn the technique of examining an ear?</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Following this training do you think that you could successfully examine an ear using the video-otoscope?</td>
<td>86%</td>
<td>14%</td>
</tr>
<tr>
<td>Did you like the Distance Education Training?</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Would you recommend this training to others?</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Would you like to have Tele Otoscopy consultation capabilities linking your clinic with another medical center?</td>
<td>86%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Visual qualities of the images were of high quality as shown in Figure 1.

**Discussion**

This project demonstrated that video otoscopy could be successfully taught by telementoring. Feedback from students on the quality and value of the training was positive and they requested receiving more skills training using a similar teaching venue. The cost effectiveness of telementoring from a developed world medical training program to a university or medical clinic in the developing world could significantly expand teaching and
enrich and upgrade medical skills. After this successful pilot our group will expand teaching numbers through the UNMC/Hanoi Medical University training partnership and add additional skills training to the curriculum.

Figure 1: Image of tympanic membrane transmitted from Karl Storz usb video otoscope over Vidyo telecommunications platform.

Acknowledgement

The authors would like to thank Gail Kuper, Chief Operating Officer for the Center for Advanced Technology and Telemedicine, UNMC for assistance with this project.

References


Dr. Chad Branecki joined the Emergency Medicine faculty in July 2007, after completing his residency at UNMC in June of the same year. He obtained his board certification with the American Board of Emergency Medicine in June 2008. Dr. Branecki is the Associate Residency Program Director. His academic interests include medical student education, resident education, simulation, wellness, burnout, life balance and injury prevention in children.

David Boedeker is a premedical undergraduate student at Doane College. He is majoring in German and Spanish and is earning a minor in chemistry. He has worked at the Center for Advanced Technology and Telemedicine (CATT) since 2011. After graduating college, he plans to have a career as a military physician.

Ben Boedeker MD, PhD, is a professor of anesthesiology and Director of the Center for Advanced Technology and Telemedicine at the University of Nebraska Medical Center. He is a retired Colonel from the US Air Force Reserve having completed 30 years of service. His academic interests include improving airway management for the far forward battlefield, developing telemedicine improvements for austere military applications and perioperative care process improvement.
Telecare and Telehealth Services Using InspectLife Platform

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Introduction

Telecare and telehealth complex information solution InspectLife includes several telemonitoring services (Telemonitoring of glycaemia, Telemonitoring of blood pressure, Telemonitoring of ECG, Telemonitoring of body weight, Teleconsultation) which could provide better and accessible care for chronic patients and also better communication possibilities for care providers and care consumers. Telem onitoring measurement devices with wireless Bluetooth data transfer and mobile application are utilized.

One of the goals was to validate and certificate InspectLife solution as medical device. Therefore pilot projects with real patients were organized for telemonitoring of glycaemia, hypertension and ECG to validate data integrity in transmission, system usability and doctors’ evaluation. Also pilot project, for assesing the images from a distance, was conducted. Simulated assistance scenarios for bathroom emergency and house appliances were also tested.

Telemonitoring of Glycaemia

15 patients (diabetes mellitus type 1 - mainly labile diabetics, diabetics during pregnancy or diabetics treated with insulin pump) measured during 6 months their blood glucose level with glucose meter equipped with wireless data transmission via Bluetooth into mobile phone and InspectLife system. Up to 200 measurements per month were carried out for every patient. Every diabetologist should have checked patient’s glycaemic profile 2 times per month and could write notes or SMS or call to the patient. With selected patients it was verified that the data transmitted from measurement device to smartphone and to web application match and are correctly represented. For several patients, many hypo- and hyperglycaemias were identified during home monitoring, therefore doctor recommended additional self-education or continuous glucose monitoring for subsequent adjustment of insulin dosage.
Telemonitoring of Blood Pressure

17 users (possible patients) were measuring blood pressure at home during the period of 14 days. They should carry out regular morning and evening measurements. Patients were using blood pressure monitor equipped with wireless data transmission via Bluetooth into smartphone application to make it available to a cardiologist for assessment. Almost all patients sent enough measured data.

Data representation in graph enabled to the cardiologist quick assessment if the patient had hypertension or not - if measurements regularly cross level of 135/85 mmHg, which represents hypertension for home monitoring. With several patients it was verified that the data transmitted from blood pressure monitor to smartphone and to web application match and are correctly represented.

Telemonitoring of ECG

14 Patients were equipped with 8/12-lead ECG device designed for home monitoring and equipped with wireless data transmission via Bluetooth. Each patient was doing regular everyday measurements during up to 14 days. Most of the patients were able to measure and transmit good-quality ECG data and cardiologist was able to assess the heart activity on distance. Together the patients carried out almost 400 measurements from which 20% were not good enough to be assessed (for example ECG baseline wandering or not recognisable ECG waves).

Possible reasons for not good-quality measurements were mainly the faulty placement of electrodes on the skin or movement of the patient. Cardiologist concluded that the service and the 12-lead variant of the device could represent equivalent for ambulatory ECG measurement at the physician’s office. Verification of data transmission and correct representation of ECG in web application was verified using ECG simulator. It enables to measure simulated predefined ECG curve with two different devices and to compare the amplitudes and frequencies in the printed ECG graphs.

Teleconsultation

A service for sharing images between home care nurse and doctor was tested in real scenario together with a center taking care of patients with lymphatic diseases. One nurse was visiting up to 5 patients at their homes per day. These patients have difficulties to leave their homes and the nurse was working out of the doctor’s office. The nurse was instructed how to make photographs using a tablet and a special mobile application which contained a list of the patients participating in the trial. In cooperation with
9 patients it was created 87 photographs from which 92 % were good-quality, i.e. acceptable. The bad quality pictures were mostly not focused.

Doctor was alerted by email when a new collection of images was stored at the web application where he could see images in big resolution. The physician concluded that regular distant consultation represented great advantage because he could see and compare condition of patient’s legs more frequently and therefore prevent possible complications. This kind of service is able to improve efficiency of the healthcare for the facility because neither patients nor the nurse need to consult doctor in person.
Conclusion

The InspectLife complex solution included several telemonitoring services for chronic patients.

During 2014 pilot projects with real users were carried out during which InspectLife services were tested intensively. InspectLife solution was certified as medical device class I and obtained CE mark.

Acknowledgment

The work has been supported by grant No. 4.2 PT03/270 of the Ministry of Industry and Trade of the Czech Republic.

References

Teleconsultations on the Assistance of Primary Care Nurses of a Developing Country: The Experience of the Telehealth Network of Minas Gerais, Brazil

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Abstract: Our aim is to assess the teleconsultations requested by nurses sent to the Telehealth Network of Minas Gerais, Brazil. This retrospective and observational study analysed all consecutive teleconsultations requested by nurses from April 2007 to February 2014. Teleconsultations were classified according to the professional who requested and the specialist who answered them. Through the study, 30,258 teleconsultations were performed. The majority was directed to medical subspecialties (76.5%), mostly dermatology (20.2%); and 20.7% were directed to nurses. Regarding the cities from where the teleconsultations were originated, 92.8% of them had < 20,000 inhabitants. In conclusion, this analysis showed that the majority of the teleconsultations were originated from small cities and nurses requested teleconsultations mostly to medical subspecialists.

Introduction

The Brazilian Unified Health System (SUS) was created in 1988, to ensure the constitutional principles of universality, equity and integrity of health access [1]. In this perspective, public health policies were made decentralized and with hierarchical attention levels: from primary care (less complex and more comprehensive care) to tertiary care (costly and high-complexity assistance) [2]. As so, nurse professionals can work on management in the Family Health Strategy, on education and direct assistance to users, through nursing consults and completion of preventive procedures [3].

However, Brazil remains with great disparities regarding access to specialized healthcare, mainly in remote cities. Thus, primary care attention
is essential to patients in such locations [4]. Facing this reality, the Teleconsultation initiative emerged, to offer support and to strength the Brazilian Healthcare Network (Rede de Atenção à Saúde) [5]. Our aim is to assess the teleconsultations requested by nurses sent to the Telehealth Network of Minas Gerais, a public telehealth service that attends 722 cities in Brazil, in order to demonstrate the importance of the telehealth to support these professionals.

Methods

This retrospective and observational study analysed all consecutive teleconsultations requested by nurses from the beginning of the service on April 2007 to February 2014. The teleconsultations were classified according to the professional who requested and the specialist who answered them.

Results

Through the study, 30,258 teleconsultations requested by nurses were performed. Table 1 shows the most requested specialties. The majority was directed to medical subspecialties (76.5%), mostly dermatology, gynaecology/obstetrics, internal medicine and paediatrics; and 20.7% were directed to nurses, especially general nursing, wound care and paediatric nursing. Of all teleconsultations, 66.5% were requested during the primary care units working hours (8 am to 5 pm).

Regarding the cities from where the teleconsultations were originated, 69.0% of them had less than 10,000 inhabitants, 33.3% had less than 5,000 inhabitants, and only 7.2% had more than 20,000 inhabitants. Out of a total of 632 municipalities that ever requested a teleconsultation, 10 (1.6%) were responsible for 11.9% of all teleconsultations. A brief socioeconomic analysis of these 10 municipalities showed they sent between 240 and 757 queries, had a population from 2,959 to 17,739 inhabitants and were over 140 kilometres from Minas Gerais’ capital, Belo Horizonte.

Discussion

This study, from a large scale telehealth service in Brazil, showed that the majority of nurses who sent teleconsultations were located in remote, small, impoverished municipalities and asked mostly about dermatology, gynaecology/obstetrics, internal medicine and paediatrics. Additionally, one third of the teleconsultations were sent outside working hours, highlighting the importance of the service on their daily practice.

These results are in line with other publications in this field. In Pernambuco state, Brazil, a similar study with nursing teleconsultations
reported that nurses asked mainly about obstetrics, gynaecology, paediatrics and dermatology [6]. Regarding the socioeconomic features of the municipalities where most queries were originated, young, inexperienced health professionals are predominant and financial resources are highly needed [7], proving that utility is one of the main factors associated with the use of teleconsultation services [8].

In Canada, a study demonstrated that local nursing teleconsultation services improve self-confidence at work and reduce the feeling of professional isolation imposed by geographical distances [7]. They also increase autonomy, job satisfaction and cut down patient referral, saving time, reducing costs and possibly contributing to diminish the rotation of health professionals in remote municipalities [7].

Further studies are needed to explore the effectiveness of nursing teleconsultations to improve clinical outcomes and to understand why nurses send more questions to medical than nursing specialties.

### Table 1: Teleconsultations requested by specialty (n=30,258)

<table>
<thead>
<tr>
<th>Specialty</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medicine</strong></td>
<td></td>
</tr>
<tr>
<td>Dermatology</td>
<td>6109 (20.2)</td>
</tr>
<tr>
<td>Gynecology/Obstetrics</td>
<td>3914 (12.9)</td>
</tr>
<tr>
<td>Internal Medicine</td>
<td>1583 (5.2)</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>1472 (4.9)</td>
</tr>
<tr>
<td>Family and Community Medicine</td>
<td>1114 (3.7)</td>
</tr>
<tr>
<td>Cardiology</td>
<td>998 (3.3)</td>
</tr>
<tr>
<td>Endocrinology</td>
<td>669 (2.2)</td>
</tr>
<tr>
<td>Others</td>
<td>6761 (22.3)</td>
</tr>
<tr>
<td><strong>Nursing</strong></td>
<td></td>
</tr>
<tr>
<td>General Nursing</td>
<td>3219 (10.6)</td>
</tr>
<tr>
<td>Wound Care</td>
<td>2142 (7.1)</td>
</tr>
<tr>
<td>Pediatric Nursing</td>
<td>382 (1.3)</td>
</tr>
<tr>
<td>Emergency care</td>
<td>245 (0.8)</td>
</tr>
<tr>
<td>Others</td>
<td>290 (1.0)</td>
</tr>
<tr>
<td><strong>Nutrition</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>528 (1.7)</td>
</tr>
<tr>
<td><strong>Dentistry</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>297 (1.0)</td>
</tr>
<tr>
<td><strong>Pharmacy / Biochemistry</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>299 (1.0)</td>
</tr>
<tr>
<td><strong>Physiotherapy</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>169 (0.6)</td>
</tr>
<tr>
<td><strong>Audiology</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>67 (0.2)</td>
</tr>
</tbody>
</table>
In conclusion, this analysis showed that the majority of the teleconsultations were originated from small cities and nurses requested teleconsultations mostly to medical subspecialists, especially dermatology. A significant amount of teleconsultations were sent outside working hours, which suggests a commitment from the nurses to the service.

References


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The Advanced Analytics in Medical Systems: New Generation Goals, Tasks and Problems

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Abstract: The research for a new generation of advanced analysis tools is the most promising direction for investigation now. The successful implementation of these studies will enable the prosperous functioning of healthcare, the better treatment of patients and to lower service costs. So, today these tools are in the priority group. The paper presents a new project oriented to defining requirements, constraints, and tasks of a new generation of advanced analytics tools in medical systems.

Introduction

In recent years, in the global healthcare industry could clearly delineate the trend of a fundamental transformation – the global healthcare industry moves from a volume-based business to a value-based business [1, 7]. Healthcare payers are under pressure to deliver better outcomes, driven by consumers’ expectations are for a higher quality of care, better outcomes and lower costs. The dynamics of healthcare costs is changing and new approaches to healthcare delivery are increasing complexity and competition. The increase of the amount of changes and the speed of changes is driven by defensive medicine practices, the increased length of life, the pervasiveness of chronic illnesses, and the infectious diseases. The situation is expected to become even more complex in the next few years [2]. It is already clear that the growing complexity of the healthcare industry will require smarter, more informed decisions. This is the only possible solution for improving medical and economic results imposed by market dynamics and increasingly demanding consumers. Very indicative of this are the analyses of the IBM Institute for Business Value [2], Deloitte [3], McKinsey & Company [4-5], and Markets and Markets [6].

After 2010 all healthcare players recognize the need for innovation: advances in technologies and management can help facilitate new medical treatment options and new medical management decisions. Advanced analytics tools in medical systems are one of the most promising solutions to this problem. These tools provide a mechanism for filtering, sorting,
searching, and extraction of information and knowledge, based on the huge flow of data in the medical community.

This paper presents the results of a new project, oriented to advanced analytics in medical systems. The aim of the project is to conduct an extensive research in the field of e-Health: a comprehensive study of the concepts and methods for a new generation of advanced analytics in medical systems. According to the available data bases, the projects outcomes will be oriented to endocrinology (diabetes) and pulmonology (COPD).

Our New e-Health Project

In the early phases of integration of e-Health and Telemedicine systems into the existing medical information systems, the results have shown improvements in the performance indicators of the health system. These advantages have reduced significantly with the development of medical hardware/apparatus and the appearance of new approaches for patient treatment and tracking. This brings the issue of new paradigms for work with medical information. One of the most promising sphere of research is considered to be the exploration of the possibilities to create a new generation of advanced analytics tools which will allow healthcare to function successfully – the expectations are to improve the balance between the demands and expectations of patients and society, to optimize the use of existing resources, and to increase the ability to respond adequately to changes in medical systems and practices. In order to achieve this, the tools for advanced analytics have to be able to use the increasingly broadening range of information about the patient, thus allowing a much earlier medical and administrative intervention.

The existing academic studies focus only on individual aspects of the problem and most often they only cover a narrowly defined field of application. Corporate developments are oriented towards the possibility of renewal and development of old company systems, through integrating new approaches to collection, unification, search and processing of data, information retrieval and generation of knowledge. The most frequently reported result is the identified impossibility to introduce substantially new tools for advanced analytics due to outdated design of systems of older generations.

By the end of 2014, our group of Technical University of Sofia, together with colleagues from Medical University of Sofia, began work on a new project aimed at defining the requirements, constraints and key features of the new generation of systems. The project objectives include:

- A research of the sources of medical and biological data;
- A research of the possibility to use information/knowledge about illnesses and their treatment in patients with similar symptoms;
- A structuring the medical data and information following requirements for the methods of advanced analyses.

To achieve the objectives we plan following activities:
- Architectures of now existing analytics tools in medical systems will be studied and evaluated;
- Researching and evaluation of new methods for processing, storage and modification over time of medical and biological data / information / knowledge will be created;
- Changes in the ways of gathering and integration of information in real time will be effected;
- Applicability of mobile agents for semantic search across heterogeneous and distributed sources will be studied and developed;
- Automated and semi-automated methods for imaging data structuring will be introduced.

Current Results

At present, the project is in its first stage. In this initial phase our investigation starts from determining input/output data streams to/from hospital and hospital networking. As a generic source of raw data we use data streams in Sofia Medical University hospitals complex.

The study of the hospital information systems and their networking determines the following data/information/knowledge sources: medical staff computers, clinical workstations, microbiology, radiology, clinical laboratories, pharmacy, clinical databases (electronic medical records), patient computers, financial systems (billing, cost accounting), material management, administrative systems, research databases, library system, and educational resources.

The study of the input/output data streams has determined the following sources and consumers of data/information/knowledge: patients (home workstations), other hospital systems, other physicians, government healthcare systems (e.g., electronic medical records), pharmaceuticals regulators, insurance agencies, medical research groups/institutions, the Internet, other information resources/libraries/databases, vendors and providers of various types, and medical education centers (e.g., medical schools).

After fixing data sources and data streams, our research is directed towards research on some characteristics of the data that have a direct impact on the ability to investigate and to evaluate data variability and data
interoperability. The characteristics are heterogeneity, distribution, and modality of data.

The studies of the heterogeneity and the distribution of data at this stage have shown that the main problems of multiple data sources are the following:

- Heterogeneity of names – different databases store the same values, but the names of the attributes given are different.
- Heterogeneity of relational structure – the composition of attributes in a complex structure is varies, but the stored values are identical.
- Heterogeneity of values – different data sources have different methods of values presentation.
- Semantic heterogeneity – different assumptions can be made about the data relevance, reliability and usefulness.
- Heterogeneity of the models of data storage – this raises the issue of transformation between models.
- Heterogeneity by time – different data are obtained at different times.

The studies of the data modality have shown that may be this will perhaps the most complex and most continuous task of our project.

Conclusion

The accumulation of large amounts of data in the process of examination of certain types of patients (especially those with chronic diseases) raises the problem of how to catalogue the obtained (often heterogeneous and dispersed) information, its machine processing in order to facilitate its understanding, as well as the ability to perform comparable and traceable measurements, especially in image (photographic) data. This calls for new research in the field of analyses of medical images; text analyses based on given semantic criteria (most often for the purpose of real time processing); comparative studies on the effectiveness of approaches and medical practices; etc. This would allow the development of new approaches which will facilitate the decision making process based on similarity between patients' data. Merging this information based on certain semantic features and generating new ideas for good medical practices will open up new vistas for patient treatment.

References


The Case for Creation of a Community of Teleconsultants: How to Make Teleconsultation a Reality

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The TeleConsultation Concept

A GP physician will perform over 200,000 consultations in his or her career with an amazing 70% success rate on the first clinical evaluation of the patient.

It says that the old fashioned consultation in 8 steps, is still valid and effective 7 out of 10 times …fairly impressive!

The eight steps of any (tele) consultation are:
- The first 4 steps: 1. Welcome; 2. Listening to; 3. Questions and 4. Observation, i.e. the conversational phase; while the remaining 4 are
- 5. Inspection; 6. Palpation; 7. Percussion; 8. Auscultation or the so called Physical examination (Fig. 1).

Figure 1
So, the question is: can we achieve same or even better success when the patient is not the in the room? Now the dimension of distance can be erased from the equation through the use of teleconsultation, if you have the right tools.

With the technical support of HOPI medical, WITELM has created the appropriate environment drawing from years of medical experience, the latest in technological advancements and medical equipment to yield in a telemedicine process that removes time/distance variable. Whether your patient is in a nursing home too frail to transport, or on an oil rig in the North Sea, the LIM seamlessly connects doctor and patient.

A Prerequisite: LIM Star “A Genie in the Box”, www.hopimedical.com

What we need basically is a device allowing the distant physician to perform all these steps:
- LIM Star is a highly mobile cart designed to transfer all necessary information to the distant physician through a conversation with the patient followed by a thorough physical examination performed with the support of a local assistant, either P.A. or nurse, next to the patient;
- With superior audio and video capabilities, the conversational part is established between the patient and the physician after the stage has been set by the assistant (installation of the patient in a comfortable armchair or on the exam bed, documentation of the session …);
- Then, through the touchscreen, in 1 (one) click and following the instructions of the physician who leads the scene through distant control of the camera, the assistant will activate one after the other, the adequate diagnostic tools (dermascope, otoscope, ophthalmoscope, ultrasound/Doppler, stethoscope, EKG ….);
- Horodating of the session is automatic and pictures can be taken (Fig. 2) either by the physician or, locally, by the assistant. If the latter is concerned with manipulation, he can give the control to the physician through a “panic button”.

Fig 2: Pictures issued from a teleconsultation

- Prevention of transmitted “nosocomial” infections has been a major concern leading to an innovative capacitive keyboard with instant
**activation/desactivation** and with a **no-contact dispenser** of hydro-alcoholic solution embedded in the back of the panel PC;
- The processor, i7, is able to support **dual videoconferencing** in order to allow the physician to get on the same screen “situation” view as well as the image produced by the endo/exoscopes or by the ultrasound unit;
- On the **Physician** side, **instant download of Neolinks, videoconferencing solution devoted to heath care professionals, easy (and free of charge)** on any PC, tablet AND smartphone (iOS, Android) with regular internet or 4G/3G connections.

An Absolute Requirement: Get a Physician to Take the Line

If we want teleconsultation to become a reality, they are many hurdles to overcome. Usually, most comments are dealing with reimbursement and legal issues. Then, considerations on ethical, deontological and liability questions take place on the agenda.

We do consider that they are not organized in the right sequence: the first and most important ingredient of success is the ability to build a community of care providers, physicians and assistants who are willing to start teleconsultations - enthusiasts, early adopters, pioneers etc.

They understand that, besides obvious practical differences, the philosophy is identical and that there is no competition between the “face-to-face” and the “distant” consultations. They are just two complementary modalities which are supposed to merge in a near future.

<table>
<thead>
<tr>
<th>“in room” consult</th>
<th>steps</th>
<th>“tele”consultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>#1 Welcome</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>#2 Listen to complains</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>#3 Orientated questions</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>#4 General observation</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>#5 Focused inspection</td>
<td>++ (pictures, videos, dimensions)</td>
</tr>
<tr>
<td>+</td>
<td>#6 Palpation</td>
<td>++ (Ultrasound/Doppler)</td>
</tr>
<tr>
<td>+</td>
<td>#7 Percussion</td>
<td>+ (Ultrasound/Doppler)</td>
</tr>
<tr>
<td>+</td>
<td>#8 Auscultation</td>
<td>+ (eStethoscope w filters)</td>
</tr>
</tbody>
</table>

That is to say that the physician will use the same tools in his own office and for the remote location according to the geographical situation of the patient.
This will bring together the best of the two worlds: the clinical appraisal inherited from generations of physicians and the fantastic instruments available in our digital age.

Join the club [www.witelm.org](http://www.witelm.org) to participate and dive in the future.

Jacques Cinqualbre M.D., former transplant surgeon at University hospital in Strasbourg, involved in health information systems and telemedicine through HOPI medical, a company of which he is the founder and CEO.
The Experience of the Telehealth Network of Minas Gerais, Brazil

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Abstract: Our aim is to report a successful experience of a sustainable large scale telehealth service which supports primary care practitioners, the Telehealth Network of Minas Gerais (TNMG), Brazil. The network was implemented to connect specialists from 6 public universities to primary care practitioners in remote cities. The project begun in 2006 in 82 cities and was expanded several times, reaching 722 cities in 2014. More than 2 million ECGs and 65,000 teleconsultations have already been performed. In 2014, an average of 2,200 ECGs and 40 teleconsultations were performed per day. The activities averted potential referrals for specialized health care services by 80%. The large number of activities performed by TNMG shows its important role in improving the access to specialized care, facilitating universality, equality and integrity of healthcare. Some factors support the sustainability and continuity of the TNMG: government-academia partnership, support of public managers, services provided by a collaborative network, systematic monitoring of the services, periodic auditing of the activities, short response time, ease use of the system, growth and diversification of telehealth activities, research development and economic viability monitoring.

Introduction

Brazil has continental dimensions and large number of municipalities. Specialized healthcare is concentrated in the bigger cities and the referral of patients from primary to specialized care may be difficult and costly. Telehealth can be an effective tool to increase the access to specialized healthcare, especially for remote areas [1].

The objective of this study is to report a successful and sustainable experience of a large scale telehealth service in support of primary care practitioners, the Telehealth Network of Minas Gerais (TNMG).
Implementation and Expansion

The network was implemented by public funds, mainly from the state government and research development agencies, to connect specialists from 6 public universities to primary care practitioners in remote cities [2, 3]. The project begun in 2006 with 82 cities and was expanded several times to other cities and other levels of care. The TNMG currently attends 772 of the 853 cities of the state, including 4 secondary care units, 7 emergency care units in Belo Horizonte, the state’s capital, and 48 ambulances in the north of the state, as part of a myocardial infarction system of care.

Activities

The main activities developed by the service were tele-electrocardiography (ECG) and teleconsultations. New applications were developed and validated, such as Holter, ambulatory blood pressure monitoring and retinography analysis.

Since 2006, the TNMG performed more than 2 million ECGs and 65,000 teleconsultations. In 2014, an average of 2,200 ECGs and 40 teleconsultations were performed per day. In relation to ECGs, 55% had no abnormality. The teleconsultations questions were associated with a clinic case in 82%, and 18% were theoretical questions.

Clinical Quality Control

Satisfaction of healthcare practitioners has been systematically evaluated. Historically the satisfaction of users with the system is around 95%.

Furthermore, to ensure the quality of decentralized clinical services, the activities are periodically evaluated by audits. The ECG audit consists of assessing agreement between different cardiologists’ ECG readings. A sample of ECGs is randomly and blindly selected, and every ECG is read by a second network cardiologist, also randomly selected. Subsequently, a senior cardiologist with strong expertise in reading ECGs assesses agreement between the two previous examiners and his readings provided the “gold standard”. The teleconsultations audit consists in the selection of a random sample of teleconsultations of a period of time, and the assessment of the quality of each teleconsultation response according to established criteria.

Cost Analysis

Considering that the activities averted potential referrals for specialized health care services by 80%, a cost analysis demonstrated that the savings related to avoided patient transfer result, during the last 8 years, in a return on investment of 4:1.
Research Projects

The TNMG maintains international cooperation agreement with Latin American, European and African countries, and coordinates several research projects. Currently, more than 10 large projects are under development.

Discussion and Conclusion

The large number of activities performed by TNMG shows its important role in providing assistance to healthcare professionals, mainly nurses and physicians, in remote municipalities, improving the access to specialized care, facilitating universality, equality and integrity of healthcare [4].

Some factors support the sustainability and continuity of the TNMG: government-academia partnership, support of public managers, services provided by a collaborative network, systematic monitoring of the services, periodic auditing of ECG analysis and teleconsultations, short response time, ease use of the system, growth and diversification of telehealth activities, research development and economic viability monitoring.

References


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eHealth Economics and
Evidence Based Telemedicine/Telehealth
Automatic Stress Detection Using Simple Telemedical Heart Rate Meters

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Abstract: The aim of this study was to analyze various HRV parameters in order to identify those that change significantly under the influence of mental stress. 48 healthy volunteers participated in the experiment. The results suggest that a simple, low cost telemedical heart rate meter could provide a reliable estimation of the state of mental stress. Based on the conclusions we propose an algorithm for stress detection which is being integrated in the Lavinia lifestyle mirror android application.

Introduction

Stress can be defined as a feeling of strain and pressure that helps our body be awake and prepared for certain actions. However, a long period of stress can be very harmful and it can cause various conditions like cardiovascular diseases, asthma, obesity or depression. Therefore, it is important to have a tool to measure stress during daytime. Various methods for measuring parameters which can be used to determine stress have been investigated recently, like galvanic skin response, temperature change of fingertips, tension in muscles or heart rate parameters [1]. Heart rate variability (HRV), being simple and noninvasive, has recently become one of the most popular methods for detecting stress. Still, this is not an easy task since HRV is not a single value. Instead there are many parameters that can be observed in time-domain, frequency-domain or using nonlinear analysis. Literature reports that under the mental stress, mean RR, pNN50, STD RR and RMSSD decrease while mean HR and LF increase significantly. However, significant differences for the same parameters and sometimes even opposite results (e.g. LF parameter) are also reported. A probable cause is that stress is not the only condition that influences changes in HRV. Physical activity, body posture, breathing, age, gender and illnesses all have a great influence on HRV. In this paper we analyzed various HRV parameters in order to find those that change significantly under mental stress. We used the results to create a simple stress detection algorithm which we are integrating in the Lavinia lifestyle support application [2].
Method

48 healthy volunteers participated in the experiment. The experiment was divided into two parts with duration of 10 minutes each. In the first part participants were asked to try to relax while listening to relaxation music. The second part of the experiment was a mental task which served as a source of mental stress. We used the Stroop color test smartphone game [3] which is commonly applied to induce mental stress. Controlled breathing and posture has been reported before to influence HRV parameters. Therefore we asked the participants not to control their breathing and to sit still in the same position during the whole experiment. This was also necessary to prevent detachment of measuring device from the body. RR intervals were obtained using a CardioSport TP3 Heart rate transmitter. It is a simple, low cost commercial chest belt which we have previously tested for reliability [4].

Statistical Analysis

We used Kubios software for getting HRV parameters and later we analyzed and compared data using MedCalc software. Wilcoxon paired samples test was used as a tool for determining significant change in values and a p value of <0.05 was considered as significant. Percentage differences were calculated between values and also average percentage differences and minimum percentage differences were calculated for all the observed HRV parameters.

Results

10 participants showed completely opposite results compared to the rest, so we postulated that for those subjects stress was higher during the relaxation period than in the game playing period. As an explanation, several participants reported that playing game was much more joyful than relaxation music. Others reported that the game kept their mind focused and that during relaxation they had time to think about problems and duties of the day. Some also reported anxiety about the experiment itself which vanished while playing. Therefore, we used the heart rate as the most obvious stress indicator for forming two groups. In the first we grouped all whose heart rate increased while playing and in the second those whose heart rate decreased. After grouping, participants showed more consistent results. Since the second group had fewer members, we statistically analyzed and presented results only for the subjects from the first group. We found statistically significant difference for the following time-domain parameters: mean RR (p<0.0001), mean HR (p<0.0001), RMSSD (p=0.0031), NN50 (p=0.0006) and pNN50 (p=0.0004). In frequency-
domain, two parameters showed statistically significant difference: LF (ms2) with \( p=0.0215 \) and HF (ms2) with \( p=0.0015 \). HF (%) parameter was close, but not significantly different \( (p=0.0588) \). In nonlinear analysis, the SD1 parameter showed a statistically significant difference \( (p=0.0031) \). Table 1 shows the results for parameters with highest difference.

**Table 1: Average percentage difference and minimum percentage difference for the parameters computed form the HR signal**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average percentage difference</th>
<th>Parameter</th>
<th>Minimum percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLF (ms2)</td>
<td>105.12</td>
<td>NN50</td>
<td>8.91</td>
</tr>
<tr>
<td>HF (ms2)</td>
<td>97.39</td>
<td>VLF (ms2)</td>
<td>6.22</td>
</tr>
<tr>
<td>LF (ms2)</td>
<td>84.22</td>
<td>RMSSD</td>
<td>3.98</td>
</tr>
<tr>
<td>pNN50</td>
<td>82.08</td>
<td>Poincare plot, SD1</td>
<td>3.98</td>
</tr>
<tr>
<td>NN50</td>
<td>81.35</td>
<td>pNN50</td>
<td>3.88</td>
</tr>
<tr>
<td>LF/HF</td>
<td>55.59</td>
<td>HF (%)</td>
<td>2.87</td>
</tr>
<tr>
<td>VLF (%)</td>
<td>53.28</td>
<td>HRV triangular index</td>
<td>1.42</td>
</tr>
</tbody>
</table>

**Stress Detection Algorithm**

Based on parameters that showed a significant difference, an algorithm has been created to automatically detect mental stress in real time environment. We used a combination of the mean HR, pNN50 and RMSSD parameters to identify stress. A sliding window over the HR signal is divided into four equal parts. Stress is detected by the algorithm if the mean heart rate in the fourth part compared to the first part increases by more than 3%, and RMSSD and pNN50 values decreases by 5% in the fourth part compared to the third part. Records of two patients were lost so we performed analysis on 26 records. As a result, this simple algorithm successfully identified stress for 21 out of the 26 subjects of the first group which gives an accuracy of 80%.

**Discussion**

In this study, we demonstrated how a simple mental stressor can influence HRV parameters significantly. Our findings are not very different from previous research. Under the influence of mental stress, mean HR increased, while mean RR, pNN50 and RMSSD decreased. Contrary to the results from literature we did not find a statistically significant difference in STD RR parameter \( (p=0.1648) \). The uniqueness and strength of this study compared to other studies is that we divided subjects into two groups based on the mean HR parameter, which improved the statistical significance. We also created a robust stress detection algorithm. Unlike other algorithms that provide formula for the level of stress as a percentage [5], we defined two states: stress and no stress. Compared to the stress algorithm described in
[6], we got slightly worse results for mental stress identification but stress levels in real life situations are much higher than in our experiment.

Conclusion

From this research we can conclude that even a simple low cost heart rate monitor device can detect parameters that change significantly under the influence of mental stress. Using these results we created a simple stress detection algorithm that is being integrated in the Lavinia lifestyle counseling mobile application for further testing in real life stress situations.

Acknowledgment

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Business Model as a Strategic Tool in Telehealth Development

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Abstract: In this research, three business model concepts, viz. the Business Model Canvas, the STOF business model framework, and the VISOR framework are studied to speed up application of Telehealth in Indonesia. Components of the models are compared and mapped to suit the factors which influence the development. Since Telehealth is a complex business, no single model is effective to cover the entirety of its development. Integration of the three models might be a good solution, e.g. Canvas business model is used in identifying business entities, the STOF framework is applied to derive business architecture into infrastructure, and the VISOR business model is used in the design and implementation of its application.

Introduction

Various research and pilot projects on the application and development of Telehealth have been done in Indonesia. Since 2012 there are 18 pilot projects of telemedicine under coordination of Indonesia’s Ministry of Health. Although the results are very promising, the application of Telehealth in Indonesia is still limited. One of the reasons is that until recently, there has been no comprehensive study on Telehealth investment that takes into account the different components that includes the business processes. This leads to investors’ hesitation in financing the Telehealth business, though the Indonesia Telehealth market is very prospective.

The aim of this research is to perceive Telehealth development from another perspective. Specifically, is to find appropriate business model that can be applied for Telehealth development in Indonesia. Moreover, based on the business model, a financial template might be designed to provide stakeholders with an overview of prospective investment on Telehealth.
Methodology

A literature review was conducted to identify various business models. This was followed by a design of Telehealth scenario for Teleradiology application. Based on the application, the business model components are identified. In addition, a financial plan of Telehealth application and cost for Telehealth operation are also defined.

Literature Review

Until recently there is no such fix definition on a business model. There are several definitions that can be found in the Business literature, e.g.: Johnson et al. [1], Casadeus-Mansell, Ricart [2], Amit, Zott [3], Chesbrough, Rosenbloom [4]. Among various definitions of business models, this research has identified three business models which most appropriate for Telehealth development, viz. Business model Canvas [5], STOF framework [6], and VISOR framework [7]. Figure 1 describes components of the models which have been compared and mapped.

![Business Model Canvas](image)

Figure 1: Mapping of business models STOF and VISOR on Canvas
It can be identified that the blocks or the components within three business model are nearly similar. Although model business STOF and VISOR have less components compared to the Canvas, but they may cover all Canvas’s blocks.

Telehealth Business Model Development

The most important stage in developing Telehealth business model is to determine the products or services that will be offered (value proportions). This will depend on the evaluation and need assessment result, the demand and the targeted market. Based on the product or services, a scenario has to be developed to define interaction between components. A general scenario for Teleradiology consultation between a patient at a health center in a rural area with a radiology specialist in a hospital referral is depicted in Figure 2.

![Figure 2: A Teleradiology scenario](image)

The basic components of a business model which involved in the scenario above are: 1) organization that consists of a referral hospital, CHC, telecommunication provider, and the health insurance if the patient is registered as a member National Health Insurance (NHI), 2) actors who are a patient, doctor in the CHC, nurse, radiologist doctor, and administrator, 3) service platforms involved IT, data and medical devices 4) value proposition or service, 5) cost structure and revenue stream.

As with any business, cost components cannot be separated from the organization's overall financial plan that consists of plan income (revenue) and planned expenditures (expenses), e.g. non-clinical personnel,
marketing, clinical expenses, educational or training program, supply and operation expenses and telecommunication costs. In addition to overhead costs, there are also investment costs, travel expenses, costs for supporting organization, e.g. the CHC involved in the Telehealth program, and other costs which are directly related to the program.

Closing Remarks

Telehealth is a complex business; no single model is effective to cover the entirety of its development. It depends on complexity of the Telehealth program and application. We can select an appropriate business model as required. When the Telehealth program does not involve many business entities, STOF framework might be the best choice. Furthermore, integration of the three models might be a good solution, e.g. Canvas business model is used in identifying business entities, the STOF framework is applied to derive business architecture into infrastructure, and the VISOR business model is used in the design and implementation of its application.

Acknowledgment

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Cost-Minimization Evaluation of the Check@flash eHealth Solution

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Abstract: Among e-Health solutions explored for supporting the elderly suffering from chronic diseases and/or multipathology, StreamVision Company’s Check@flash is an armchair endowed with multiple noninvasive sensors that offers a complete health check-up in 7 minutes. It would be particularly useful in the context of French elderly residential care facilities (called EHPADs) to provide a valuable aid to residents’ follow-up and diagnosis. To assess its socio-economic feasibility and viability, we have designed an in situ and in vivo non randomized trial in 4 French EHPADs. While many effectiveness studies are performed only a posteriori and focus mainly on the health system perspective, the aim of this study is to assess the cost-effectiveness of Check@flash using cost-minimization analysis and profitability from EHPAD’s perspective. Furthermore, we improve cost-minimization analysis by a comparison of the utilization costs of multiple devices (weight, blood pressure, thermometer, and oximeter) employed for the monitoring of EHPAD residents in 2013, to the utilization cost of a single integrated system (Check@flash) measured by “production minutes”. We collect cost data by extracting from EHPADs’ analytical accounting and by timing the medical exams performed by nurses or caregivers using the standard medical kit.

Results show that Check@flash is less expensive than the standard kit when direct costs are taken into account. The sensibility analysis results are context dependent, showing that in EHPADs where measures of blood pressure and weight are more frequent, Check@flash’ utilization is preferable to the standard medical kit.

Introduction

Long term health conditions related to the ageing of the population result in increasing healthcare demands and public health expenses as final years of life approach. In order to overcome this phenomenon and medical desertification, ICTs are able to transform health systems by avoiding or reducing costs and improving healthcare access in remote areas. In France,
500,000 elderly dependent persons live in dependent senior’s nursing homes called EHPAD and their hospital expenses represent 1.7 billion euro per year. Up to 67% of hospitalization stays of institutionalized elderly individuals may be avoided and a better EHPAD management may save up to 1 billion euros of public health expenses [1]. In this context, the use of Check@flash in EHPADs may benefit different stakeholders (patients and their family, medical and non-medical health care staff…) and may represent a solution to improve elderly medical follow-up and therefore avoid hospitalizations. StreamVision Company’s Check@flash is an armchair endowed with non-invasive sensors (weight, ECG, blood pressure, pulse oximeter, spirometer, IR temperature) which are able to measure patient’s vital parameters and generate a complete health checkup in 7 minutes, screening for 60 pathologies. Thanks to non-invasive sensors and to the wheeling aspect of the armchair, it brings more comfort to the elderly, providing a better patient’s quality of care. It is easy to use, mobilizing few medical resources, optimizing EHPAD’s time and management. While many studies focus mainly on the health system perspective and are conducted a posteriori, this paper assesses the effectiveness of Check@flash by using cost-minimization analysis from EHPAD’s perspective.

Methods

Cost Minimization or cost-cost analysis is a common type of cost analysis whereby the costs of a program are compared to the costs of alternative methods of service delivery under the assumption that both approaches result into similar outcomes. To assess the socio-economic feasibility and viability of Check@flash, we have designed an in situ and in vivo non randomized trial in 4 French EHPADs [2]. We collect cost data by extracting from EHPAD’s analytical accounting and by timing the medical exams performed by nurses or caregivers using the standard medical kit. We improve classic cost-minimization analysis by a comparison of the utilization costs of multiple devices (weight, blood pressure, thermometer, and oximeter) of the standard medical kit to the utilization cost of a single integrated system (Check@flash) measured by production minutes [3]. We assume that EHPAD production consists in all regular follow up exams as a production chain and not as a fortiori isolated medical act. We also compare total costs of multiples devices vs. total cost of Check@flash including a comparison of direct costs (amortization and staffing). In order to examine simultaneous influence of several variables in terms of direct and total costs on the results, we perform univariate and multivariate analyses. The variables are: multiple devices (forming the standard kit) price and their use frequency, Check@flash price and expected lifetime, medical staff using
Check@flash (nurse or care assistant), EHPAD capacity (number of beds). Results are obtained for each of these variables considering their baseline and a variation interval for the sensibility analysis.

Results and Discussion

When direct costs (amortization and staffing costs) are considered, Check@flash is less expensive than the standard medical kit for all 4 EHPADs. Assuming that Check@flash is used for a monthly follow up, 7 minutes is required contrary to 34.5, 13.25, 11.75 and 8.75 minutes for using the standard kit. Univariate analysis measures the evolution of direct costs resulting from the variation of one the variables that may influence costs. We consider that the regular check-up with the armchair is performed either by a nurse (IDE) or by care assistant (AS). The probability that one of them (IDE, AS) uses Check@flash is calculated based on full time equivalents for the period considered. If the armchair is used by a care assistant rather than a nurse, an economy is made (due to a lower hourly wage). Delegating this task to care assistants may result to their skill improvement together with a better use of nurses’ time to improve healthcare quality and patient safety. For an acquisition cost of maximum 36,800 euros and 10 years lifetime, Check@flash is less expensive than the standard kit, even in the pessimistic case of 5 years lifetime. For the multivariate analysis we take into account all the previous discussed variables and devices price (5% variation) and use frequency of the standard kit. The results show that in EHPADs where measures of blood pressure and weight are more frequent, Check@flash’ utilization is preferable to the standard medical kit.

Conclusion

Cost minimization results show that Check@flash is preferable to the use of the existing standard kit. Although frequently used, cost-cost analysis excludes program outcomes from the analysis, providing only restrict information to decision makers when implementing or expanding a program. Cost Minimization will be further completed with cost-efficiency and cost-utility analyses during the experimentation, to also take into account the benefits of Check@flash solution for EHPAD’s residents (quality of life) and their family (reassurance), for EHPAD’s staff (time saving, better organization) and for the Social Security (cost optimization, better healthcare).

Acknowledgment

Thanks are due to M. Rebiai, CEO of StreamVision, for trusting us with the economic assessment of Check@flash and to all four EHPADs for
providing cost and time data. StreamVision is a French company specialized in the design and implementation of quick medical diagnosis systems enabling the capture of body information and medical analysis via non-invasive sensors. More info on www.streamvision.com

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Angela MARTIN, PhD, is currently working as an Economy Scientific Expert for Altran’s Research department that aims to strengthen the group’s position in Innovation Consultancy. She earned both her Doctor Degree and her Master’s Degree in Business Economics at the University of Orleans, France.”
Economic Assessment and Key Success Factors of Nationwide Telemedicine in the Slovenian Blood Transfusion Service

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Background
The Slovenian Transfusion Service Network has centralized its operations. Transfusion medicine centers and blood banks have been merged into three regions: Ljubljana, Maribor, and Celje.

Pre-transfusion testing
Transfusion medicine is practiced under a strict regulatory framework to ensure the safe and appropriate use of blood and blood components [1]. One of the safety measures is obligatory. A pre-transfusion serological testing before a blood transfusion is given to the patient, in order to confirm donor-patient compatibility. In 2013, the Slovenian Transfusion Service Network performed almost 140,000 pre-transfusion cases, or on average around 370 cases per day.

Averages of 31 cases daily were performed per center, with the largest one performing 131 cases and the smallest one only 5 cases on an average day.

Standard service provision of pre-transfusion testing in Slovenia before telemedicine
The provision of hospitals with blood products and pre-transfusion serological testing requires the continuous availability of a well-qualified medical team (24h per day, 7 days a week) in each institution. The transfusion laboratory personnel perform the tests, while the read-out and interpretation are carried out by transfusion medicine specialists.

For most units, the continuous presence of a transfusion medicine specialist presents a great staffing (not enough available) and financial challenge. Consequently, the departments have come up with two solutions to the problem: a) To have their own medical specialist on standby and called in when necessary (delayed in-person care locally), and b) to have medical specialists from other fields working in nearby hospitals called in when a case appears (under a specialized in-person care locally and a
delayed in-person care locally). Both alternatives have certain drawbacks in service quality compared to having medical specialists present on site.

**Telemedicine for pre-transfusion testing**

According to the law, each patient in Slovenia has to be treated with the same quality of service regardless of the geographic location [1]. Professionals argued that having standby physicians translated into unequal access to care throughout the country and was more prone to mistakes, especially with emergency and complex cases. Consequently, a telemedicine system was developed allowing the remote inspection and interpretation of pre-transfusion tests from the central reference laboratory for any remote site.

The increasing importance of telemedicine in the Slovenian Transfusion Network is backed up by figure 1. While in 2010 only 18% of all pre-transfusion cases at smaller sites were performed via telemedicine, in 2013 that number grew to 46% “Fig. 1”. The two smallest sites are almost fully covered by telemedicine.

<table>
<thead>
<tr>
<th>Year</th>
<th>On-site</th>
<th>Telemedicine</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>82%</td>
<td>18% 49.400</td>
</tr>
<tr>
<td>2013</td>
<td>54%</td>
<td>46% 43.500</td>
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</table>

Figure 1: Pre-transfusion cases performed via telemedicine in nine blood transfusion departments, 2010 and 2013

**Objective**

This study evaluates how a telemedicine alternative (experienced transfusion medicine specialists interpreting pre-transfusion tests remotely via telemedicine) compares to the standard (pre-telemedicine) mode of interpreting pre-transfusion cases in terms of cost performance.

**Methods**

As part of the economic evaluation we carried out a cost minimization study to determine the cost difference between performing pre-transfusion testing in blood supply by teleconsultation versus standard pre-telemedicine practice [2]. Only incremental resource use was included; costs common to
both alternatives were eliminated. The analysis was performed from a health care provider perspective.

Study design

The framework examined the actual volume of the pre-transfusion tests performed by the Slovenian Transfusion Service Network in 2013, and compared the costs of providing the pre-transfusion service between the telemedicine alternative and standard (pre-telemedicine) practice for one year. The basic scenario encompasses the regionally organized telemedicine network.

Results

The total annual incremental fixed cost of running a telemedicine network is 206,000€, of which the equipment costs are estimated to be 86,500€ [3]. The annual equivalent internal development and implementation costs were 43,000€ per year. The yearly maintenance fee totals 76,460€. The basic scenario requires 4 medical specialists, which add up to 1,020,000€. The total incremental cost for the telemedicine alternative, as currently introduced, is estimated to be 1,226,000€. If consultants were to be shared between the regions, an additional optimization could be introduced, thus bringing an additional 200,000€ of savings.

The total annual incremental cost for standard pre-telemedicine practice is estimated to be 1,906,908€. In 2013, regionally implemented telemedicine practice saved 681,000€ for the Slovenian Blood Transfusion Network compared to the standard, pre-telemedicine practice. An additional 220,000€ could be realized by combining the regions together.

The incremental cost of having a medical specialist present 24/7 at each site is estimated to be almost 3mil€. The telemedicine alternative offers the same quality of service for as much as 1,8mil€ less.

Conclusion

Pre-transfusion testing is carried out at 12 centers throughout Slovenia. Most of the procedures are performed by laboratory technicians, while the read-outs and interpretations are carried out by transfusion medicine specialists. The service needs to be available 24/7. For smaller units, the continuous presence of a transfusion medicine specialist was too expensive. The transfusion network has developed a system allowing the remote interpretation of pre-transfusion tests from any remote site.

The essence of this study was to investigate and synthesize the findings as to whether telemedicine is able to deliver in terms of cost savings. Compared to standard pre-telemedicine practice, the nationwide
implementation of telemedicine in pre-transfusion testing brings 0.65 mil€ annual savings. Short-term savings are mainly realized through a reduced number of medical specialists by combining pre-transfusion cases throughout the country.

While this study is limited to economic evaluation, the effect of introducing telemedicine into the Transfusion Network is much broader. Medical professionals feel the strongest impact of telemedicine on pre-transfusion testing is intra- and inter-organizational, especially the improvements in the work processes which in effect could result in an improved quality of service delivery and patient outcomes. The following effects were most prominent: Streamlining the work process for laboratory technicians, having dedicated medical specialist positions, bringing experienced professionals to every transfusion unit, and instant second opinions.

References


Economic Foundation of e-Health and Its Promotion in Japan

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Introduction

Telemedicine is a dynamic and important method of delivering healthcare services that holds the potential to benefit the Japanese healthcare community, patients, the government and the broader economy as a whole by virtue of its ability to enhance traditional medical services and in some cases, improve access to healthcare in a more affordable way.

Benefits of telemedicine intervention are numerous and typically fall into one of four categories: (1) enhanced efficiency; (2) improvement in patient satisfaction and Quality of Life (QoL); (3) greater access to healthcare; and (4) contributions to clinical safety and reduction of medical errors.

Although there are few, if any, objective statistics on the application and delivery of telemedicine services in Japan or for that matter, around the world, many experts in the field believe that there is a wide gap between (i) the technological capabilities of Japanese manufacturers and service providers, and the advanced infrastructure within the country and (ii) the utilization of telemedicine amongst healthcare practitioners and patients here in Japan.

Under the circumstances around Japanese telemedicine mentioned above, the objectives of this paper are to analyze the real obstacles of further telemedicine implementation and eHealth in Japan and demonstrate solutions to overcome from the viewpoint of eHealth economics.

Issues of Japanese Telemedicine and eHealth

A number of issues that it believes represent obstacles to the growth of telemedicine in Japan include the following:

Article 20 of the Medical Law
It was legislated about 100 years ago and then the wording makes no mention of telemedicine and contains language that many legal professionals and academics believe could be interpreted to prohibit
telemedicine. However, the ordinance issued by the Ministry of Health, Labor and Welfare on March 31, 2011, shortly after the Great East Japan Earthquake, accepted telemedicine under the same conditions as face-to-face treatment. Although treatment delivered via telemedicine is not the same as face-to-face treatment, telemedicine does not automatically conflict with Article 20 of the Medical Law, if it enables useful information on the physical and mental condition of patient to be obtained in a sufficiently substitutable manner. Article 20 thus should be revised in the manner that reflects the ministry notice and incorporates telemedicine.

**Credentials of telemedicine**

There is no official guideline for telemedicine exist in Japan except that of the Japanese Telemedicine and Telecare Association (JTTA). It is unclear who is authorized to implement it. The primary interpretation is that only medical doctors can implement telemedicine, but for the full benefits to be realized, other medical professionals including nurses and co-medicals should be allowed to participate. Given the shortage of physicians, particularly in rural areas, the ministry should implement a system that expands the services that nurses, psychologists, clinical engineers and other healthcare professionals can provide under a doctor’s remote guidance. In the United States, credentialing for telemedicine clearly designates the persons who can implement specific telemedicine treatments and operate specific devices. In more details, nurses are authorized to practice tele-consultation or tele-triage under the establishment of the safety standard, protocol or guideline [1]. In Japan, timely intervention by nurse for patients with oxygen therapy at home is reported to improve the acute problem [2]. Accordingly, both the government and the medical sector are active in educating, training and monitoring telemedicine practice in U.S. medical institutions.

**The current reimbursement**

Telemedicine is also suitable for health management in ways other than direct treatment such as for continuous monitoring of a patient’s condition, consultation by medical specialists, disease-management, prevention of the worsening of illnesses, and guidance and education for patients. The costs of these telemedicine practices should also be reimbursed. As an example, Medicare in the United States accepts the costs of telementoring, guidance and education on diabetes and dialysis treatment in its reimbursement scheme. Authors’ previous paper [3-6] estimated the economic benefits in terms of reduction of medical expenditures or treatment days achieved by telemedicine interventions.
Currently teleradiology, telepathology, telephone consultation, guidance and management fees for a pacemaker (telemonitoring) and asthma treatment at home are some rare examples of telemedicine services whose costs are clearly approved for reimbursement [7]. It is uncertain whether other telemedicine practices qualify for reimbursement or not. The ministry is reluctant to expand reimbursement to other medical treatment, probably due to the shortages of budget or strong opposition from traditional medical doctors. Teleradiology is one of the most successful telemedicine activities, and its reason lies in the current reimbursement system. Private firms which specialize to read X-ray, MRI or CT scan pictures accept requests from hospitals. Their business model is simple; their charges to read pictures are less than those of reimbursement and busy medical institutions ask them to read.

**Stance of the Ministry**

The reason why the Ministry of Health, Labor and Welfare is reluctant to expand approval of reimbursement to other areas is simple; medical treatment itself is already approved for imbursements, and no additional telemedicine treatment is needed. Here let us take an example of the treatment of patients at home, which includes visiting those patients at home twice a month. The amounts of reimbursements consist of the following items: (1) comprehensive management fees (per month) JPY42,000 (300 Euro); (2) visiting treatment fees (twice a month) JPY16,660 (119 Euro); (3) visiting management fees (twice a month) JPY5,800 (41.43 Euro). Thus for one patient staying at home, physicians can receive JPY64,460 (460.43 Euro) per month. These are only related to the face-to-face treatment, but the Ministry considers these amounts are enough to physicians, even if they use additionally eHealth such as the video conference system. Medical doctors, on the other hand, insist that reimbursements should cover the costs of depreciation allowances for eHealth equipment and communication charges of video conference between physicians and patients at home. Communication allowances are only approved for those used fixed telephone, but not for video conference, tablets or smartphones. These do not meet demand in the age of the information society.

**Conclusion: Issues of m-Health for Further Diffusion**

eHealth or mHealth does not necessarily develop in accordance with the development of technology. Further diffusion of these services requires the conditions related to medical, social, economic and legal conditions. The switching costs from traditional medicine to eHealth are larger than expected, because it is not a simple change but a paradigm shift. Besides, nor it is a change only inside the hospital, but it is a change to the patient-
centered system, or to the regional health and care system. It is necessary to construct a system in which all related medical institutions such as medical doctors, nurses, care takers, dentists, pharmacies, hospitals, and so on must collaborate. Moreover, the reforms of social systems including medical and long-term care insurance and firm economic foundations are also required.

References


Masatsugu Tsuji, Professor of Economics, Graduate School of Applied Informatics, University of Hyogo, and Professor Emeritus of Osaka University. His study includes economic evaluation of e-Health.

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Satoshi Inagaki, Graduate student of University of Hyogo. He has been studying nursing informatics focusing on a patient at home
e-Health System: A Tool for Investigations on Demographic Distribution Pattern of Dermal Diseases in Remote Beneficiary

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Introduction

Dermatology is one of the most visual specialties in medicine and also it is suited for modern telemedicine techniques. In teledermatology, dermatologists use telemedicine techniques to diagnose and treat patients from a distance, which involves the clinical evaluation of skin lesions and the review of laboratory findings [1]. The primary aim is to make sure that patients from remote area are getting specialized dermatological care. The further aim is to decrease the Patient flow to the big urban tertiary care centers and to increase diagnostic efficiency [2]. One objective of teledermatology is to deliver high quality healthcare more efficiently, by reducing travel and expenses [3]. Teledermatology applications consist of two different models of operation, one is store-and-forward (i.e. prerecorded) and other is real-time (i.e. synchronous). In store-and-forward telemedicine, photographs of patients are sent for the review of a consultant at any time. On the other hand real-time telemedicine often use videoconferencing equipment and a direct interaction between teledermatologist and patients occur. Both systems offer a clear method of service delivery directed towards improvement of access and decreasing cost, by eliminating travel for patients, physicians and nurses [4]. It is seen that there is an increasing demand of dermatology and so that the demand of teledermatology has increased at the same time [5].

Background

The first teledermatology consultation at Mayo hospital telemedicine department took Place in February 2009. Since then more than 21000 (data compiled on 4th February 2014) Patients are consulted from seven districts of Punjab. The districts are Attock, Khushab, Gujrat and Jhang central-north Punjab and Rajanpur, Dera Ghazi Khan and Sahiwal from south Punjab. It is estimated that directly and indirectly 70 million masses can benefit from
the telemedicine facility in above mentioned areas. The district headquarter hospitals in their respective districts are equipped with telemedicine video conferencing equipment supported by high resolution cameras and other advanced medical gadgetry. Dermatology comprises more than 59% of total consultations made so far. Mayo hospital has two units of dermatology. Both units provide 4 days consultancy services to Telemedicine Department every week.

Consultancy Plan

The fundamental visual nature of dermatology makes it appropriate for telemedicine. When the qualities of images are reliable, digital images can be a substitute for physical examinations in dermatology [6]. Patients at remote areas can visit their respective telemedicine center in any working days. Still pictures of patients are taken and uploaded in the software. A receipt is provided to the patient, mentioning time and date of consultation. The Remote Telemedicine centre also facilitates patients by conforming appointment via telephone. On specified date and time patients are consulted with the help of still Pictures, live video conferencing and sophisticated zooming derma scopes. Patient record is saved on dermatology software for referrals and advance research purpose. Photographic images of patients play an important role in dermatological record keeping. Physicians usually use the patient data that are collected and transmitted by teledermatological systems, which use informatics and telecommunication technology, diagnose the disease and suggests all necessary therapeutic measures [7].

Demographic Distribution of Dermal Diseases

On compiling the data, the picture of disease distribution pattern appeared. Among different skin related diseases, most commonly seen problem was superficial fungal infections (six types) namely Tinea Capitis (mostly common in Gujrat, khushab and Attock), Tinea Corporis (mostly common in Gujrat, Jhang, Khushab and Rajanpur), Tinea Faciei (mostly common in Gujrat and Rajanpur), Tinea Cruris (mostly common in Attock, Gujrat and Dera Ghazi Khan), Tinea Incognito (mostly common in Gujrat, Khushab and Jhang) and Tinea Mannum (mostly common in Gujrat and Rajanpur). Among other notable diseases worth mentioning were Acne Vulgaris, common in age group 15-40. During consultation it was also noted that severity of Acne was due to frequent and injudicious use of over-the-counter available steroid mixed fairness creams and bizarre eating habits among the young population. The Acne problem was observed during every consultancy day from every remote Telemedicine center.
Nodulocystic acne was also reported from every centre. Scabies with and without secondary bacterial infections was recorded mostly among poor societies with unhygienic practices. It was also observed that children from religious schools were mostly and commonly affected from Scabies (mostly common in Rajanpur, Dera Ghazi Khan and Jhang). Secondary Eczematization (mostly common in people of rural areas from all Districts), Alopecia Areata (mostly common in Rajanpur, Khushab and Jhang), Sycosis Barbæ (almost equal Number of Patients from every district), Impetigo Bullosa Contagiosa (mostly common in Gujrat and Rajanpur districts), Ichthyosis (mostly common in Attock, Rajanpur, Gujrat and Jhang). Every district had almost equal number of DLE (Discoid Lupus Erythematosus) patients except Sahiwal. Most of the patients suffering from Hirsuitism (polycystic ovarian syndrome) belonged to Gujrat and Rajanpur districts.

Fig 1: Some of the Patients consulted through Teledermatology

Few cases of Leishmaniasis and among Herpetic infections recurrent Herpes simplex Labialis and Genitalis were consulted from Attock, Rajanpur and Dera Ghazi Khan districts. Viral Warts (mostly from Khushab, Jhang and Rajanpur), Molluscum Contagiosum (mostly from Khushab and Jhang), Condyloma Accuminata and Lata (most common in Khushab and rajanpur), Psoriases (most common in Gujrat and Attock). Vitiligo was equally noted among patients of every district. CD (Contact Dermatitis) was also noted from every centre and in many cases the patient himself/herself was responsible for the cause of the problem due to ignorance or bad advice. SD (Seboric Dermatitis) was also equally noted.
from every centre. Patients suffering from Urticaria were mostly rural and most of them belonged to the districts of Gujrat, Attock and Khushab. Distribution frequency of the data showed that the mentioned skin diseases were more seen in age group between 20-50 years age group with equal gender distribution. The victimized group was mostly due to unhygienic & poor socioeconomic living standards. While the distribution frequency of skin diseases namely DLE (Discoid Lupus Erythematosus), Nodulocystic Acne with Hirsuitism (Polycystic Ovarian Syndrome) and Herpetic infections belonged to middle class.

Tab. 1: Most frequent dermatological disorders observed during consultation

<table>
<thead>
<tr>
<th>S.No</th>
<th>Diseases</th>
<th>Age group</th>
<th>Frequency</th>
<th>Areas</th>
<th>Social group</th>
<th>Mild %</th>
<th>Sever %</th>
<th>Rare occurrence %</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Tinia capitus</td>
<td>4-57</td>
<td>1793</td>
<td>Rural</td>
<td>946 Urban 847</td>
<td>53%</td>
<td>39%</td>
<td>08%</td>
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<td>Tinia Carporos</td>
<td>12-42</td>
<td>1479</td>
<td>Rural</td>
<td>845 Urban 634</td>
<td>69%</td>
<td>15%</td>
<td>18%</td>
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<td>3</td>
<td>Tinia Fascia.</td>
<td>05-39</td>
<td>762</td>
<td>Rural</td>
<td>439 Urban 323</td>
<td>73%</td>
<td>22%</td>
<td>05%</td>
</tr>
<tr>
<td>4</td>
<td>Tinia Cruis</td>
<td>07-61</td>
<td>535</td>
<td>Rural</td>
<td>297 Urban 238</td>
<td>43%</td>
<td>37%</td>
<td>20%</td>
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<tr>
<td>5</td>
<td>Tinia Incognato</td>
<td>09-43</td>
<td>397</td>
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<td>182 Urban 215</td>
<td>68%</td>
<td>29%</td>
<td>03%</td>
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<tr>
<td>6</td>
<td>Tinia Manuum</td>
<td>11-64</td>
<td>232</td>
<td>Rural</td>
<td>153 Urban 79</td>
<td>84%</td>
<td>11%</td>
<td>05%</td>
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<tr>
<td>7</td>
<td>Acne Vulgaris</td>
<td>15-40</td>
<td>7221</td>
<td>Rural</td>
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<td>26%</td>
<td>63%</td>
<td>11%</td>
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<td>Scabies</td>
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<td>2353</td>
<td>Rural</td>
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<td>46%</td>
<td>31%</td>
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<td>Norwegian scabies</td>
<td>06-51</td>
<td>32</td>
<td>Rural</td>
<td>28 Urban 04</td>
<td>37%</td>
<td>51%</td>
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<td>Alopecia areata</td>
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<td>529</td>
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<td>11</td>
<td>DLE</td>
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<tr>
<td>Disease</td>
<td>Age Group</td>
<td>Incidence</td>
<td>Prevalence</td>
<td>Poor &amp; Middle Class</td>
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<td>07-71</td>
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<td>231</td>
<td>255</td>
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<td>19 SD</td>
<td>09-76</td>
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<td>172</td>
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<td>182</td>
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<td>53</td>
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<td>27 Insect bite</td>
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<td>36</td>
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<td>28 Others</td>
<td>Every group</td>
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<td>163</td>
<td>166</td>
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</table>

**Conclusion**

The rapid growth of information and technology allowed potential eradication of many of the world's illnesses including dermatological problems. Now we are living in a period of time, which may call “The Information Age”. The present embellishment of telemedicine illustrates that it may act as an important media to condense some of the most important skin related problems or disorders. With passage of time we are observing keen interest of both, doctors and patients towards the adoption of Telemedicine system for provision of swift and cost effective mode of health care provision. The data produced during the period is used for academic and research purpose at King Edwards Medical University.
Lahore. With the help of available data students can look at the demographic distribution of Dermal Diseases across the Province and experience diversified proliferation of diseases in different areas and social groups in society.

References


Doctor Ali Hasnain, Senior Registrar, Dermatology Unit II, King Edwards Medical University/ Mayo Hospital Lahore Pakistan. A dermatologist researcher, closely associated with Telemedicine department since 2009 till the date. He has consulted highest number of Patients through Telemedicine system.
Introduction of Telemedicine Technologies in the Practice of Sports Medicine

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Introduction

The department of sports medicine specialises in the provision of medical assistance to people engaged in athletic training and sports and to other persons participating in physical and sport events, physical and sport exercises and in the rehabilitation of athletes after disease and injury.

The use of telemedicine technologies in the practice of the department of sports medicine of the State Healthcare Institution NAO “Nenets Regional Hospital” is more than topical, given the geographical, social and economic features of the Nenets Autonomous Okrug, such as:

- Remote distance of settlements from the regional center where the Nenets Regional Hospital is located;
- Absence of ground communication ways between settlements (accessible only by air transport);
- Irregular air flights and high price of air transport;
- Absence of specialists skilled in sports medicine in the NAO villages;
- The regional center of sports medicine is located in Archangelsk, the distance to Archangelsk is 650 km and 1.5 hours flight time.

In such conditions telemedicine services help resolve the problem of remote distance and availability of medical care to people engaged in sports and physical training.

Practical Activity
The total number of persons in the NAO in 2014 engaged in physical culture and sports was 11700 people. Of these 4,992 are children. Children pass a medical examination to get admission to sports and for medical control. Sports can cause the onset of a previously latent disease, a complication of pre-existing, including sudden cardiac death. The American Heart Association gives recommendations for pre-participation cardiovascular screening of competitive athletes [1].

Telemedicine consultations have been held with the specialists of the “Arkhangelsk Center of Sports Medicine and Physical Therapy” and “Arkhangelsk Children Clinical Hospital” from November 2012 when the department of sports medicine was opened. For 2.5 years they gave 63 telemedicine consultations.

Of them 74% (37) – for cardio-vascular pathologies, 16% (8) – for expert issues of permit to do sport exercises, 4% (2) – for issues of management of athletes with nervous pathologies, 6% (3 consultations) were held for the management of athletes with impaired vision (Fig. 1.)

A large number of consultations on diseases of the cardiovascular system are due to the fact that among persons who are intensively involved in sports, the risk of sudden death is more than 2 times higher and is 1.6 per 100,000 against 0.75 per 100,000 in the general population [2]. In economically developed countries, sudden death is one of the most important medical and social problems. Thus, in the United States, sudden cardiac death annually occurs in 200-450 thousand people [3]. In Russia, there are estimated 450-600 thousand sudden deaths per year [4].

Conclusion

A sports doctor needs telemedicine consultation when he deals with a difficult clinical case, has some doubts about the management tactics and
diagnosis, when there is no profile specialist around, and when he has doubts whether to allow the patient to take sports. Thanks to telemedicine consultations we have received an adjusted diagnosis, the “second opinion” of the skilled specialist, help in selecting the management tactics, care and rehabilitation, and help in addressing the expert issues of access to sports.

Future Development

Telemedicine in the area of sports medicine has the following potential for growth:

- Dynamic monitoring of athletes engaged in the year-round training with a possibility of remote tracking of functional indicators;
- Monitoring of the athlete's health status in case of pathology and the need for regular consultation with a specialized doctor;
- Specification of indicators for referring a patient to an MPI for on-site consultation;
- Remote training. Telemedicine technologies open possibilities for remote training of medical personnel, improvement of skills, arrangement of certification cycles, round table discussions, and regular reports;
- Being consulted by the national team while away from the main base (competitions etc.) on the issues of diet, sport nutrition, rehabilitation, etc.;
- Psychological support of athletes;
- Use of videoconferencing for sport rehabilitation, group exercise therapy.

References

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Medico-Economic Evaluation Methodologies for eHealth: A Critical Appraisal

Or e-Health Economics Explained to Non-Economists

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Introduction

The gold standard for medico-economic evaluation is based on outcomes research for pharmaceuticals and medical devices. It requires randomized controlled trials (RCT). In such trials, one “intervention group” is compared with a “control group”. The structure of each group is made similar through “randomization” in order to assure a strict consistency of results.

Ideally, the trial is blinded to avoid behavioral bias. It can be “single-blinded” when the patient does not know whether he is in the control or the intervention group or “double-blinded” when neither the dispensing physician nor the patient know in which group the latter is.

Then, in order to make a medico-economic analysis, one must demonstrate that either the equivalence of outcomes for both intervention and control groups, or, if not, a clear measurement of respective outcomes. Once this demonstration is completed, then it is possible to compare cost.

If B is better than A and cheaper, no question. If A is better than B and B is cheaper or B better than A and less expensive or the contrary, then one has to assess the relative efficacies of A and B and their relative prices.

In the case of telemedicine, three major situations can be described:

a) Telecare is much better than standard care. This is the case for telestroke in remote areas.
b) Telecare can be compared with standard care from outcomes point of view and is significantly cheaper. This can be the case for remote consultations for inmates or weekly consultations for ESRD patients in a telemonitored dialysis setting [4].
c) Telecare is more expensive than standard case with mixed results. This is the case for most homecare / telemonitoring / telecoaching results.

We consider however that the RCT model is not inappropriate for the economic assessment of e-health projects. We have retained four reasons to justify this heterodox point of view.
The Confusion Regarding the Control Group

There is frequently confusion between the medical outcomes and the cost. The control and intervention groups are designed properly and usually, one can compare medical results. The main problem arises with the measurement of cost.

In some studies, the control group is indeed randomized but the cost is calculated on the basis of existing historical cost, including all patients. The cost of control group is based on the population treated at the year n-1 by the hospitals that participate to the project. This would be acceptable if ALL treated patients should participate at year n to either the control or the intervention group.

In the large pan-European multicentric project Renewing Health [1], approx. 43% of patients had refused to participate to the study. One has no knowledge on their patterns of care consumption of those refusing patients. One can imagine that, for instance, there is a positive correlation between the refusal to participate to a study and a weak compliance to treatment. On the opposite, one can also consider that they are or feel already well-treated by current standards of care and do not perceive the interest of an increased coaching by Telemedecine.

In other words, it seems difficult to admit that the cost of control group, based on an entire population and it can be statistically equivalent to the cost of a given percentage of the population when the criteria for non-participation are not well known.

In some other cases, criteria of inclusion in the study can indeed contribute to a strong bias even if the medical conditions of patients in both groups are similar. This is the case for instance in a recent Chinese study [2] where “patients were excluded if they did not have an internet device as required for the home telemedicine system used”. In this cases, both control and intervention groups can be compared, but the results CANNOT be extrapolated to the entire population.

Behavioral Bias

This bias has been widely documented. As mentioned in Renewing Health final report [1], the use of RCT “requires that the interventions remain constant and are similar for all patients during the study. In practice, this means that the experience of the clinical staff and the patients cannot be used during the trial to improve the interventions”.

Since telemedicine RCT cannot be blinded and requires intervention over a significant period of time, one can assume the existence of adaptive behaviors from caregivers on the intervention group which can modify outcomes.
The Period of Observation

The period of the study can affect the validity of the results in numerous ways.

Since telemedicine is based on innovative technology, cost can vary significantly over time and negative economic results can turn positive when cost of technology diminishes. It takes a minimum of 3 years to design, build, operate and evaluate a study protocol, which represents a fairly long time when telecom devices are concerned.

On the other hand, the observation period is generally relatively short and one can question the sustainability of positive effects linked to patient compliance over a longer period of time.

Even worse, cost benefit ratio can switch in the long run. A recent Medicare study on patient compliance [3] demonstrated a favorable outcome over 36 months and an unfavorable outcome over this period.

The Confusion between Fixed and Variable Cost

This is probably the major issue regarding transposition of results of RCT into the real world. One of the major benefits for telemedicine is the decrease in hospital cost. This is true under one major assumption: that the hospital cost are mostly variable and not mostly fixed.

A simple example will allow to explain this bias: Hospital A treats annually 1000 patients for a specific disease for a unit cost of 1 000 €. Total cost is thus 1 000 000 €. A telemedicine program is launched for 50 % of the patients, at a unit cost of 700 €. Telemedicine is thus cost efficient.

However, the societal benefit of telemedicine will depend on the proportion of fixed vs variable cost of Hospital A. In this case, if cost of hospital A is split 50 % on fixed cost and 50 % on variable cost, the total cost resulting from the implementation of telemedicine will be 500 000 of fixed cost + 500 * 500 of variable cost for patient still treated in the hospital setting + 700 * 500 for telemedicine patient. The introduction of telemedicine has in this case generated an extra cost of 100 000 €, i.e. 10 % of hospital budget.

Unlike pharma outcomes where a drug A will substitute to drug B, processes of care cannot be switched from one to another at no residual cost. The real benefit of implementing a telemedicine program should thus be balanced by the impact on the overall cost structure of care givers and also by the mode of financing of hospitals.

Conclusions

When purchasing a cell phone, the consumer will probably hesitate between several models and several packages proposed by different
operators but he will not compare his cell phone to his home telephone. This is however what we try to do when comparing telemedicine and “traditional” patterns of care.

Telemedicine is a fact in real world. The main question is no longer “do we implement telemedicine vs standard care”? Consumers and healthcare providers have already chosen. In order to ensure its development, telemedicine will have to answer five main questions:

- How do we segment patients that are eligible or most receptive to telemedicine and how do we reorganize delivery of care to remaining patients for what might be a long transition?
- Among various solutions of telemedicine, which one is the most cost-efficient?
- Is there a unique economic model which would fit all types of program (“one size fits all”)?
- Who are the potential “free-riders”, ie who benefit from savings trough telemedicine without paying its cost.
- How do we guarantee consistency between all the telemedicine programs to avoid potentially important but hidden flaws and costs associated with lack of interoperability?

References


After holding major positions within French Social Security and a pharmaceutical company, Aïssa is, since 1999, a consultant on medico-economics and project management applied to innovation in Healthcare. His company, HMS, is one of the French leaders in telemedicine projects. He also teaches Economics within several business schools and has published in 2013 a book on Healthcare Globalization and Medical Tourism.
Telehealth for One Sixth of Humankind
Making it Happen: The Apollo Story

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Introduction

The universal phenomenon of urban rural health divide is particularly striking in India. We have centres of excellence, better than the best [1]. A detailed analysis of 3666 members of the Neurological Society of India and the Indian Academy of Neurology revealed that not a single member lived in a geographical area covering 900 million people. 30.09% live in the four metros, 29.54% in the state capitals, 30.58% in Tier 2 cities, 7.12% in tier 3 cities and 2.67% lived in rural areas covering a population of 84.59 million. Additional neurological centres cannot be the only answer, given the acute shortage of both funds and trained personnel. The story is likely to be similar in most specialities and super specialities. In 1999, the author among others, foresaw that it could be possible, to extend the reach of urban doctors to suburban and rural India, virtually.

This presentation traces the 15 year role of Apollo Hospitals as a catalyst in promoting telehealth in India. Simple Videoconferencing, has escalated to deployment of software integrated with EMR, eHome Visits, international teleconsults, tele CME programmes, deployment of internet enabled peripheral medical devices, mHealth, promoting eHealth Literacy and multi centre Grand rounds. The world's first VSAT enabled village hospital at Aragonda, was commissioned on March 24th 2000 by the then US President Bill Clinton [2] with 135 centres (15 overseas), 92,000 teleconsultations in 25 specialities, for distances from 100 to 4500 miles. With 200 presentations in regional, national and international conferences and 110 publications, Apollo Telemedicine Networking Foundation has created considerable awareness of telemedicine in the region. The largest and oldest multi-speciality Telemedicine Network, ATNF was selected by the Government of India for the Pan African e-Network and for providing telehealth to 10,000 internet enabled villages and by the Himachal Pradesh Government to deploy telemedicine units at altitudes of 16,000 ft, Apollo is fully engaged in PPP’s (Public Private Partnership). Cited in the European Atlas of Telemedicine History, selected as Global Best Practice Telemedicine case study by Columbia University, studied by Harvard MBA
programme, winner of Asia Pacific HIMSS award etc. Apollo Telemedicine has enthused scores of organisations. Even the Prime Minister of India recently announced that telemedicine will be incorporated in Healthcare. With exponential growth in ICT, a rural tele-density of 45% steadily increasing, quality, affordable, accessible health care to everyone, anytime, anywhere deploying telemedicine, will eventually happen. This summary will give an overview of the past, the present and the future, with reference to telehealth in India, emphasising the role played by Apollo Telemedicine. The trials, tribulations, challenges in introducing a radically different approach in an emerging economy will be highlighted.

Evolution of Telemedicine in India

Creating awareness was the single most important agenda in the first ten years. Every opportunity was taken to talk about telehealth at every forum both in the healthcare arena as well in the field of Information and Communication Technology. Enthused by the slow but steady progress of Apollo telemedicine, more and more organizations realized the value of telemedicine particularly in the Indian setting. Many newly inaugurated telemedicine units, particularly those in the government sector, were “photo-op” not being regularly used later. The problems were many. Nonavailability of human resources, absence of reliable bandwidth became secondary to the lack of conviction and motivation. It took several years of sheer persistence by a small band of dedicated doctors – interestingly there were all specialist surgeons – before Telemedicine was no longer considered a dirty word !! in India.

The Indian Space Research Organisation (ISRO) played a major role in the growth and development of telehealth in India. Though all the 450 VSAT enabled hospitals do not necessarily utilize the satellite connectivity optimally ISRO’s contribution has made a difference. Most notable is the work done by Arvind Eye Hospital which provides almost a thousand teleconsultations every day. Shankar Nethralaya also excels in teleophthalmology.

ATNF was the first to start a Telehealth Technology Course in conjunction with Anna University. As a member of the National Task Force on Telemedicine, ATNF played a significant role in formulating initial policies. Wharton School of Business, the Yale Institute of Management, Ross Business School - Michigan, the London School of Business, the London School of Economics, Indian school of Business are some of the several international organizations who have used Apollo Telemedicine as study material. Home telecare and electronic house visits have been initiated [3]. The latter initiative was recognised with a special award at the
8th Annual World Healthcare Congress held in Washington in 2012. An in house, custom built Medentegra software which in addition to a user friendly EMR (facilitating uploading of images, investigations etc.), has inbuilt video conferencing capabilities has recently been introduced. The widely used eDoc [4] virtual booking service will soon be extended to virtual teleconsults as well. The teleradiology service [5] ensures a turnaround time of 4 to 6 hours (45 minutes for emergencies). From 2009, 190 grand rounds in six specialties, have been conducted between different Apollo hospitals using multipoint VC [6]. 21 clinical meetings and conferences with multiple overseas centres have been carried out in addition to webcasting complex unusual surgical procedures. Attempts are being made to deliver health care in rural India as well [7].

Telemedicine enabled Hospital on Wheels

There are about fifty five operational “Hospital on Wheels” (HoW). Many of them are VSAT enabled. A villager gets into an air-conditioned mobile truck which has an ultrasound, X-ray, echocardiogram, ECG, biochemistry laboratory, ophthalmic equipment etc. A technician focuses the ophthalmoscope into the eyes of the patient, and the image of the fundus is evaluated by the teleophthalmologist in the tertiary care center. Through internet or a VSAT on the truck, video conferencing and transmission of images is enabled. While many HoW’s are dedicated to ophthalmology, diabetology and psychiatry multipurpose HoW’s are also available [8]. In a first of its kind initiative, 527 patients in 13 different specialities were connected simultaneously to six tertiary Apollo hospitals, in different parts of India from a HoW at a mega health camp held at Ajmer in Northern India on 11th and 12th February 2012. Remote clinical evaluation was followed by ePrescriptions. Subsequently similar telecamps were held in different parts of Tamilnadu in Southern India.

mHealth

In August 2007 the author was requested by Ericsson, to study, for the first time in South Asia, the feasibility of doing remote clinical examinations entirely through wireless connectivity. In July 2008 The Rockefeller Foundation organised a Making the eHealth Connection Conference at Bellagio, Italy. The author presented a paper on “mHealth: A potential tool for Health care delivery in India”. The term mHealth was conceptualized here for the first time. None could have foreseen the phenomenal explosion of mHealth or the utilization of smart phones in the “third world”. With 915 million phones, mBanking, mEntertainment, mCommerce and mGovernance are becoming a reality, but mHealth today is conspicuous by its relative absence. Pilots and proof of concept studies in
various aspects of mHealth are abounding in India. Hundreds of thousands of SMSs sent every day by government health departments, NGOs and the private sector are ensuring better adherence and compliance be it for immunisation, vaccination, ante natal counselling, or blood sugar evaluation. Medical Call centres are providing authenticated validated health information through mobile phones. Thousands of health “apps” can now be downloaded. VC through mobiles, using 3G and eventually 4G is on the anvil. The transformative potential of mHealth in India, however hinges on its acceptance and use. A multilingual field survey was carried out by the author between Oct 2012 and April 2013. 1886 valid responses were analysed (69% urban and 31% rural). 46% of the urban sample had smart phones vs 22% in rural areas. 72% in urban and 48% in rural areas were aware of mHealth. 55% (urban and rural) showed a very strong intent to use mHealth. The study revealed that Rural and Urban India appear to be ready to use mHealth but the solutions need to be customised. Utilisation depends on education, empowerment and building trust.

Effective delivery of telehealth services requires maintaining standards with reference to privacy, authentication, confidentiality, telecommunications, records, authorised access to patient data, encryption, guaranteed reliability, interpretability, legal obligations, multimedia applications, performance levels and security. This has to be an ongoing process. Interoperability of systems, compatibility and scalability are a must. Constant benchmarking of equipment is required meeting international DICOM standards. Several publications from India have addressed these and other allied issues. Standardising, certifying, authenticating and registering telemedicine units to ensure uniformity is the next step.

Patient empowerment in rural India

Health Literacy is critical in improving health outcomes. Deploying multi point Videoconferencing the author has initiated a knowledge empowerment programme at the internet enabled Village Resource Centers of the MS Swaminathan Research Foundation in rural Tamilnadu [9]. Consultants interacted with 9600 villagers in 18 villages. The Q&A interactive sessions were stimulating. Using MCQ’s, knowledge levels were measured. The modest increase of 20% was attributed to unfamiliarity with the MCQ model. Feedback was excellent. Use of visuals and videos made the interaction more meaningful. More important, was the subsequent discussion the attendees had, with those who were unable to partake.

Global Telehealth Initiatives of Government of India
The Ministry of External Affairs, Government of India initiated the Pan Africa e-Network project for teleconsultations in 2009 [10]. Through this network Apollo Hospitals Chennai is connected to 39 countries in Africa. The SAARC e-Network for South Asian Countries and the ASEAN network is being followed by the Central Asia e-Network Project. The 5 Central Asian CIS countries Uzbekistan, Kazakhstan Kyrgyzstan, Turkmenistan and Tajikistan will be connected to India for Telemedicine and Tele-education services for five years. Five reputed Universities and Super speciality Hospitals in India will be connected through a dedicated network, to a Study Centre / ICT Resource Center and a leading hospital, in each CA country. This hospital may further connect to their secondary hospitals in remote areas. Post Graduate, Under Graduate, Certificate and Diploma Programs in various disciplines through distance education via on-line teaching hosted at each of the Indian Universities will be made available.

Social and ethical issues
Organisational matters, absence of a self-sustaining / revenue generating model and human factors, not technology, are the deterrent factors. Telehealth should not result in depersonalization or diminish trust. Tele diagnosis must be followed with appropriate referrals for investigations and subsequent management. Producing cost effective appropriate technology, hardware and software and ensuring connectivity alone is insufficient. Short term courses to train trainers and users, ensuring reimbursement, getting grants, subsidies and waivers to introduce telehealth is necessary.

Conclusion
Can telemedicine alleviate India’s health problems [11]? Will a virtual rural healthcare service be the answer [12]? Providing accessible quality healthcare be available to anyone, anytime anywhere at affordable cost, will be the new mantra. The most important enabler is not further advances in technology, but meticulous attention to **Wi-Fi** for every single stakeholder in the entire ecosystem. The question “**What Is In It For Me**” has to be addressed. A solution is not a solution unless it is universally accepted and available. With private players playing the major role, particularly in secondary and tertiary health care it behoves them to extend their reach and provide health care particularly where it is not available.

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Telemedicine, Solutions, Systems and Services: A Market Analysis

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The objective of this paper is to understand the market potential for Telemedicine in India, and analyze its opportunities, challenges and landscape for 2020.

The Global Remote healthcare delivery market is a $12Bn market growing at 18.6% and is dominated by the services segment, which is expected to reach $27.3 billion in 2016. The Remote Healthcare Delivery market is segmented into tele hospital and tele home markets. The tele hospital market was worth $6.9 billion and tele home market was valued at nearly $2.9 billion, however the tele home segment is growing faster than the tele hospital segment at a projected CAGR (Compounded Annual Growth Rate) of 22.5% vs. 16.8%.

The Remote Healthcare Delivery market is also segmented into technology & service segments. The technology portion is expected to reach $11.3 billion in 2016, with a CAGR of 19.8% and service market is expected to grow to $16.0 billion in 2016 at a CAGR of 18.1%. BRICS Remote healthcare delivery market is growing at 15.8% and is mainly driven by chronic diseases such as heart failure, diabetes, asthma, and hypertension. The Remote Healthcare Delivery market in BRICS has witnessed an exponential growth due to multiple factors such as Fast Technology adoption growth, increase in IT spending and growth in telecommunication network. Market in BRICS countries is dominated by technology segment rather than service segment suggesting Public investment, slow adoption and/or absence of revenue model.

Indian Remote healthcare delivery market is expected to grow at a CAGR of 20% and reach $18.9 Mn by 2016. However; few estimates also expect the market to grow to $500 Mn by 2016. The market is witnessing increased acceptability; however estimates vary because of the nascent stage of the industry. The Government of India has taken several positive initiatives to develop the entire ecosystem of Remote healthcare delivery. Until a few years back, use of Remote Healthcare Delivery (RHD) in Public hospitals has been driven by PPP (Public Private Partnerships) models.
A multitude of factors are coming together to create an enabling Remote healthcare delivery ecosystem in India and RHDS (Remote Health Delivery Service) concept is seeing more acceptability. Large private hospitals have started changing their focus and attracting patients to their existing hospital facilities using Remote Healthcare Delivery services usually as a CSR (Corporate Social Responsibility) or PPP initiative. Hospitals which have in-house IT departments use their IT resources to drive RHD initiatives by dedicating staff to the RHD unit, ensuring integration with HIS (Hospital Information System) and troubleshooting connectivity issues, while others which do not have an in-house IT department tie up with IT vendors to assist in RHD services. Such hospitals are open to alignment with new RHD solution providers.

For profit revenue models are beginning to evolve and stable proven revenue models have already been developed in select fields like radiology, ophthalmology, education and tele-consultation. Other areas such as Diagnostic Centers and Ambulance Providers see a potential for Remote healthcare delivery but are not using it in their operations currently.

As every new stream has challenges, lack of legal framework, low commitment from specialists and a poor commercial viability are some of the key challenges cited by various stakeholders to growth of remote healthcare delivery.

Other notable challenges lie in Infrastructure issues such as poor bandwidth in some areas and expensive bandwidth in others; potential maintenance of equipment’s. Systemic problems such as training of technicians at village end, IT staff and local doctors are also noted. At consulting doctors’ end, coordination issues are important.

Cultural issues, such as unwillingness of hospitals to share data, are also one of the major deterrents. For a village doctor & rural patient, using high end technology may be too inhibiting and radical. Once benefits are seen, the acceptance rate will be higher.

Remote Healthcare Delivery in India has largely been a part of hospitals’ social responsibility, with hospitals aims of improving bed occupancy in case tele patient requires hospitalization and needs to transform into a sound revenue generating model, attractive for village level entrepreneurs & other investors. However the Indian government at the Central and state level has been working on these challenges and significant developments have taken place in the last decade.

A lot of new Suppliers are mushrooming who have focus on providing innovative solutions to address the cost and connectivity challenges. Companies have developed devices with communication capability used in the field of Dermatology, ENT (Ear-Nose-Throat), Cardiology,
Product innovation pipeline suggests research in the areas of wearable, communicable and portable devices and Open source, Cloud based and mobile compatible solutions are some of the key areas of innovation in platforms. PwC Analysis suggests Ophthalmology, Radiology, Cardiology, Diabetology and Tele-consultation are the most attractive markets. E-ICU (e Intensive Care Unit), Diagnostics, Education, Gastroenterology, Neurology, Oncology, Pathology and Psychiatry are medium attractive markets. Multi-lateral funding agencies, Governments and private equity are eager to fund projects / companies in the remote healthcare delivery to enhance accessibility to healthcare in the country.
eHealth: Ethical/Legal Issues, Standards, Security and User Requirements
A Globally Accepted e-Health Terminology?

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Introduction

The classic works of Oh et al. and Sood et al. [1-2] show clearly the foolish spectrum of ‘definitions’ available in the literature. They describe just two terms, e-Health and Telemedicine; these two terms alone have over 150 ‘definitions’, and who knows how many more have been added to the literature in the past decade? But we have survived this onslaught, so what is the value of defining terms? This lies in credibility and sustainable implementation. The literature is also peppered with papers speaking of the lack of uptake and lack of sustained and scaled application of e-health, which cite a variety of reasons [e.g., 3-4].

But an additional reason is the confusion engendered amongst important stakeholders (policy- and decision-makers; clinicians; users) inflicted by publication of conflicting and poor definitions [1-2]. If ‘we’ appear not to understand, how can others – and why should they believe anything else that we say? Collectively we have created a state of forced global e-health illiteracy. This circumstance is of our making, and we have the responsibility to correct it, and based upon response to an initial presentation a desire exists for this to be corrected [5].

We behave like basic scientists debating within a narrow theoretical domain, which can do little harm but frustrate a small cadre of individuals. We forget that we are ‘change-makers’, now operating in an open access environment, and performing ‘applied research’ that must transcend theory, and lead to meaningful change in policy, process, and practice. Clarity in language is crucial to this, especially given the inter-jurisdictional and international nature of e-health.

How Do You ‘Define’ Something?

To define something well is to state unequivocally the precise meaning of a word (or phrase). Done well, a clear definition can unite disparate individuals under a common understanding. Done poorly it simply perpetuates controversy, misunderstanding, and misalignment of intentions.
and activities. Worse still is the common practice of providing *stipulative* definitions (those that provide a meaning the writer intends to impose upon it) rather than *descriptive* definitions (those that provide the meaning that a term bears in general use). Practice of the former is extremely common. A new ISFtEH Terminology Committee (TC) will focus on identifying or formulating *descriptive* definitions only and, whenever possible, taking into consideration the roots of terms and applying first principles.

A further complication lies in defining something that is ‘incomplete’. e-Health and its component parts are not fundamental ‘laws’ or ‘constants’. It is often stated that the field of e-health is, and remains, in a state of flux, with new ideas and technologies - and evolving capabilities - constantly opening up new possibilities. Ten years ago m-health was not common practice, and ten years before that neither was telesurgery. Just how many pieces are there to this puzzle, and can e-health and its myriad components be accurately and concisely defined?

Truly unequivocal communication through a singular terminology may not be possible, since those involved may have different languages, backgrounds, cultures, and existing (potentially restrictive) vocabularies. Where essential the project will identify and ensure awareness of alternative uses of terms (for example where the same term may represent different concepts in different settings or countries, or where different terms may be applied to represent the same or similar concepts). However, the goal will remain provision of succinct *descriptive* explanations.

**Principles**

The TC will establish principles and guidelines to follow for identification and agreement on, or development of, ‘definitions’. It is important to have a touchstone when embarking on a journey of this complexity, unknown duration, and uncertain direction. As a consequence, the definition of e-health provided by the World Health Organisation will be adopted. That is, “eHealth is the use of information and communication technologies (ICT) for health” [6].

It follows therefore that an expansive view will be held of e-health. It is anticipated a comprehensive and structured taxonomy or typology will also result from this work, but initially e-health will be considered to be comprised of telehealth, health informatics, e-learning (health related ‘training’; education, instruction, teaching, awareness [7]), and e-commerce (health related business practice).

**Planned Process**

A small core group will lead the activity; the ‘Terminology Committee
Members’. However, the intent is to adopt a process that allows for inter-jurisdictional and international consensus.

Limited work has already been performed in this area [e.g., 8-11]. A structured literature review will be performed to identify reviews, glossaries, and similar resources from the scientific and grey literature. This will inform selection of terms and current definitions or descriptions of terms. For any single term selected by the Sub-Committee Members, the available material will be separately collated, and form the basis for development of ‘Definition Documents’ which will proceed through a review and consensus process.

Consensus Process

Each Member Country of ISfTeH will be asked to identify and provide contact information for one representative who can respond knowledgeably and swiftly to the sequential process of critiquing ‘Definition Documents’ (DD). These members will comprise the ‘Committee Advisors’.

A standardized approach, developed by the TC Members, will be used to develop DDs. Each DD will progress through several stages; Candidate Definition, Review, Tentative Definition, Review, and finally Approved Definition and Publication. Progression from Candidate to Tentative to Approved will be facilitated through a web-based process where, for 4-weeks, Committee Advisors are able to perform on-line review and provide feedback. In this way each definition will receive broad critique, which will be used by the Committee Members to revise each DD and advance it to the next stage. This staged process, facilitated by direct input of the ‘Committee Advisors’, will provide the desired international and inter-jurisdictional consensus.

Next Steps

The TC will begin with the overarching term ‘e-health’ and proceed from there, focusing at this time on telehealth related terms; e.g., telehealth, telecare, m-health, home e-health, telemedicine, and practical aspects such as telehealth ‘unit’, telehealth ‘site’, telehealth ‘service’, and so forth. The initial mandate of the Terminology Committee will be for a 2 year period (January 2015 – December 2017). Progress and impact will be assessed, and a decision made regarding continuation and the mandate.

Conclusion

A clear, concise, and common terminology will bring consistency to our collective e-health communications. This will align stakeholder insight and intentions, allow more rapid growth and application of technologically
appropriate and culturally sensitive e-health solutions, and lead to sustained, scaled, and successful implementations that benefit individual and global health.

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A New Generation Perspective on Long Distance Treatment in the Social Media Age

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Abstract: With the rise of internet-capable devices the internet is becoming more of a frequent resource to seek for medical information on symptoms, diseases and treatments. So, medical information and communication are not excluded from digitalization. Doctors now face more and more patients that have ‘googled’ before visiting them. We are convinced that this shows that there is a huge need for a) sufficient, reliable and understandable medical information online and b) an online dialogue between doctors and patients.

Doctors and patients are not two isolated groups on the internet, they are both users and they share the same platforms. As part of a generation which is familiar with online-conversation, e.g. instant messaging and video-conferencing, this technology is no longer an extraordinary form of communication. To the new generation of patients, doctors and medical staff, communication via the internet becomes part of the everyday life and simplifies interpersonal communication including the communication in healthcare especially in terms of the physician-patient consultation [1].

In some countries, such as Germany, remote diagnosis and consultation from doctors is forbidden by law. In our eyes this regulatory framework opposes innovation in healthcare and does not meet the needs of young doctors and patients for e-health solutions, an electronic patient record infrastructure and social-media-communication as one of the future pathways in doc-to-patient-interaction.

We advocate for changing existing rules that may hinder the development of new forms of communication in healthcare and to allow remote diagnosis and remote consultation under certain circumstances. Social media will change the channels of communication between doctors and patients anyways. It is therefore our duty as (future)
doctors to supervise these changes with a productive and not a preventive attitude while keeping an eye on patient safety and needs.

Introduction

With this short essay we want to provide a students’, new-generations’ and future doctors’ perspective on medical long-distance treatment. The labour market entry of so called ‘digital natives’ (persons who grew up with technologies of the digital age) denotes a specific generation and therefore a paradigm shift regarding the use and view on technological opportunities and threats.

There is an ongoing rise of internet-capable devices as well as internet usage among people of all ages. Unsurprisingly the many possibilities of the internet are also used for health purposes, ranging from research (by patients and professionals) to discussion and requests.

Doctor-patient Relationship in the Social Media Age

The internet allows a low-level access to health information and it becomes more common place for patients to look up their symptoms online before visiting a doctor [2]. Some doctors fail to take such patients seriously [3] and label this behaviour as ‘Morbus Google’. We are convinced that this shows that there is a huge need for:

- Sufficient, reliable and understandable medical information online;
- Online dialogue between doctors and patients.

Online Healthcare Information

We believe that doctors should respect patients’ needs and especially be open-minded towards concerns associated with information obtained through internet research [3-4]. It should become normal and regular to (pro)actively address patients’ internet research and ask whether they did so, what their results were, and if they are concerned about something they found. If doctors do not esteem the new generation of patients to some extent patients will lose their faith in doctors and medicine. So, gathering information online should be understood as complementary information to doctors’ communication [5].

Furthermore doctors should provide their patients with recommendations on reliable, valid and neutral (online) sources of healthcare information so that shared decision making will be easier in the future. This will have positive impact on health literacy and compliance. We see a need for quality standards [2] and do appreciate initial approaches with easy-to-read information for patients like the resources provided by the U.S. National Library of Medicine ‘MedlinePlus’ [6] or the German Institute for Quality
and Efficiency in Health Care ‘GesundheitsInformation’ [7] and hope that such projects will be steadily extended and improved.

Online Communication

Doctors and patients are not two isolated groups on the internet, they are both users and share the same platforms. Just like in the offline world, doctors should also act professionally online. They should be careful to not share patient stories on social networks, or if this happens for a scientific reason, the patient shall not be identifiable.

The Internet makes it easier to communicate over long distances and continues to establish itself as the standard in communication. As stated above, doctors and patients are not isolated from each other online, they are likely to meet and communicate on the internet; this cannot be prevented.

We are part of a generation which is familiar with online-conversation, e.g. instant messaging and video-conferencing. This technology is no longer an extraordinary form of communication. To the new generation of patients, doctors and medical staff, communication via the internet becomes part of their everyday life and simplifies interpersonal communication. This also includes communication about healthcare especially in terms of the physician-patient consultation. Today there is only a blurry line between distant communication of doctors and patients and distant treatment.

Remote Diagnosis and Consultation

In some European countries, such as Germany [8], remote diagnosis and consultation from doctors is forbidden by law. In our eyes this regulatory framework opposes innovation in healthcare and does not meet the needs of young doctors and patients for e-health solutions and social-media-communication as one of the future pathways in doc-to-patient-interaction. We advocate for changing existing rules that may hinder the development of new forms of doc-to-patient-communication and to allow remote diagnosis and remote consultation under to certain circumstances.

Social media will change the channels of communication between doctors and patients anyways. It is therefore our duty as (future) doctors to supervise these changes with a productive and not a preventive attitude while keeping an eye on patient safety and needs.

Electronic Patient Record and eAdministration

Healthcare remains one of the last sectors that rely heavily on analog data storage and paper records. This turns the healthcare sector into an outdated and unappealing work environment for future healthcare professionals. Even though the aim to introduce national electronic health record (EHR)
systems, and despite this aim being expressed by several European
governments for years, there are still many countries (such as Germany)
with no or poor EHR-systems, such that European countries are far away
from an interoperable Europe-wide system and common standards, whereas
the mobility of people and patients increases [9].

In our eyes there is a huge need to accelerate such efforts because
transferring patient information electronically in combination with an EHR
is a powerful instrument helping to reduce clinical errors and improve the
quality and safety of treatment, as well as access to healthcare. An
expansion of communication and collaborations between healthcare
professionals and other health and social service providers, nationally and
across Europe, will lead to better informed professionals and patients. This
will positively influence patient outcome.

In addition, the detailed patient history in the EHRs helps healthcare
professionals to plan treatments more wisely, manage patient data more
effectively and to communicate more quickly [10]. Furthermore EHRs can
help avoid redundant diagnosis, treatment and documentation.

There is also great research potential in fully anonymised ERHs. The
enormous amount of health data could help solving scientific and even
health policy issues and could provide the basis for predicting future patient
or epidemiological outcomes [11]. By providing access to the EHR patients
have the chance of being more empowered and having greater control over
their individual health information. This enables patients to become more
responsible and active in terms of health issues, as well as communicate on
an equal and partner-based footing.

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Design and Implementation of a Hospital Database Management System (HDMS) for Medical Doctors

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Abstract: The paper “design and implementation of a Hospital Database Management System (HDMS) for Medical Doctors” is aimed at designing and implementing an automated system that will alleviate the problem of handling patients data in a hospital. The researchers were motivated to embark on this project because of the inherent problems of the manual system of hospitals file management. This manual system has so many problems associated with it such as insecurity of files, poor file retrieval system and inefficient file update system etc. This paper examines an existing information system of a hospital and designed an automated system that can help Medical Doctors and those who handle hospitals’ data to perform their work more effectively and efficiently. The System would be developed with a Window, Apache, MySQL and PHP (WAMP) software. The HDBM would be a web application that runs in a computer network. It would provide easy and fast access to stored data as needed by different users with security against unauthorized access. Any authorized user can add, delete and update data into the database base on their user-assigned-role. It would equally have the facility to give a unique identity for every persons and stores the details of every patient and the staff automatically. It includes a search facility to know the current status of each room in the hospital. A user can search availability of doctors and the details of a patient using the system. The interface is very user-friendly.

The Need for Database Management Systems in Hospital

All large enterprises need the database systems for handling the information. One kind of those enterprises is the hospital. Because of large number of patients, doctors and other staff in hospitals, data processing becomes more crucial. Data Management in hospital can be used for achieving the patient’s information, arranging doctors’ schedules and
accounting business. Doctors should access the patient’s record for giving the best diagnosis to cure the patient.

On the other hand patient can access their lab results and all kinds of information that doctors indicate. Data base hospital helps to control the accounting business easily.

Organizational Structure of the Hospital

The diagram illustrates the hierarchy structure of Our Lady of Mercy hospital

Input and Output System

The system constitutes of patients inventory which would contain patients records arrangement or organized in file and the general stores record which includes the input of the quantity in stock the drug code, drug number and the expiring date of each drug in database. The output to generate from this system will be to update, add, delete, clear, and provide summary of the total monthly, yearly even daily records of events in the various departments of the hospital. It will also produce the estimate of report generated by very given module.

Files and Records

The files and records will both contain the detail of the event carried out in every department as performed by each particular module or form.

Problems and Weakness of the Current System
The problem observed in the current system has to do with cost. The startup costs are enormous. Not only must you buy equipment to record and store patient charts (much more expensive than paper and file cabinets), but efforts must be taken to convert all charts to electronic form. Patients may be in the transitional state, where old records haven’t yet been converted and doctors don’t always know this. Further, training on the hospital software adds additional expense in paying people to take training, and in paying trainers to teach practitioners.

Also, some are concerned about the security of their medical records, which should be completely confidential. Hackers may ultimately be able to penetrate the system despite security precautions, and they may then release confidential information to others. This has some patients worried about how safe and confidential their electronic medical records really are.

System Proposal/Proposal of New System

The proposed system is going to focus on the personnel and patients management system. The proposed system is also aimed at achieving computer management base system.

Expectation of the New System

- To fully automate the operation of the hospital and managerial system in the hospital;
- To improve and standardize practice planning of efficient and communication skill in the hospital.

Justification of the New System

This system is justified based on the cost of running the manual system compared with the one of the automated system.

From observation and interview through case study, we found out that the management spent much money on buying files and folders stores for alter access, hence from analysis, the hospital spent up to forty thousand Naira N40,000.00($200) on buying files and stationary every month. While the installation and running of this new system will cost at most N400,000.00 ($2000) hence it is considered more advantageous for the management.

Advantages of the New System

The following are the out timed advantages of proposed system:
- It offers the hospital on management issues and provides a base for large database;
- It offers the hospital accurate information on management issues and provides bases for large database;
• It also exposes the user to the knowledge of computing. The system put a stop to unnecessary waste of time in carrying out operations in the hospital.

Testing and Evaluation

First and foremost, the skeleton of the entire system was set up with a module for the initialization phase. After testing to verify accuracy, subroutines were added. Thus, the systematic top down testing before the rest lager of complexity was added. Hence, during implementation, programmers worked on modules in parallel and periodic testing and check performance of the whole system allowed management growth in complexity without introducing untraceable bugs. This involves the training of user in the operation of a new information system.

System Change Over

This process can be achieved in two ways:

• Gradual system change over
• Direct/immediate or direct systems change over

Gradual system changeover: This happens when the new system, run alongside the manual or old system and after a period of time the old system is phased out and the new system continues.

Direct/immediate or direct systems change over: This involves changing over directly to the en system without any significant delay.

Recommendations

• There are backups for all files for security reasons. Each office has its own computer with a large memory to run the program;
• Each of the offices should be networked in order to reduce the need to be moving files from one office to another and also to save time;
• Uninterruptible power supply (UPS) with Inverter should be provided for every computer to reduce the rate for hard disk or system failures;
• Adequate power generating means should be provided to meet up with demands.

Conclusion

The developed system and its evaluation so far have been carried out to improve the database system and management processes in Our Lady of Mercy hospital. Thus, care was taken to handle the way information about the hospital and patients were treated from the first.
Usually, as the population of an area increases and the database gets bigger. Hence, the Hospital database management needs to be improved or upgraded to meet any situation. It is capable of storing variety and large volume of database. More so, the software has been designed to include program modules to handle the Medical Centre information such as patients’ data, supply (drug) management, patient’s bill etc.

Thus, this software contains the database files of hospital database file of Our Lady of Mercy Hospital and will provide the necessary information of the hospital and also will be compatible, accurate, flexible, secured and efficient for the desired purpose it is to serve.

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Design of Modern Mobile Devices Based on Medical Information Interchange Standards

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Abstract: The increasing use of mobile and individual healthcare devices is one of the major tendencies in out-of-hospital care. Many vendors provide extensive sets of those devices. Unfortunately, most of them cannot work outside their servers and service software. Transition of health data between hospitals, healthcare providers and health insurance companies is still very limited. Some of these limitations are defined by law restrictions, but many result from data format differences and general incompatibilities. The only way to solve these incompatibilities is to follow available standards and to maintain all new devices to be compatible with those standards. Common use and exchange of information between different actors in the healthcare process, in particular in clinical diagnostics process, is only possible if all partners adopt a common format, content, structure and meaning of exchanged messages. This article targets some ideas about standards implementation in the area of personal mobile healthcare devices design and implementation.

Introduction

The increasing use of mobile and individual healthcare devices is one of the major tendencies in out-of-hospital care. Many vendors provide extensive sets of those devices. Unfortunately, most of them cannot work outside their servers and service software. Transition of health data between hospitals, healthcare providers and health insurance companies is still very limited. Some of these limitations are defined by law restrictions, but many result from data format differences and general incompatibilities. The only way to solve these incompatibilities is to follow available standards and to maintain all new devices to be compatible with those standards. Common use and exchange of information between different actors in the healthcare process, in particular in clinical diagnostics process, is only possible if all
partners adopt a common format, content, structure and meaning of exchanged messages.

As we have analysed in [1], the number and variety of mobile health-oriented devices, connected through general purpose devices (smart phones, tablets, etc.), will grow. In [2] we have demonstrated that one of the main problems for this integration is the diversity of the systems, vendors, the lack of (or the opposite – too much) standards. All these, and the current situation, insisted for a new more generalized and standardized approach for medical devices design.

In the early phases of integration of e-Health and Telemedicine systems into the existing medical information systems the results have shown improvements in the performance indicators of the health system. The growth of the use of mobile sensors, distributed services and remote assistance decreased the interoperability of the systems.

This article targets some ideas about health data exchange and the applicable standards for the new generations of personal mobile healthcare devices.

Communication Standards for Health Data Exchange

The work in the area of communication standards is growing during the last decade. Here will be discussed only that elements that touch the medical applications and data exchange between health information systems and medical devices. In our discussion we will use both levels and layers as terms. The “level” will be used as a more general term and we will assume that one level can have several internal layers.

According the interactions between the different actors in the medical data exchange process we can point two levels:

- Application level
- Infrastructure level.

The **infrastructure level** corresponds to the interchange formats related to communication and transport protocols used from layer 1 (physical) to layer 6 (representative) of the OSI (Open System Interconnection) model [3] of the ISO (International Standard Organization).

The **application level** corresponds to the content of the message. It can be divided into three layers: the syntax, semantics and pragmatic layers. It corresponds to the layer 7 of the OSI model.

- The **syntax layer** describes the rules presenting how various phrases, signs and other may be combined into corresponding messages containing data or control information. These rules define the shape, consistency and physical representation of the messages;
The **semantic (or content) layer** describes the content of the message and it requires an agreement on how to interpret the data unambiguously. Many health service providers use their own data presentation conventions. As a result, in the process of data exchange, the receiving system cannot understand the messages if it does not have an appropriate classification catalogue. Data exchange between many organizations is practically impossible. That is why standardized clinical nomenclatures have to be widely applied (clinical vocabularies, medical terminology, etc.).

The **context (or pragmatic) layer** describes the information and knowledge about the environment (context) where the message is generated.

Hereafter will be presented some of the major standards in the field of medical informatics. By “standard”, we understand collection of specifications adopted by a standards organization or group. Starting from early nineties many organizations have proposed standards for data exchange, but unfortunately most of them are defined at the level of syntax only and are not applicable together.

**Pragmatic layer standards**

The list of these standards is presented by the model of the European Committee for Standardization (CEN, French: Comité Européen de Normalisation) - European Healthcare Record Architecture (EHCRA). In 2004, the ISO Technical Committee 215 published the specification TS 18308 – Requirements for an Electronic Health Record Architecture. It is extended with ISO/TR 20514 published 2005. Most of the novel developments like CEN EN 13606 and OpenEHR are based on this technical specification.

**Semantic layer standards**

The following standards can be assigned to this level: LOINC (Logical Observation Identifiers, Names and Codes) [4], GALEN (Generalized Architecture for Languages, Encyclopedias and Nomenclatures in medicine) [5], GRAIL Language (GALEN Representation and Integration Language) [6] and the multi-axial Systematized Nomenclature of Medicine-Clinical Terms SNOMED – CT [7].

**Syntax layer standards**

These are generic standards. Some of them are independent of the field of application, such as EDIFACT (Electronic Data Interchange for Administration Commerce and Transport) [8], XML (Extensible Mark-up language). Other are specific to the field of health are standards of the HL7
organization (Health Level 7) [9], the DICOM (Digital Image and Communications in Medicine) [10] of the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA), representing a standard for the formatting, processing and storage of digital images and its associated data and the standard IEEE 1073 - MIB (Medical Information Bus). MIB is applicable to the exchange of data between devices located in intensive care, critical care and operating rooms (such as monitors, infusion pumps, ventilation devices). Work on the specialization of the generic standards, such as XML, to answer service specific requirements of health applications, has started in the past few years.

Standardized Conceptual Structures

The discussion here is focused on the possibility to “plug-and-play” a new device from some vendor in an existing health network. As we mentioned above today mostly this is impossible or very hard to do. The most important element for this connection process is the pragmatic layer of the application level.

The GEHR (Good European Health Record) initiative started at the beginning of the 90s as European Union project. Currently, this initiative is maintained by an international online, non-profit organization, called the OpenEHR Foundation [11]. The most important concept of this initiative is a knowledge-based model, also known as the archetype modelling technique. It facilitates, on one hand, the specification of a generic clinical record structure, and on the other hand the specific semantic definitions of clinical contents. This model has two-levels:

- The first level defines the Reference Object Model (ROM), which typically contains only a few generic, concepts/classes. At this level there are specified additional methods on how to organize and group clinical information, capture contextual information, query and update the health record, etc.
- The second level is used to define constraining rules and mechanisms called archetypes. Their role is to specify the common data structures, which have been created in the first level.

In 2008, the archetype approach to structuring patient-related records became ISO standard 13606-2:2008, as a specification of the information architecture required for interoperable communications between systems and services dealing with EHR data [12]. This way, ISO 13606-2:2008 defines how to organise hierarchically the EHR content, how to define the individual data items and their aggregations, what types of values or measurement units are appropriate, and so on. Archetypes are viewed as a
serialized representation, an exchange format for communicating individual archetypes between archetype libraries.

All this work makes archetypes as a platform for integration in future mobile device connectable to extended hospital or other health care networks.

Design Approach for Mobile Applications Conforming To Archetype Concept

The design of a mobile health device that can be “plug-and-play” to the existing hospital information system needs some specific steps to be done (except the technical design):

- Definition of minimum clinical data set - the main goal of this step is to prepare appropriate data set for clinical data measurements. This involves the definition of the measurements to be performed. A specialized data set of clinical markers for patient’s status description has to be provided;
- Data standardization - the goal of this step is to prepare presentation of all registered markers and measurement results as clinical archetypes according CEN EN ISO 13606 standard. The possibility to integrate the obtained measurement and analysis results to available EHR has to be proposed;
- Design of infrastructure level communication depending on the exact communication environment.

This number of steps is the minimal number offering the possibility to design a device with standardized interconnection interface. Some preliminary design of a medical sensor is done by the authors for validation purposes. The results from this design are some lessons for the future real designs.

Conclusion

In this paper, we presented a general overview about the available standards for medical information interchange and their usability for system-to-system and device-to-system connection. We discussed about availability of standard elements in clinical descriptions. The problem of achieving common understanding of the exchanged content between systems was discussed. A new way of thinking in terms of archetypes and conceptual structures for solving many problems in this area was presented also.

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Introduction

In 1997, nearly two decades ago, Pelletier-Fleury and colleagues stated “Telemedicine has been talked about for more than 20 years, without it entering daily use with any success” [1]. In the intervening years the issue of ‘readiness’ surfaced, with Jennett and colleagues stating in 2003, over a decade ago, “‘Readiness' needs to be systematically assessed and is important for long-term success” [2]. Similarly, just last year in a study on population readiness, Schwartz and colleagues stated “e-Health has been a recurrent topic in health reform, yet its implementation, ultimate role, and feasibility are yet to be clearly defined” [3]. Overall, there is agreement that in much of the world, telehealth has ‘stalled’ [4].

For about 50 years then, telehealth (and other aspects of e-health) has been trying to find its place within healthcare systems. The need for different types of readiness for different audiences and in different organisational settings has been illustrated and exemplified. Yet very few published implementation studies, or stories, show readiness to have been overtly considered and assessed prior to introducing an e-health solution. However, available literature makes it clear that ‘readiness’ is a crucial factor in the uptake of telehealth and similar e-health solutions and tools are available to assist.

This paper focusses on telehealth, and summarises key findings from the ‘readiness’ literature. It is intended to inform and encourage policy- and decision-makers, as well as researchers and other e-health proponents, to incorporate readiness assessment as a routine step in the path from conception, through introduction and implementation, to integration of any e-health solution.

Methods

A strong e-readiness literature, and a more modest e-health readiness literature, exists. A structured search of PubMed was made (keywords: (e-Health OR eHealth OR Telemedicine OR Telehealth) AND Readiness), and
identified 135 references. Most literature referenced telehealth readiness, and after review 37 were selected. These were supplemented with hand searching (including Google-based searches of the grey literature). Fifty-seven telehealth readiness related references were identified, extending from 1996 [5] to 2014 [3]. These were reviewed and summarized in regard to definitions, theories, and tools. Key lessons are presented in the discussion.

**Readiness**

**Definition:** Jennett et al. defined telehealth readiness as “the degree to which users, health care organizations, and the health system itself are prepared to participate and succeed in its application” [6], immediately identifying three ‘levels’ of users: individuals, organisations, and a system. This was changed in a subsequent publication to identify four domains: patient, practitioner, public and organization [7]. Khoja and colleagues later provided a slightly more restrictive definition, stating e-Health readiness refers to the “preparedness of health-care institutions to implement programmes that involve use of Information and Communication Technology (ICT) in provision and management of health services” [8].

**Theories:** The reviewed literature revealed many theories and models have been applied in examining telehealth readiness. These included the Technology Acceptance Model, Normalization Process Theory, Grounded Theory, the Diffusion of Innovations Theory, Implementation Theory, Program theory, Weiss' Program's Theory of Change, Unified Theory of Acceptance and Use of Technology, Organizational Change Readiness, Systems Theory, and the Structure-Process-Outcome model.

**Tools (Frameworks and Models):** Similarly, a number of tools have been developed and applied, with some being more suitable to specific settings compared to others. These include the Technology Readiness Index (TRI), Technology Readiness Levels (TRLs), e-Health Readiness Assessment Framework (eHRAF), Telemonitoring Attitude and Readiness Questionnaire, Technology Adoption Readiness Scale (TARS), and the Country Readiness e-Health Assessment Tool (CeRAT). Additional unnamed models and tools have been developed and applied by others.

Using these tools and frameworks, telehealth readiness has been assessed in a variety of settings, including: rural and urban hospitals, health regions, home care agencies, hospice organisations, communities, and even countries (developed and developing).

A variety of methods have been used to collect the insight, but were primarily qualitative methods, such as literature search, focus groups, key informant interviews, home visits, telephone or face-to-face interviews. In
addition, surveys and questionnaires (structured and semi-structured, with closed and open-ended questions) have been used to develop specific instruments, some of which have been validated through psychometric evaluation. Such approaches and instruments can be used as decision support tools for entities planning on introduction of telehealth.

Discussion

A host of factors appear to be related to or affect telehealth ‘readiness’. These include: current information technology use; perceptions of the new technology (perceived usefulness, perceived ease of use); practice context; task demand, physical location (urban vs rural); efficacy; learning curve; apprehension; resources; patient choice; confidentiality and security; political pressures; turf; ownership; culture; gender. To this list might be added trust and language. Which of these (or others) may be of most relevance must be assessed in any given situation.

An overlooked aspect is ‘systems thinking’. An efficient organisation is comprised of multiple smaller components each of which interacts with one another – therefore changing one (e.g., a department) will impact all others (i.e., the organisation as a whole). Introducing a telehealth initiative in one ‘department’ of an organisation will inevitably have ripple effects. This was identified as an issue in the pre-implementation stage of telehealth many years ago when Whitten and Adams stated “Telemedicine programmes are positioned within larger health organizations and do not operate in a vacuum” [9]. This concept was subsequently confirmed by other authors [10]. System thinking has also recently been acknowledged in post-implementation assessment of telehealth initiatives [11].

Once areas of poor readiness have been identified, it will be necessary to implement actions that lead to improved readiness. Such tactics will range from simply raising awareness to opening the Pandora’s Box of ‘change management’. In only one paper was this link between e-readiness and change management overtly noted [8].

If not consensus, then at least some consistency exists around the need to differentiate between individual and organisational readiness, to identify and measure readiness of users with different roles (e.g., clinicians, managers, patients, public), and to examine elements that assess their core, engagement, and structural readiness. Consensus does appear to exist around the need for measuring readiness, and for the results to modify and guide implementation and integration efforts.

Conclusion
Before even considering ‘readiness’, a presumption is that functional and user-friendly technology underlies any acceptable telehealth intervention. Assuming this, sufficient evidence exists to demonstrate that readiness assessment is crucial to success. A thorough assessment of e-health readiness, performed on the appropriate stakeholder group(s), at the appropriate level(s) within the appropriate organisation(s), will reveal areas of readiness-related weakness and strength. Thereafter, remedial actions that will permit the revealed factors to be mitigated or leveraged can be employed, developing a tailor-made approach that raises readiness, reduces risk, and concomitantly increases the likelihood of successful implementation of e-Health. All e-health proponents must recognise and act on this evidence.

Until we better understand what makes a setting ‘ready’ for introduction, implementation, and sustainable integration of e-health solutions, and apply the lessons learnt during these processes, we may remain stuck on ‘Ready’, and not progress to ‘Set’ or ‘Go’ for a long, long time!

References

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Experience of Integration of the IHE Based Luxembourgish eSanté Platform with an Open Source EMR System, GECAMed

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\(^2\)gence-eSante, Luxembourg \texttt{jean-claude.karasi@agence-esante.lu;}

Abstract: This paper relates the experience of integrating the open source medical practice system GECAMed (\texttt{www.gecamed.lu}) with the DSP (Dossier de Soins Partagé) of the Luxembourgish eSanté (eHealth) platform. The objective was two folded: on one hand, the physicians should be given a seamless access to the DSP in their private practice. Thus the eSanté Agency, who manages the platform, would get a first base of physicians as end-users. On the other hand, GECAMed helps to test the platform’s interoperability features and creates a reference implementation for other Luxembourgish EMR software providers.

Introduction

In 2013 a consortium, led by the French software company IDO-IN and the Luxembourgish cloud hosting provider EBRC, was chosen to implement the Luxembourgish “eSanté plate-forme”. One of the important applications of this platform is the Dossier de Soins Partagés (DSP), the national shared patient health record. The Luxembourg Institute of Science and Technology (LIST, formerly CRP Henri Tudor), was part of this consortium, and was tasked to equip his own open source electronic medical record (EMR) system, GECAMed (\texttt{www.gecamed.lu}), with a fully integrated access to the DSP according to IHE integration profiles such as XDS.b \cite{1}.

IHE Profiles

The exchange of data between heterogeneous information systems requires standards to make systems interoperable, i.e. a common way to communicate. A lot of standards exist for healthcare interoperability, some of which have been largely adopted, such as DICOM and HL7. However, experience shows that implementation choices and the freedom of data interpretation allowed by these standards increases the effort to achieve ad hoc system interoperability. IHE was set up by healthcare professionals and
industry to provide so called integration profiles to ease the implementation by: a) making a selection among the existing standards, and b) severely restricting the many implementation options of the selected standards. IHE organizes each year events called Connectathons to assess and test the profiles implemented by the different software vendors. When an information system has been successfully tested for conformance in respect with a profile, it is granted a corresponding integration statement, which is nowadays often required by customers as proof for interoperability.

To interoperate with the eSanté platform’s DSP, GECAMed was required to implement the following IHE profiles:

- ATNA (Audit Trail and Node Authentication) for secure access control, audit trail logging and network communication security;
- CT (Consistent Time) for synchronization of system clocks and time stamps of computers across networks;
- XDS (Cross Enterprise Document Sharing) for discovering and sharing electronic documents between systems;
- PDQ (Patient Demographics Query) for querying patient identities from a central registry using patient demographics data.

XDS architecture (fig. 1) relies on a document repository used to store a document provided by a document source, and on a document registry functioning as an index that stores the document’s metadata and links it to a patient identity source, to enable the document retrieving by the document consumer [2].

Figure 1: IHE XDS architecture
eSanté Integration

The eSanté Agency has elaborated a so-called “connectivity kit” for software editors [3] to specify the data exchange formats and protocols with the eSanté platform. The connectivity kit exactly describes the usage of the IHE profiles and OASIS web services security standards through use cases such as search for a patient’s DSP (PDQ), check DSP status, DSP access, search, retrieve and provide documents (XDS). Documents are structured according to the HL7 CDA (Clinical Document Architecture) standard. The security layer has been organized around the use of HTTPS encryption and a strong authentication of healthcare professionals based on SAML (Security Assertion Mark-up Language) and the secured certificate provided by the national ID provider, LuxTrust.

In general, the use of IHE profiles is clearly an asset when it comes to data exchange between health care institutions equipped with systems from different vendors. Today the systems of the big software vendors often come pre-equipped with IHE interoperability options. However, in Luxembourg there are only a handful of well-established EMR systems for medical practices, plus a lot of small, often handcrafted and unmaintained systems. Except for the occasional DICOM or HL7 Bridge, none of them has implemented standard IHE level interoperability before the arrival of the eSanté Agency.

Therefore the GECAMed - eSanté integration was above all needed to offer a freely available and fully integrated out-of-the-box replacement solution for those EMR systems that can’t evolve anymore, or for physicians who wish to immediately benefit from the platform’s DSP services. In order to increase the user acceptance, the DSP services have been seamlessly integrated into GECAMed, in order to not disturb the well-established work routine of the physician and the management of his practice. Thus the eSanté platform can go online with a first base of end-users from private practices, hopefully avoiding the chronic lack of users that has plagued similar platforms elsewhere.

Other objectives of the GECAMed - eSanté integration have been:

- Test the new platform’s interoperability features;
- Provide an integration reference implementation for other Luxembourgish software providers;
- Setting the integration gold standard for a future EMR system certification;
- Providing free source code to the developer community;

At the end of the development, which took six months at an approximate workload of 2 person-months, a workshop has been held to share the project’s experience with interested local software providers. The aim was
to present the technologies, help to avoid traps, suggest solutions, estimate workloads, offer assistance on demand, and in general minimize risks.

So far, there has been little demand for technical advice. This might be due to the fact that the DSP is not yet online (postponed due to the ongoing data protection assessment of the national data protection commission, CNPD).

Future Outlook

GECAMed, being part of the eSanté applications, will be continually updated to implement future eSanté services for doctors such as ePrescription, eBilling or Patient summary.

The LIST as an eSanté consortium member continues to invest in building up expertise for IHE relevant technologies. GECAMed participates in this year’s IHE Connectathon to assess its IHE profile implementation.

References

[3] DSP Connectivity Specification, version 0.91, 14/8/2014, non-public; can be obtained on request from Interop@agence-esante.lu

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Fostering Digital Health Innovation and Research Adoption: An Example Involving Occupational Therapists in the UK

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Abstract: Increased impetus to using digital technologies in healthcare and for care professionals to engage in research and development, with the motive of improved efficiency and patient care, is noted. Staff willingness and openness to technological innovation and research is a key issue for service adoption. A case study of a knowledge exchange partnership between occupational therapists, working in a busy acute hospital setting and university staff in a Centre for Assistive Technology and Connected Healthcare is reported. Observations suggest that the occupational therapists desire and are open to embrace use of useful digital technology.

Introduction

In many countries in the world and the United Kingdom governments are driving increased use of digital technologies in healthcare and engagement of healthcare staff in research and development [1-4]. Their reason is that with well evidenced benefits more efficient and sustainable wide patient care is possible [3-6]. However staff willingness and openness to digital care innovation and research is a key issue for service adoption [7-8].

Occupational Therapists (OTs) have become increasingly important in managing safe discharge of patients from across acute care and that relies on not just human but technological resources. They have been called ‘the gatekeepers’ of technology not least because of their capability to judge and enable patients’ ability to use technologies successfully [9]. The obvious opportunity to take advantage of their skills to facilitate adoption of technologies within acute care settings is there. However, they are not necessarily ready for the role of technological service and tools innovation [10].

A case study of a knowledge exchange partnership between health service and university staff aiming to encourage involvement in technological
related research has been conducted; offering the opportunity to consider OT openness to innovation with digital technology. OTs, working in a busy acute hospital setting, are sharing their clinical insights about needed innovation of technology and associated services with local university researchers (URs). The ‘Collaboration Aiming to Build Occupational Therapy research (CABOT)’ partnership goals are that in six months joint teams with the right expertise will form and then apply for research and development funding, subsequently leading to sustained long term collaborative research programmes.

Methods

To reach the goal of teams ready to bid for collaborative research and development projects, essentially the right people within each organization need to meet and work together. An underpinning assumption is that the URs would bring research leadership and experience and the OTs their clinical experience and issues that could have better solutions (not necessarily digitally based). Five steps were employed in what is essentially a social process: encouragement to take part; collecting ideas – through the first author visiting the teams where OTs work; share the ideas across the entire OT staff of the hospital and URs in the Centre for Assistive Technology and Connected Healthcare (CATCH); promotion of dialogue; and, team formation. Table 1 summarizes the approaches planned.

Table I Steps in the CABOT Knowledge Exchange Project

<table>
<thead>
<tr>
<th>Step</th>
<th>Techniques/tools planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encouraging taking part</td>
<td>Communiques via: Email; OT specific weekly bulletin; face to face meetings; visits to UR team leaders; talks in regular team management meetings.</td>
</tr>
<tr>
<td>Collecting ideas</td>
<td>Documented discussion with individuals/teams, followed by observation of individual therapists in their work. Consolidate ideas that are near identical or are better versions. If time filter for, ideas that don’t require research, solution(s) already known/available or strong research already underway; i.e. achieving this via literature and web searches.</td>
</tr>
<tr>
<td>Sharing the ideas</td>
<td>Translation of the ideas to plain language. Document the list of ideas and distribute. Presentation in workshops. Face to face meetings. If lots of ideas, develop prioritization.</td>
</tr>
<tr>
<td>Promotion of dialogue</td>
<td>Workshops. Individuals in both organizations highlight their research interest using the spreadsheet, and then match them up by strong interest. Stakeholder wide and targeted emails. Face to face meetings. If time also underpin idea selection for research by literature and web searches.</td>
</tr>
<tr>
<td>Team formation</td>
<td>Workshops. Specific introductions. CABOT investigators: provide advice; support networking; and/or become part of team (where they have expertise).</td>
</tr>
</tbody>
</table>
A straightforward concept was needed when explaining it to those asked to participate. The Open Innovation model of idea generation and sharing, Incubator and Projects phases [11] was adopted. A project was deemed as formed when, the team started to synthesize an outline and/or develop a collaborative research and development funding bid.

Findings

The three phases of open innovation was well accepted. The CABOT interaction and its performance, requires too much space to describe in detail, but Table 2 indicates how many staff engaged in the various activities. To reduce CABOT team bias on the process it was necessary to allow them to contribute in the same way as other participants could.

Table 2 Numerical summary of individuals engaged in CABOT (at time of writing)

<table>
<thead>
<tr>
<th>Step</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encouraging taking part</td>
<td>OTs: 18 out of 18 contacts engaged.</td>
</tr>
<tr>
<td></td>
<td>CATCH (URs): 17 teams across 12 departments engaged</td>
</tr>
<tr>
<td>Collecting ideas</td>
<td>76 ideas generated from OTs (without optional filtering)</td>
</tr>
<tr>
<td></td>
<td>OTs: Only 2 out of the 18 OT contacts didn’t contribute to ideas</td>
</tr>
<tr>
<td></td>
<td>CATCH (URs): 4 out of 17 didn’t meaningfully respond</td>
</tr>
<tr>
<td>Sharing the ideas</td>
<td>OTs: 5 identified 34 ideas as of research interest</td>
</tr>
<tr>
<td></td>
<td>CATCH (URs): 13 identified 45 ideas as of research interest</td>
</tr>
<tr>
<td></td>
<td>With so many ideas it was necessary to consider prioritizing.</td>
</tr>
<tr>
<td>Promotion of dialogue</td>
<td>Fora Workshop Email only Idea meetings</td>
</tr>
<tr>
<td>OTs</td>
<td>23 18 1 19</td>
</tr>
<tr>
<td>CATCH</td>
<td>14 6 6 14</td>
</tr>
<tr>
<td>Team formation</td>
<td>Advancing to project meaningful activity: 2 rapidly through serendipity; 9 incubating on course through quickly identified shared capacity; 13 incubating more slowly.</td>
</tr>
</tbody>
</table>

Before CABOT started there was speculation about the number of ideas and how their evolution might be managed. With over 70 ideas the optional filtering and online searches had to be left to incubator teams rather than CABOT staff. In addition an online method of sharing and engaging participants in indicating their interest in ideas and dialogues about them was needed. Turning to social media approaches, i.e. on online discussions was an obvious choice [11] as this would allow direct and widespread communication between the participants. Online externally closed fora were established. While the numbers signed up to use the Fora shown in Table 2 looks reasonable, the amount of dialogue has been minimal. A two hour workshop could only encompass about 20 of the 70 ideas. However the face to face events were more successful in producing follow on, i.e. the workshop and individual idea meetings. Some staff in both organizations
were eager to engage, while others needed more support and/or encouragement. CABOT was not set up to study the reasons for engagement/non-engagement in the steps and activities. But, evidence for co-existing work commitments competing and even blocking engagement was often noted during the six month project.

Table 3 illustrates the division of ideas found across digital connected technologies/services. The E- and tele- technology ideas were put forward by many teams, much of this relating to gaps and/or barriers relating to the specifics of localized care in the community and the patients home. The implication from the ideas put forward is that the OTs had significant interest to use, and research of, digital technologies in their practice.

Table 3 Distribution of digital technology types in the OT ideas

<table>
<thead>
<tr>
<th>Type of technology</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicitly E-health related</td>
<td>7</td>
</tr>
<tr>
<td>Explicitly Tele-services related</td>
<td>11</td>
</tr>
<tr>
<td>Digital technology where benefit from digital connectedness likely</td>
<td>39</td>
</tr>
<tr>
<td>Other (e.g. purely mechanical, not technological)</td>
<td>43</td>
</tr>
</tbody>
</table>

Conclusions

In the short time frame of the project significant engagement of both OTs and URs was achieved. If repeating the exercise of engaging busy staff who hadn’t pre-arranged and allocated involvement a longer duration would allow more embryonic collaborations reach fruition. If the CABOT team had had more time to invest in facilitation and encouragement – especially with so many ideas – this would have enabled more participants to engage in dialogues (including use of the online fora) and allow the accrual of the valuable but limited time releasable to research by participants to be sufficient for team building and bid outlining. Only in the fullness of time will it become evident if this approach to encouraging adoption of digital healthcare and research successfully generates increased use.

The fact that the OTs were mainly engaging positively and suggesting digital technological ideas, including E-health and remote health service related ideas, may suggest they are a profession who could through being early adopters be instrumental in increasing other healthcare professions openness to adoption of digital connected technology and services. Their skills in facilitating patient use of technology should also be considered as potentially useful to add when any colleagues in other professions are in the process of exploring the use of E-health and remote digital services with patients.
References


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Interoperability Testing of Continua-compliant RESTful eHealth Platform

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Introduction

A Personal Health Record (PHR) system is an eHealth platform for individuals to manage their health data. Users transmit health data to a server from various locations, such as their home or fitness club, using various sensors. Health data collected at such locations results in high-quality medical service. Interoperability between PHR systems is necessary because users use more than one PHR system or hold onto their health data throughout their lives without depending on a specific PHR system. Through interoperability testing we clarify the issue of interoperability because PHR implementations are different due to the difference in understanding of the PHR specification. In this article, we explain the results of interoperability testing of PHR which was carried out in France (Orange labs) and Japan (NTT Secure platform Labs).

PHR Architecture and Interoperability Issue

Continua Health Alliance created the Continua Design Guideline (CDG) [1] to describe interfaces between health devices and servers. PHR architecture is composed of a personal device to measure health data, WAN device to collect and manage health data and application hosting device (AHD) to transmit health data to the WAN device. Because the personal device does not have a user authentication function, it is performed on the AHD. After authentication, health data from the AHD is sent to the WAN device.

The Simple Object Access Protocol (SOAP) [2-3] was first adopted in the CDG between a gateway and server, defined as the WAN interface. With the RESTful API, compared to SOAP, strict-type checking and session management of data are difficult. Since then, a more lightweight RESTful API has been defined as being more attractive for web applications. Moreover, implementation and understanding are straightforward. In 2014, the RESTful API was newly adopted in the CDG [4].
In the RESTful API architecture, health data transmission by SOAP is replaced with the RESTful API and authentication is conducted using OAuth2 [4]. Authentication server authenticates using authentication information such as ID/Password input on the AHD and the server replies with a token. The AHD sends health data in a set with a token to the receiver in the WAN device. The receiver sends a token to authentication server to check whether the token is valid. After validation of the token, the receiver registers the health data to the database.

The HTTP POST request method is used to send both an XML-based SOAP message and HL7 based health data. In the RESTful API, HL7-based health data and a token are sent using the POST request method. As a result, there is no computation cost for the processing of XML messages. Therefore, implementation is straightforward.

Next, we discuss issues of interoperability. Even if PHR systems are implemented by referring to one specification, implementers’ interpretations of a specification may be different. There are cases in which differences in implementation can result in interconnection impossibility. For example, if application-specific security was implemented using the records in the standard message format, interconnection has become impossible. Therefore, it is necessary to clarify the implementation differences that affect interoperability. Because of this, interoperability testing is important.

Interoperability Testing

We at Orange Labs and NTT Secure platform Labs have respectively deployed PHR systems in France and Japan with the RESTful API to conduct interoperability tests on the WAN interface. The goal was to connect a gateway (called the AHD in the CDG) from one side the PHR system to the other and to clarify the implementation differences that affect interoperability.

The testing environment is shown in Figure 1. France (Orange labs) constructed the receiver side, and Japan (NTT labs) constructed the sender side. We conducted testing in the following protocol.

The AHD sends authentication information to the OAuth2 server, the OAuth2 server performs authentication and replies with a token. The health data measured by vital sensors is transmitted in a set with the token to the receiver via the AHD. The receiver stores the health data into a health record database and replies to the AHD with the results.
In this section, we explain the results of the interoperability testing. We also discuss the response times of the RESTful API.

Our testing revealed that URL encoding used for the HTTP method adversely affects interconnections. In areas that use double-byte characters, such as Japan, the character code is generally specified to accept-charset of the request header, sending the entire parameter to the URL-encoded server. The sender transmitted by encoding the entire HL7-format health data in the POST request message. For this reason, we were unable to connect with the receiving server. When performing the transmission of the POST request message, we transmitted data without performing the encoding process to resolve the defect connection.

Next, we describe what kind of effect the HL7 message has.

The receiver identifies which user is associated with the received health data. In the Japan implementation, it was assumed that the authentication user ID is associated with the health data. User IDs can be defined as Patient IDs (PIDs) in the HL7 message. On the Japan side, the PID field is recognized as a display ID field. The French side server uses the PID of the HL7 message to associate the health data and user ID. As shown in Figure 2, “111” in PID segment is important information to be used in association with users and health data. We solved this defect by sending the HL7 message that the French side server accepts.

Finally, we discuss the total response time of health data transmission. The measurement server environment is summarized in Table 1. The major steps of the receiver are shown as follows:

1. Send a query to the oAuth2 server and authenticate;
2. Store in a database that includes syntactic analysis of HL7-based health data.

Table 2 shows a breakdown of the total response time. The average times are estimated from five times executions. Transmit data consist of blood pressure values.

```
... PID||111^^^MHealthTourEUI-64^PI||Doe^John^^^^^L
...
```

Figure 2: PID Segment

Table 1: Test Server

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>4 Cores</td>
</tr>
<tr>
<td>Memory</td>
<td>6144 MB</td>
</tr>
<tr>
<td>HDD</td>
<td>100 MB</td>
</tr>
<tr>
<td>OS</td>
<td>CentOS 6.3</td>
</tr>
<tr>
<td>Middleware</td>
<td>Apache 2.2.3, Tomcat 6.0.32, OAuth2.0, Apache Oltu, OAuth2, Jersey 1.18, PostgreSQL 8.4.20</td>
</tr>
</tbody>
</table>

Table 2: Breakdown of total response time

<table>
<thead>
<tr>
<th>Item</th>
<th>Response time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Authenticate</td>
<td>127.2</td>
</tr>
<tr>
<td>2. Store in database</td>
<td>185.8</td>
</tr>
<tr>
<td>Total Response time</td>
<td>313.0</td>
</tr>
</tbody>
</table>

Conclusion and Future Issues

Interoperability between PHR systems is necessary because users use more than one PHR system or hold onto their health data throughout their lives without depending on a specific PHR system. There are cases in which differences in implementation cannot be interconnected occur because of differences in an implementation's specification interpretation. When making interconnection, it is necessary to confirm the way to use the HL7 health data in the receiver. Although use of HL7-based health data is not defined in the PHR specification, it affects the connection.

We measured the total response time of the health data registered by the RESTful API. Data stored in the PHR system do not require real-time
response. This is a sufficient response time for data for understanding a user’s daily health condition.

Furthermore, the newly adopted RESTful API provides a scalable and cost-effective environment.

In the future, various devices other than Continua-compliant ones, such as toothbrush and heartbeat sensor clothing [6], will be connected to the Internet. Useful data are accumulated in platforms other than PHR such as oneM2M [5]. Therefore, system architecture design and interoperability testing for interconnection between different systems, such as PHR and oneM2M are future issues.

References


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Making Advanced Telemedicine Affordable

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Introduction

Telemedicine becomes increasingly important, especially in rural areas or for rare diseases requiring an expert’s opinion. Due to the widespread use of proprietary communication protocols, existing telemedicine approaches can only incorporate a subset of relevant medical devices. Thus, the remote physician is dependent on on-site colleagues and video-based reading of the device and medical parameters. According to Ackerman et al. [1] vendor-independent medical device interoperability and plug-and-play functionality as well as the lack of standardization are key problems that have to be solved for future telemedicine systems. Therefore, we state that an open standard for medical device communication does not only enable locally interconnected medical systems but is also vital for creating comprehensive telemedicine systems.

In this paper we describe a system for local device interoperability based on a service-oriented architecture (SOA) that is proposed for standardization in the IEEE 11073 family. Because the new architecture is designed mainly for hospitals, we focus on telemedicine for this environment. We introduce a comprehensive telemedicine system, which enables remote monitoring and control, based on this architecture. The whole system extension for telemedicine is comprised of cost-efficient off-the-shelf components. This will build the basis for affordable telemedicine.

State of the Art

Multiple studies have shown the benefit of telemedicine for the patient’s health and the costs, especially for intensive care units (ICUs): [2–5]. Information and communication technologies for telemedicine applications in ICU and inpatient treatment context have been investigated in several research projects and thoroughly technically documented. The projects Maryland eCare [6], THALEA [7] and Tele-Intensivmedizin [8] focus on telemedical ward round of the ICU where hospitals in rural areas work together with the university medical centers.

At the commercial market there are several proprietary, vendor-dependent, and closed solutions for telemedicine available from the major
manufacturers. All mentioned projects and (commercial) solutions have one problem in common. Only a (small) subset of medical devices can take part in the telemedical environment. In case of the vendor-dependent solutions only the vendor ecosystem can be used. However, to enable proper care, all medical devices that are associated with the patient need to be directly accessible. To the best of our knowledge there are no solutions that can provide these features yet. Hence, reading device parameters via video stream is necessary or only potentially outdated information that is available at the clinical information systems (CIS) can be used.

Interoperable Communication for Distributed Medical Devices

Following a SOA-based framework for medical device communication that meets the requirements for a comprehensive telemedicine system is presented. It enables both interoperable plug-and-play communication among medical devices and between the medical devices and the CIS. This architecture is going to be standardized in various sub-standards as part of the IEEE 11073 family.

The central part of Fig. 1 shows a schematic representation of a loosely coupled, non-centralized service-oriented device communication. Multiple medical devices are interconnected. Information about the patient like demographic data or order information from the CIS is accessible via the information system connector. A detailed view into the structure of a device that participates in the communication is shown in the left part of Fig. 1. The Devices Profile for Web Services (DPWS) [9] is used as basic communication technology. IEEE P11073-20702 extends DPWS to the Medical DPWS (MDPWS). It introduces some modifications in discovery, messaging and event propagation to allow utilization for Point-of-Care medical devices. This includes the following three major points: Firstly, the safe remote control of medical devices including single-fault safety via dual channel transmission over one medium. Secondly, the SafetyContext that enables the ability to define the requirement for transmitting safety-relevant contextual information for a message in the message header. A concrete example is the requirement to send the last power value of an ultrasonic dissector within the header of the command to change the power output. Thirdly, the possibility of data-stream transmissions (e.g. for waveforms) has been extended.

The information- and service-model for distributed medical systems are defined in the IEEE P11073-10207 “Standard for Domain Information & Service Model for service-oriented Point-of-Care medical device communication”. The information model that is derived from the 11073 Domain Information Model (DIM) (IEEE 11073-10201) allows a semantic
interoperable representation of the capability description as well as the current state of the medical device. The semantic description is done via codes and corresponding coding systems (e.g. code: 18442; coding system: IEEE 11073-10101; meaning: pulse rate). The medical device is accessible via the service-oriented communication model (or service model). There are services to retrieve information about the device capabilities and the current state, set parameters, and get event reports. IEEE P11073-20701 defines the binding between MDPWS and the Domain Information & Service Model.

Telemedicine Infrastructure

Based on the service-oriented device communication for medical devices introduced in the previous section we present our telemedicine solution. We developed a dashboard that dynamically composes all available medical information at one place. It consolidates virtual panels of distributed medical devices, vital parameters, pictures, and video streams. The Tele-Base-Unit (TBU) is part of the hospital’s distributed medical device system. It collects all the information and provides read access as well as remote control access if possible with respect to medical risk management. The dashboard can be accessed by a common web browser. Due to security aspects the corresponding web server will only be accessible via a Virtual Private Network (VPN). Fig. 1 shows the proposed infrastructure: Medical device network of the hospital including the TBU and the remote physicians having access to the medical devices by using the dashboard via a VPN connection and a firewall due to security issues (dashed line).

Our solution has several advantages. The whole system is comprised of cost-efficient of-the-shelf components. The web browser based approach
requires no configuration effort and no special hardware from the remote physician, even mobile devices can be used. Physicians can access exactly the information they need for diagnostic purposes or treatment.

Demonstrator Implementation

We developed a demonstrator to showcase the described telemedicine infrastructure. It is shown that the solution is able to provide the whole range of device accessibility that is necessary to provide a comprehensive telemedicine system. An endoscopic camera and light source (right part of Fig. 2) as well as a pulse oximeter (Fig. 2 bottom left corner) that implement the described communication infrastructure are included as medical devices. The TBU is located in the device stack at the right part of Fig. 2. The left part shows several devices, also mobile ones, which access the dashboard. Reading and setting parameters and showing pictures and video streams are possible.

Conclusion

In this paper we have shown that a comprehensive telemedicine system can be built based on interoperable service-oriented communication architecture for locally distributed medical device systems. The described solution comprises cost-efficient of-the-shelf components and is easy to use for remote physicians. This will make advanced telemedicine affordable.

Acknowledgment

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References


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Return of the Introduction of a Prince 2: Procedure to Manage the IT Projects of the Liege University Hospital

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Introduction

The IT department of the Liege University Hospital (CHU) manages from 25 to 40 IT projects in parallel. The project coordination needs are then important and critical. The IT department is composed of four units: the application management service, the technical architecture service, the project and information service (SPI) and the medico-economic information service. A PMO (Project Management Office) has been created in the SPI in 2012. Its first goal was to put in place a project management methodology standardized and adapted to the hospital environment. The methodology implemented is a subset of the Prince 2 Methodology. Prince 2, created in the 80th for the English public departments has become one of the standards of project management in Europe around the year 2000 and is well adapted to IT projects.

This paper presents the method that has been followed to implement this methodology and gives a first feedback 2 years after its launch in the CHU of Liege.

Set Up of the Methodology

The PMO (Project Management Office) of the IT department carried on the set up of procedures and deliverables inspired by the Prince 2 standard. The main Prince 2 principles have been followed: continuous justification for the company, roles and responsibilities definition, product focus, adaptation to the project environment and lessons learned.

Nevertheless, this methodology has been adapted via several modifications. Here are the main ones:

- Rapid set up of the Prince 2 processes in order to answer the urgent needs spotted by the PMO concerning deliverables management, project control and follow up.
- Management products aligned on the adopted processes, taken from the selection and the adaptation of the standard products (6 products instead of the 26 product identified by Prince 2).
The methodology to put in place had to be adaptable enough to be used for projects with variable size. Some of these projects take one month while others can be spread over several years. They can involve 50 to 3000 users. The IT department leads projects involving one medical unit and other projects involving the entire hospital. The methodology has to cover the entire project cycle, from the project initiation and demand to the product delivery, but it has to be adaptable in order to ease its implementation for small projects. A selection of deliverables has been made in order to document the key steps of the projects.

As shown in figure 1, in the Liege CHU, the IT projects are not going directly from a development phase to a production phase. Generally, a first part of the product is deployed while a second part is still in development, or the product is deployed in some care units before other care units. The project management methodology had absolutely to take account of this.

An interesting example is the electronic medical record project: each of its modules has been deployed over several years. Indeed, for each care unit using the system, a strong parametrization including sometimes additional development has to be carried on. The CHU is linked with a medical faculty with a complete cycle and is composed of 50 different care units, which increase strongly the deployment period.

After having selected the standard methodology, six deliverables have been adapted or created by the PMO. These 6 deliverables are the project demand, the project charter, the step or final report, the exception report, the launch document, and the exploitation document.

The launch document and the exploitation document have been created in order to complete the launching phase of the project.

The first document is mainly a check list, allowing the project leader to verify if everything has been correctly prepared before the launch. It means that it controls if everything has been tested, if the necessary information or training actions have been carried on with the users, the support teams and the management.

Figure 1
The second document holds all the information useful for the management of the delivered product, after the project closure or as soon as a partial launch has been made. It includes the related maintenance contracts, the support organization and the future product evolutions.

The PMO hasn’t treated work organization of the development teams in the project methodology in order to leave the choice to the team leader concerning this part of the job. They are free to use, for example, agile methods to produce part of the final product. Agile and Prince 2 can then be combined, one producing the product and the other identifying and defining the product breakdown structure.

This methodology has been presented to the active project leaders and to the analyst who could became project leader shortly. Main principles of Prince 2 have been explained and then the CHU flow and deliverables have been detailed.

A tool of document management has been provided in order to centralize all the projects information. The projects that were already started at that moment have been documented in order to include them in the global process.

All these projects are followed by the PMO and a monthly report is produced to the management. This report is a cockpit view indicating the last activity of each project and the next step to reach. A color code indicates the last positive or negative facts concerning each project and rings a bell in case of increasing risk or major problem.

The CHU Liège Feedback

One year after the set up of the methodology, 32 projects or demands were followed by the PMO. A brainstorming has been organized with the IT team leaders and several project leaders in order to collect their feedback and to act some requested improvements.

Here are some positive items that have been expressed during this brainstorming:

- Request formalization:
  - The project demand document presents several advantages as it allows to easily structuring the demand around several themes like cost, risk, quality, perimeter and benefits. Even if this structure seems pretty logical, the request previously sent to the IT department were far to be expressed in this way. The requesters greatly appreciate this procedure as it helps them to structure the expression of their needs. We have to say that a help from the PMO is often necessary at the start of this process.
o IT services also appreciate this formalization of the demand as it helps to select more efficiently the different request. Some of them are rapidly abandoned or delayed as it appears that the requester hasn’t a clear view of its needs or that the benefit of the project is not obvious or, sometimes, that the request can be answered by a simple parametrization of an existing application.

o A global view of the IT request by the department allows to concentrate some of them into one institutional project (i.e. several request around paper digitalization).

- The project charter allows to fix clearly the project environment, its perimeter, but also to define the roles and responsibilities. The chapter “out of perimeter” is greatly appreciated as it allows defining from the start what is not included in the project. Several project drifting have been avoided due to this document. The main goal is to avoid the “eternal projects”, never closing because there is always a bug to fix or an improvement to put in place, preventing a correct migration from the project phase to the operation phase. The management by exception proposes to limit the reporting of the project leader to the important steps of the project. Out of these steps, he’ll have to report uniquely in case of problems (planning delay, additional resources needed, initial perimeter modification). It is the project leader responsibility to focus on the useful information. This type of management is much appreciated as it leaves the opportunity to the project leader to concentrate on tasks that bring a real added-value (no more monthly report to produce systematically). The exception report creation is requested when the project goes further the limits defined in the project charter concerning the perimeter, the costs, the planning or the risks. Concretely, the way of using these exception reports varies from one project leader to another. Additional training will be necessary. It is necessary to make a follow up of the project leaders to provide them to try to hide the projects drifting.

- The exploitation document, and its availability to all the teams, allows centralizing the information concerning the responsibilities of each team during the exploitation phase, facilitating their continuous upgrade.

- The cockpit listing the different projects is appreciated by the management as it allows having a global view on all the active
projects or demands. It’s also appreciated by the IT teams which can have a summary of every projects conducted in the department.

- The project closure phase brings two important advantages. It allows formalizing the migration from project to operation mode, preventing the problem of the never-ending projects. It also sets a post project review date in order to analyze, several months after the project launch, the success and weakness linked to the project launch. A good practice database will be enriched after each post project meeting. This integrates the seventh principle of Prince 2, lessons learned from experience. It’s also during this meeting that planned benefits are verified and that pre defined performance indicators are measured. The organization of the way of working of a project, especially concerning the process flow, the deliverables and the communication plan, helps the project leaders as well as the team members to gain an important time as it prevents, for example, too many useless reporting meetings.

- The simplicity of the deployed methodology allows the project leader to quickly assimilate this new way of working and to become good sponsors.

The main points that have to be improved are the following ones:

- Deepen the product breakthrough chapter in the project charter. This part allows going through every product and sub product linked to the project.

- The communication plan must be formalize and improved in order to optimize the project communication to the management, the project leaders or the team members. The information to the different players needs to be continuously renewed. This is part of the evangelization role of the PMO.

These requirements have been put on the “to do list” of the PMO for 2015.

Future Evolutions

The project management methodology created by the PMO mentions that the call for tender production and the provider selection can be the first step of a project. At the end of this step, a migration meeting will be organized, in order to start the second phase of the project. A version 2 of the charter will be created in order to take into account the following points:

- The choice process can take from several month to more than a year due to the workload needed for the functional needs collection and formulation, the analyze of the offers, the choice report redaction and its validation by several commissions. The
constraints linked to the regulation of the public market can be very heavy especially if you are in a European level call for tender.

- The human resources implicated in the call for tender are different than the ones implicated in the production phase: key user, analyst, call for tender specialist in the first part, developers, testers, analysts, trainers, selected provider resources in the second one.

- The cost, planning and perimeters will have to be reviewed to be in line with the selected offer.

Another adaptation will concern the technical projects. Some of these projects include a long part of market study, evaluation and comparison of technical solutions and need analysis inside the hospital. There is no project demand at this level and the project charter used here will be different than for a standard project. Indeed, in addition to the perimeter definition and the other field required in a standard charter, an important chapter will be dedicated to the different technical solutions evaluated during the project and the explanation of the choices that have been made. From this point, the deployment follows the standard process. This document has been carried out in collaboration with the It department of the Liege University (ULg).

Beyond Prince 2

Priorities and resources management

The management of the priorities and project loads in a global planning tool is planned for 2015. In order to optimize this portfolio management, we need to collect the data concerning the resources, financial and human, involved in each project. By mapping these information with the institution priorities, the set up of an efficient IT project steering will be possible.

This will help the IT managers, during the demand validation phase to take efficient decisions based on actual or planned resources availability (acceptation, refusal, delay, delay of another project).

We are here in a second phase of the global PMO project for which PMO members have been certified P3O (project, program and portfolio office). This is the portfolio management phase.

Program management

The program management following the MSP (Managing Successful Program) will be used shortly. Indeed, for the king size projects, composed of several sub projects, this method allows a global approach, still including Prince 2 as project management method. It helps to define clearly the global objective via a strategic vision but also to manage in a structured manner the implementation phase and the change management, which are missing
in the Prince 2 steps. The selected program is the IT security program, leading to ISO 27001.

Conclusion

The setup of a project management methodology in the IT department has helps the IT teams to improve their efficiency in terms of management and control of their activities. It is on the demand management level, on the projects follow up and steering that the greatest improvements have been acted. The increase of the visibility of each project has created a positive impact on the teams and on the users. This first phase will now allow moving to a global IT project resource management that will increase teamwork efficiency.

We deployed and we will continue to deploy governance tools based on improved best practice method that have been used previously in other sectors and listed in the figure 2.

The mix of an improved methodology with best practice rules linked to typical the way of working of an hospital have been the key factors in the success of this deployment.

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Social Media: The Power of Networking


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Abstract: Social Media has high penetration and impact in many countries including the low and middle income ones. Using them to promote, disseminate and discuss medical knowledge, initiatives, projects, research, news and other activities between peers has become one of the most powerful ways of communication nowadays -even more useful than the traditional methods. Objectives: The aim of this communication is to offer an overview of the use and impact of Social Media in the network of European New and Future General Practitioners from 2 different perspectives: the use of the social media networks by the newly qualified and in-training GPs and the impact / reach / awareness of the activity developed from the official social profiles running by the European Young General Practitioners during the period 2012-2014. Methods: Analyzing the use of Social Media (Facebook, Twitter, LinkedIn and YouTube) in the New and Future General Practitioners network in Europe during the period 2012-2014 and the correlation with their activities will provide the clues of the effectiveness and success reaching the official channels in terms of community, engagement, education, innovation, impact and revolution that have been extended and copy as a strategic model to implement in order to improve the communication among peers in equivalents networks around the world.

Introduction

Internet and all the advances in technology have changed the way that health care providers access and use information significantly. Social media tools such as Facebook, Twitter, and YouTube have been used to train medical personnel, provide information to patients or professionals, and allow rapid communication in times of crisis [1], having a high penetration and impact in many countries including the low and middle income ones.
Using them to promote, disseminate and discuss medical knowledge, initiatives, projects, research, news and other activities between peers has become one of the most powerful ways of communication nowadays, even more useful than the traditional methods.

Not only do they enable users to see what their peers are doing, but they also facilitate the automated selection of “relevant” information, reputation and trust management, accountability and quality control, and foster viral dissemination of information and applications. That is why social networking is a potentially powerful tool to engage users and construct professional relationships; this collaborative nature of social media allows for a meaningful participation from all user groups. James Surowiecki stated in *The Wisdom of Crowds* that these “Groups are remarkably intelligent, and are often smarter than the smartest people in them” [2]. This has been echoed by supporters of social media, who promote the benefits of this synergistic relationship [3]. The best example is the use of Social Media in the network of the European New and Future General Practitioners, the Vasco da Gama Movement (VdGM), which is a working group within WONCA Europe (the European branch of the academic and scientific society for General Practitioners / Family Physicians). WONCA Europe has 47 member organisations and represents more than 75,000 family physicians in Europe.

VdGM launched in 2004 and its ideals were set down in Lisbon, the home port of Vasco da Gama, from where he set out on a similar voyage of discovery, inspiring us to employ his name for our Movement. The aim of its Image Group is to promote the network, its communication, and activities, as well raise awareness of family medicine/general practice. Since 2011 the Social Media strategy has been developed and dedicated members have been appointed to manage the accounts of VdGM and its website, including the use of Facebook, Twitter, Linkedin, YouTube and Flickr.

Even if the accounts have been managed by physicians, the content has been posted in a professional way and the communication followed the same standards. One of the keys of the successful implementation of our program has been the assignment of the account management to doctors with high motivation to use Social Media, thus benefitting from their engagement with their peers, the direct communication and trust, their recognition of the needs for tailoring the content, and the increase in collaboration, involvement and openness. On the other hand, this very benefit could become a double-edged sword, as the social media managers have not received any compensation for their effort and invested time, and could even lead to burnout, endangering a key element of the strategic plan.
and compromising the continuity of the network’s communication.

Analysis

The Vasco da Gama Movement has an official presence with a Facebook Group and Twitter, YouTube and LinkedIn accounts. The Facebook group has 1345 members and it is the most dynamic channel, followed by Twitter (@vdgmeu) that was created in August 2011 and has 2,345 tweets and 1301 followers. Moreover, the YouTube channel was established in September 2011 and has 55 subscribers and 8,692 views since its creation. From 2012 to 2014, 22 videos were uploaded (43 in total until nowadays) and the most viewed one has 1784 hits (duration 8:53 min).

Even if LinkedIn is considered as the most professional network, Facebook has become the most popular channel of communication in this young network community, facilitating sharing knowledge and information on collaborative projects, research and medical education programs, as well as providing interaction, opportunities, and fostering brainstorming and brand recognition. Perhaps not surprisingly, the interactions in our LinkedIn group have been rather limited.

There is an extensive body of literature on employing Social Media in medicine, primarily for medical education, and a plethora of recommendations and good-practice advices have been produced over the years. Yet, considering the popularity and prevalence of these tools, research must focus on finding innovative ways to capitalize on their potential.

Recommendations

VdGM has been promoting the use of dedicated hashtags for the WONCA Europe conferences and events since 2010, that can also be considered as using twitter as a medical education application [5]. To
facilitate participants commenting on the conference, VdGM distributed instructions on how to use the network and encouraged them to make observations on presentations in real time, suggest workshops, help and communicate with each other. Furthermore, useful information concerning the schedule was posted and photographs were shared instantaneously through the official Twitter account.

The most used hashtags by @vdgmeu account are shown in Figure 1. The worldwide impact is illustrated in Figure 2.

![Figure 1](image)

**Figure 1**

Increasing the frequency of posting content and making the difference with the content post in twitter and in Facebook will give more dynamism and create more conversations and project opportunities, but this will require, at least, resources and people that will be entrusted with this position exclusively.

**Conclusions**

Social Media are a relatively new concept for a lot of physicians, who are often resistant to change or to adopt new channels of communication that are transforming continuously, but have an increase potential. Physicians and health care organizations should use the power of Social Media to facilitate interactions not only with peers, but also with patients and the general population.

By promoting “online professionalism” and fostering the constructive education of our peers, the appropriate employment of Social Media is encouraged and many opportunities are presented that can lead to improving the network’s communication and productivity.
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Standards and Competencies for Telenursing: Are They Necessary? How Would They Be Used?

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Introduction

The nursing profession has long been committed to practicing within the identified scope and standards of practice and according to established competencies for practice. This commitment has, however, become a significant challenge, given the wide diversity of nursing specialties, practice settings and levels of educational preparation. The articulation of scope and standards of practice and competencies for telehealth nursing in all of its manifestations is a work in progress, challenged by variability in education (academic and on the job), regulation and work environments.

Scope of Practice

A nurse’s scope of practice is determined by the licensing authority in the jurisdiction of practice. Nurses must provide services that are consistent with their legislated scope of practice [1]. The scope of practice of the nurse provides guidance and direction to nurses, the nursing profession, educators, regulatory authorities and the consumers of care [2]. Specifying the professional’s scope of practice can help to protect the public and can also support governments in planning for their workforce needs [2].

Telehealth nurses work within their scope of practice in accordance with their license [3]. Telenurses integrate information and communication technologies with their practice to interact with clients at a distance or across barriers. Regulatory bodies worldwide are keen to describe nursing’s scope of practice through their licensing functions, be they regional or national. Telenursing practice (and other tele-practices) may be cross-border or multi-jurisdictional, e.g., with remote systems for intensive care (eICU). Regulators and health care providers have the responsibility to discern how these new eHealth ways of health care delivery can most effectively benefit clients or patients.

Standards of Practice for Telehealth Nurses

Standards can be defined as concepts or principles established by agreement that are used as models to compare the quality or performance of
a practice [4]. Standards of practice are designed to be used consistently, as a rule or guideline. Nursing is guided by standards of practice and standards of professional performance; often these guidelines are by practice specialty [5, 6].

Standards for telehealth nursing are grounded in the meta-concepts underlying professional nursing practice while recognizing that eHealth in all of its manifestations is an integral phenomenon for nursing [7-10]. Meta-concepts include, e.g., client safety; client privacy, confidentiality, informed choice/consent, and security; safe and professional practice environments; therapeutic nurse-patient relationships; and nurses practicing according to professional ethical standards and with the competence appropriate to the specialty and setting of care.

One challenge for telehealth nurses today is whether it is necessary to develop telenursing standards that are separate from professional nursing standards since their primary practice and performance standards come from their care delivery setting or nursing specialty or both. A nurse working in an eICU monitoring station, e.g., has access to the array of scope and standards documents from the American Association of Critical Care Nurses (AACN).

About 15 years ago, the International Council of Nurses (ICN) and the American Nurses Association (ANA) developed telenursing programme standards and telenursing protocols but these have not been renewed, possibly because they were not brought forward for application in the current nursing environment. However, what can be seen throughout these older documents and in current resources is the importance of telehealth nursing competence.

Telehealth practice guidelines, both from nursing and other disciplines, or multidisciplinary organizations, may suffice, in concert with their scope and standards of practice, to guide nurses in the aspects of their care delivery that cause them to be called telenurses. Guidelines are proliferating and address many issues related to eHealth that change preparation, delivery and evaluation of client or patient care [11, 12].

Competence for Telehealth Nurses

Competence can be defined as a set of related skills, knowledge and abilities that enable one to act effectively in a situation [13]. Nurses are expected to be competent in their area of practice, whether that is in a care delivery setting, e.g., ambulatory care, or a nursing specialty, e.g., pediatrics, informatics. Nurses are also expected to be competent for their level of practice, e.g., registered nurse or advanced practice nurse.
Telenursing standards and guidelines often include the stipulation that nurses must be competent or possess the requisite competencies.

The concept of competence in nursing, and especially its assessment, is difficult, however. Two concept analyses [14, 15] of competence found little support for didactic education ensuring competence or for the ability to assess such things as critical thinking, human caring or knowledge integration skills. Competencies vary in level of application, from ‘provide patient-centered care’ to ‘hands-on care,’ such as with a dressing change. Garside and Nhemachena [15] noted that competence is a simpler thing to define when recognizing where it does not exist, in the form of incompetence.

The issue of articulating and assessing competence is the second challenge for telehealth nursing. Professional nursing values performance evaluation as a means of ensuring safe care and, optimally, a high quality of care resulting in optimal client or patient outcomes. What seems to be needed is the identification of a unique array of telenursing competencies determined to be necessary and sufficient to represent telenursing. This product would need to be flexible enough to span multiple levels of nursing preparation and many care delivery environments, that is, where telenurses work. It should not be necessary to repeat the competencies already available for specialties, settings and levels of practice.

Conclusion

This paper has briefly addressed the issues of telenursing scope and standards of practice and telenursing competencies. National or state nursing regulatory agencies have the responsibility to describe nursing scope of practice in terms of educational preparation and, where applicable, certification of advanced practice. Management of cross-border and multi-jurisdictional telehealth nursing practice are being addressed by these regulatory agencies. Standards of practice for nurses are common tools used by nurses to guide practice and ensure quality. Practice guidelines are another set of standards for nurses. Telehealth nursing standards are available in the literature; the organizing meta-concepts used for these standards parallel those used for other nursing specialties.

The issue of competencies for telenursing remains unresolved. If telehealth nursing is to have a reliable and valid way to measure and evaluate their work, then a new set of competencies that address the telehealth aspects of their work should be considered. This would be a complex set of competencies, taking into consideration the practice indicators of telenursing practice and the range of environments in which it takes place.
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Standards for Telehealth and the Emergence of the International Code of Practice for Telehealth Services

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Abstract: The International Code of Practice for Telehealth Services is the product of the Telehealth Quality Group (TQG) that was established as a key outcome from the European Commission funded TeleSCoPE project (www.telehealth.global). The TQG inherits the mantle of the European Code of Practice for Telehealth Services that became operational in 2014 and which, building on a partnership with DNV GL, boasts a growing number of services that are registered or accredited to the Code.

This paper considers the wider landscape of standards and the way in which the new Code is positioned in relation to them. It briefly appraises the role that standards are playing in a rapidly changing context for telehealth services.

Introduction

The European Commission eHealth Action Plan called for ‘coordination on common standards’ in health [1]. And while much of this call was concerned with the need for common definitions and the interoperability of systems and services, there was recognition the wider role of standards to help the effectiveness of eHealth ‘ecosystems’ within which telehealth is positioned. Such a need underpinned the work of the TeleSCoPE project that developed the European Code of Practice for Telehealth Services - which has now, under the auspices of the Telehealth Quality Group been re-launched as an International Code.

Telehealth can be taken as embracing at least some elements of telemedicine. It, therefore, helps to address some clinical as well as broader well-being needs. Telehealth at the same time also includes telecare and social alarms in recognition of the importance of the latter in supporting people to live more independently at home. The definition adopted by the TQG builds on that adopted within the TeleSCoPE project, viz. telehealth is ‘the means by which technologies and related services concerned with health and well-being are accessed by people or provided for them
irrespective of their location’ (see www.telehealth.global). This definition makes telehealth relevant to the daily lives of people of all ages.

The need for standards around telehealth relates to the challenges of both technological and demographic change. In respect of technological change there are opportunities to make telehealth services more accessible to and usable by people in ways that meet their needs and respond to their choices. The debate around standards should not, therefore, be primarily (or just) about the provision of guidance for service ‘delivery’ in any formulaic way; rather it must be at least in part about how services can meet flexibly those needs and choices.

Demographic changes represent the other challenge – most obviously in relation to the growing number and proportion of older people. Hence what was a small cadre of older people (aged 60 or over) is now a substantial cohort of ‘nearly 12%’ of the world’s population, projected to rise to 21% in 2050 [2]. At the same time, the prevalence of disability and range of long-term conditions increases with, of course, implications for telehealth and other services.

The extent of needs can, however, be at least reduced - first through the use of telehealth (and a broader range of ‘assistive’ technologies); and second through adoption of service frameworks that support greater self-reliance – whether for people at home, in the workplace, in training, or participating in family and social life.

Telehealth and the World of Standards

Given the nature of the challenges, appropriate standards around telehealth need to (a) safeguard providers and consumers of services in terms e.g. of the risks to which they might be exposed; and (b) steer the shape and operation of telehealth services towards those that are responsive, accessible, usable and flexible.

With regard to the lack of standards (regardless of their appropriateness) Krupinski and Bernard lamented differences in approaches and norms for conducting telehealth’ [3]. Standards for telehealth services would, of course, help to remedy this. The European Commission eHealth Action Plan referred to the ‘lack of … standards at an EU level’ [1].

The barren standards landscape for telehealth has, however, begun to change. What was a limited number of codes or standards around some aspects of telemedicine (as developed by the American Telemedicine Association, ATA, see www.americantelemed.org) and social alarms/telecare (notably as developed by the Telecare Services Association, TSA in the UK, see www.telecare.org.uk) are now complemented by a growing raft of codes that take either a broader ‘strategic’ position or are
more ‘operational’ and relate to specific telehealth service areas. Regarding this the work of the ATA is particularly notable in view of their guidelines covering at least six service areas including ‘home telehealth’ [3].

Taking the technological and demographic challenges as its context, the International Code of Practice for Telehealth Services offers a strategic framework that it is envisaged will guide the way in which telehealth services develop. Its approach has been noted as sharing common elements with the ATA Core Standards for Telemedicine Operations [3]. Both can be considered, therefore, as pointing to some strategic service ‘elements’ that require to be met regardless of the particular focus or operational framework being followed by service providers.

For the International Code the strategic framework offered is seen as linking to a range of more operational codes. It may herald, therefore, a shift away from the idea of telehealth standards as invariably offering rigid formulae (although certain basic requirements around e.g. governance and finance will always require to be met) towards more flexible frameworks in which different (and perhaps multiple) service models, driven by outcomes rather than rigid performance measures, have their place. This dual approach of a strategic and a range of operational codes responds to the developing consumer agenda and helps, it is suggested, to guard against the potential for telehealth services to be ‘technology-driven’.

Significant is the fact that the International Code has embraced all aspects of telehealth. This positions it to link to both new and extant operational codes – with the latter addressing, for example, specific service areas such as social alarms, telecare, mHealth, virtual visits or activity monitoring. Additionally, the Code’s international credentials are enhanced by its incorporation of the 2014 ISO Technical Standard ISO/TS 13131 on Health Informatics (Quality Planning Guidelines for Telehealth Services).

With regard to more operationally oriented codes various extant guidelines can be noted. For telemedicine, notable by virtue of its wide ranging content and its publication over a decade ago (in 2003) are the guidelines developed by the National Initiative for Telehealth (NIFTE, Canada) and available via the International Society for Telemedicine and eHealth see www.isfteh.org). The range of telemedicine guidelines offered by the ATA has been also noted.

In the social care arena, operational codes that focus on social alarms (personal response systems) and/or telecare include those of the Association Française de Normalisation (AFNOR, France) [4]; the Personal Emergency Response Services Association (PERSA, Australia see http://persa.com.au); the TSA; the Telecare Services Association New Zealand (TSANZ see http://tsanz.org.nz); and Wonen, Diensten en Techniek voor Mensen
(WDTM, Netherlands see https://www.wdtm.nl). All of these, of course, require certain criteria to be met and both the TSA and the TSANZ codes include specific and measurable performance indicators to be satisfied. Such codes will, it is envisaged, be added to through outcomes of current work within the CEN CENELEC Technical Committee 431 'Service Chain for Social Care Alarms’.

‘Operational’ codes (aside from those of the ATA) that address specific aspects of telehealth that also may also be viewed as telemedicine include those for vital-signs monitoring developed respectively by the TSA and Verband der Elektrotechnik Elektronik Informationstechnik (VDE, Germany) with the latter specifically addressing services that use of set-top boxes [5].

Conclusion

As telehealth services develop the ‘barren landscape’ of standards is necessarily changing. This paper has pointed to the strategic positioning and potential role of the International Code of Practice for Telehealth Services in relation to other codes – notably those that are ‘operational’ (and address, therefore, particular types of telehealth service). In a context of technological and demographic change the approach involving compatible strategic and operational codes is pointed to as offering the means by which peoples needs and choices can be more effectively responded to.

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eHealth for Low Resource Settings and Developing Countries
A Proportional Interoperability Framework as an Appropriate Growth Strategy for eHealth in Sub-Saharan Africa

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Introduction

The analysis of selected eHealth platforms implemented across the globe undertaken in the context of the ISAES study showed that there does not and cannot exist a generic blueprint meeting the eHealth interoperability needs of all possible application contexts. This applies all the more to sub-Saharan Africa (SSA). Core reasons are cultural differences across countries and regions, divergent health policy priorities, and concrete needs and constraints in a given context. Furthermore, successful implementations depend to a large extend on personal interactions and mutual trust, and henceforth local ownership. Trust can be gained by building on integrative, successful (eHealth) initiatives – which are often absent or only rudimentary in the African context – on any level, while local ownership can only emerge from adopting proven cooperative solutions meeting priority needs of the local community. Such an approach stimulates bottom-up thinking, which may generate heterogeneous, non-interoperable islands of operations. The standard answer to that seems to be top-down interoperability guidance by a central authority. This, however, is a fallacy: heterogeneity is a feature, not a bug that is to be overcome by a one-size-fits-all paradigm. The issue at stake is how to deal with heterogeneous interoperability. We propose a value-driven, hybrid approach with intense user involvement that incrementally improves interoperability proportionally to what can be gained in terms of improved health services for citizens in SSA [1].

Previous studies provide some insights into the critical success factors for eH-IOp in SSA [2-5]. These include (i) responding to basic health system priorities, (ii) acknowledging the continent’s rich diversity by addressing variety in urgent local or district needs, (iii) respecting the resource situation and absorption capacity of both medical and technical staff, (iv) implementing an appropriate governance and regulatory framework, and –
most of all – (v) assuring local ownership by involving all key stakeholder groups intensively and from the start. Organizing and promoting this productive cooperation between organizations and between people is especially critical for SSA innovation projects because these typically combine different sectors: besides the government and business, they involve not-for-profit organizations and thus combine public, commercial, and social logic [3].

Our concept of interoperability is that of an operational model of cooperation between at least two organisations; it only takes into account the necessary but sufficient conditions from 6 enabling dimensions, which we identified as social and political, regulatory, organisational, technical, semantic, and financial (see Fig. 1). The minimal demand for eH-IOp, requires (i) one mutually beneficial and agreed common use case, and (ii) its sufficient coverage by the necessary factors of the enabling dimensions.

Interoperability is only a means, and must not be confused with the goal it serves: improved health services and better health outcomes for citizens in SSA. These objectives can be pursued at international, national, district and local level, all with their own eH-IOp requirements, but nevertheless loosely coupled. We propose to facilitate this inter-level interoperability [7] by stimulating bottom-up strategic decision-making where possible, e.g., stakeholder-driven decision on appropriate improvements, and complement it with top-down architectural guidance where necessary, i.e., dimensional constraints that are tailored to the context of need. We will first discuss the

Figure 1: Enabling dimensions for eH-IOp and their levels of application

Mutually beneficial and agreed common use case

Organisation A

Proportional
Political / Social
Regulatory
Organisational
Technical
Semantic
Financial

Organisation B

Local
Regional
National
International

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specifics of (e)Health in SSA, followed by issues of its adoption, before discussing key principles for the eH-IOp framework.

(e)Health Challenges and Constraints in the SSA Context

Particularly in resource restricted environments, the focus of initial applications must be on supporting well defined core health system priorities, where relatively straightforward solutions will deliver early benefits to both professionals and patients. A corollary is that the scope must be commensurate to the given resource situation. Global evidence suggests that the more successful platforms can be found at the district (or small country) level, but sometimes linked to and taking advantage of cooperation at the national level. It must be sustainable within the phase of development (healthcare system, overall country) at hand. And it needs to be acknowledged that across SSA a wide variety of divergent factors impact on the respective national or district health policy priorities, concrete needs, and specific challenges to be considered, like available ICT infrastructures and eSkills, connectivity, reliable electricity supplies etc. Open source software should be considered, and systems should provide for replication technology that allows temporarily operation without network connectivity.

Issues towards Adoption of eHealth in SSA

Despite the great benefits of eHealth that drive the innovation and implementation of health care in SSA [9-11], there are many barriers as well that hinder the adoption. Several of those barriers are related to interoperability on all six enabling dimensions. The social and political diversity of this vast continent, e.g., heterogeneity of the market, does not make it easy to scale-up, spread or replicate eHealth solutions that respond to local needs. To quote Prahalad, “firms will be better off if they exploit the differences between countries rather than utilizing a more homogenous strategy” [4]. Differences in culture, language, level of development, infrastructure can all be causes that block cooperation and adoption. National longer-term health system policies are lacking or ineffective, and there is often a lack of priority from political leaders as there are many urgent topics, and short term solutions are preferred. As a result, many eHealth solutions lack African ownership as few are developed in SSA itself, and many are imposed and implemented by overseas companies or NGO’s. Often there is a lack of regulation that could help in focusing efforts in eHealth. eHealth should fit into an organizational structure with sufficient skills and resources that is often lacking at the local or district level. On the technical dimension the lack of reliable infrastructure is hindering eHealth. The lack of required skills to work with and maintain eHealth
solutions, an incomplete or invalid problem view and condescending assumptions are known barriers. Industry standards and technological solutions are developed by and for the “industrial countries”, and do not take into account the specifics of SSA, where, e.g., the current pressing issue in semantic interoperability is mainly about the many different languages. The financial and economic dimension is often a problem as eHealth demands an up-front investment to get a social profit in the long term that is not easy to monetize. Forgetting cost of ownership or user’s economic benefits, or an absent sustainability model are mentioned as root causes for failures [6]. Disposable income of patients is generally low and health insurances are scarce. This further challenges a (semi-) commercial driven approach.

Towards a Flexible and Demand-Driven eH-IOp Framework

The guiding principles of our framework inherently address these issues by combining an enabling structure for achieving interoperability with the notion of a flexible contextualisation for consolidating user needs. Rather than imposing interoperability through top-down rigidity, it allows for selection-based guidance that is directly tied to improve health services for citizens in SSA. Inspired by the EIF eHealth framework [8], we propose (a) the notion of partitioned principles of good administration of eHealth in the context of SSA, (b) service domains or use cases to reflect user demand, and (c) discerning various levels of interoperability in order to classify issues. The principles are selected from topics at all levels, e.g., technical about information exchange and distribution (openness, security, reuse, etc.), or organisational about provisioning mechanisms (access, process), and alike. The service domains should initially reflect the most relevant application domains of eHealth, including all necessary stakeholders. The interoperability levels express concerns with respect to organisational, semantic, technical, etc. interoperability in support of the use cases and are shaped by the guiding principles. This creates a toolbox of clustered concerns: profiles that resolve SSA-specific impediments to eHealth by addressing related issues from various dimensions in a coherent context. An example can be found in the guiding principle of stakeholder centricity. Based on available use cases in SSA, this may transform into medical professional centricity, as opposed to, e.g., patient centricity in Europe. This translates into a focus on multi-channel delivery to the professional, or integrated decision support. It goes without saying that profiles can be extended to respond to future impediments of eH-IOp.

Discussion and Conclusion

The social embedding of the proposed framework should come from
human agents as linking pin between the society and platform operation. This implies educational material, not only about its technical operation, but on all aspects of interoperability. It further implies addressing stakeholders on all levels, with appropriate arguments, to take ownership on this aspect. This might turn out to be quite difficult to achieve.

In SSA, eHealth interoperability is important, but not at all costs. Our approach provides for a framework that, when weighing contradicting needs, allows one to take a pragmatic, hybrid or even non-interoperable approach for one or more dimensions, as long as a sustainable, effective improvement of health services for citizens in SSA can be achieved.

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Demonstration of Virtual In-service Telementoring from Omaha Nebraska to Set Up a Novel Telemedicine Platform in South Africa

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Abstract. Telemedicine provides a method to extend specialty reach to underserved populations through use of new communication technologies. This technology could be especially useful in Africa where patients may need to travel great distance to a specialty provider. We have demonstrated that the Telepack X can be used as a successful telemedicine platform to support general and endoscopic telemedicine functions. In this project we demonstrated that a distant site medical team could be telementored in the set up and use of the Telepack X for telemedicine purposes.

The views expressed in this manuscript are those of the author(s) and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

Introduction

When a new technology is introduced into a medical care setting, an in-service training is commonly performed to train personnel in the set up, care and use of the new technology. If the new equipment insertion is being performed at a distant, rural site, difficult, costly travel may be required to perform the equipment in service training. This project demonstrates the use of Virtual In Service to provide training in the set up, use and care of a telemedicine platform capable of supporting endoscopy.

Methods

A Telepack X (Karl Storz GmbH & Co. KG, Mittelstrabe 8, Tuttingen, Germany) and a Epiphan DVI2USB 3.0 Frame Grabber (Epiphan Systems Inc, 540 University Ave. Suite 250, Palo Alto, CA) were shipped to the Red Cross War Memorial Hospital, Cape Town, South Africa. A teleconference was conducted using Vidyo (Vidyo Inc, Hackensack, NJ), between the Red
Cross War Memorial Hospital and the University of Nebraska Medical Center. Bandwidth used for the videoconference was 768 kb/s to 1 mb/sec.

Results

By videoconference, the participants at the University of Nebraska Medical Center were able to demonstrate to the team at the Red Cross War Memorial Hospital how to integrate the frame grabber with the Telepack X and computer. Common information technology problems that the UNMC team had experienced with the Telepack X telemedicine system were shared with the distant site team. A description of work flow for the telemedicine device to support teleendoscopy was outlined. Exact, detailed descriptions were provided to show the connection points for the frame grabber and telepack (Fig 1 and Fig 2). Endoscopic images using a Vitom (Karl Storz GmbH & Co. KG, Mittelstrabe 8, Tuttlingen, Germany) were transmitted from the South African site to the Omaha site. Audio and video quality was excellent.

Discussion

This demonstration showed that a Telepack X with frame grabber could be inserted into a distant site, spoke hospital and the equipment in service training could be successfully conducted by videoconference. This concept has high utility if a novel, complicated medical device must be inserted into a remote, rural site where travel is difficult, costly or dangerous. This concept can also
support the expansion of new medical technology by saving the travel cost for in service training.

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Enabling Virtual Visits to the ICU at Apollo Hospitals, Chennai India

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Introduction

Reducing physical visits to the ICU (intensive care unit), contributes to reduction of ICU infection. Many ICU’s enforce a protocol of changing attire and scrubing before entering the ICU. However relatives still wish to see their sick near and dear often and get constant updates. Often potential visitors are located in faraway places making physical visits difficult. To bridge this, the I SEE U Service (patent pending) was conceptualised and implemented, enabling Virtual Video Visits from anywhere in the world. A high level of privacy and security is however required to ensure that only authorized personnel are allowed to make these virtual visits. Interaction with the Cubicle Nurse and Duty Doctor enables a real time interaction with an ICU patient report leading to “customer delight”

This unique service enables patient’s authorized friends and relatives to “SEE” and closely interact virtually with the patient and the duty doctor/nurse, from anywhere in the world, through the internet. Multiple Consultants and the Primary Physician can now make additional professional Virtual Visits resulting in closer and better patient care. A high definition Networked IP Camera, with extensive pan, tilt and zoom features was initially identified. Specific software was developed to ensure a high level of privacy and security so that only authorized individuals are allowed to make virtual visits. These cameras were fixed in 25 cubicles initially. Trainer Manuals were developed to ensure that nurses, ward secretaries, telephone operators, IT support staff, Junior Doctors and Consultants knew the entire sequence of events to make a Virtual Visit. A simpler user friendly note was prepared for friends and relatives of patients. A small “visiting card” summarizing the steps to use the I-SEE-U service was also provided (Fig 1) Patient’s relatives were made aware of this facility. A fool proof administrative system was devised to ensure that the billing would seamlessly integrate with the hospital HIS. Virtual visits were initially recorded and archived but subsequently this was discontinued. Specific sets of hours were identified for virtual visits, to ensure that nursing care is not affected.
Objectives

They included: a) To provide a highly secure, reliable, state of the art method to enable Virtual Video Visits from anywhere in the world, to authorised relatives and friends of an ICU patient; b) To facilitate multi-point VC with relatives, with duty doctor at the ICU patient’s bedside, for real uptime updates and c) To help physicians make additional professional visits virtually from home, office or while travelling and to directly visualise monitors in the ICU.

Methodology

Training Sessions were initially conducted for all stakeholders. Billing was integrated with the HIS. An introductory I-SEE-U coupon was provided to every ICU patient’s relative during admission, detailing the following steps: Call Apollo Call Centre only from the registered mobile number (for security and privacy) to initiate the I See U Service, and agree on time of Virtual Visit (VV). After VV time was reconfirmed by the ICU cubicle nurse, SMS and email was sent to the registered mobile number and registered email giving the One Time Password (OTP), specific to the cubicle camera, used in the URL (www.iseeu.apollo.net.in). The OTP could be shared by the authorised relative. On entering the URL, the access page displays a simple user friendly menu enabling the visitor to pan, tilt and zoom the cubicle camera. Once the VV has commenced the Apollo Call Center will enable an audio call with the duty nurse/duty doctor and if clinically permitted also with the patient.

25 IP cameras were installed in 25 ICU cubicles at the Apollo Main Hospital, Chennai, India. This was made part of an existing LAN with a dedicated server, hosting the I-SEE-U software. The software was located in a cloud accessible via a browser. The exclusive URL ensures remote access from anywhere. The cameras were networked to a standalone IBM server. A firewall was deployed for checking internal and external network access. Software was developed, governing camera access in a highly secure manner. The software had four separate functional logins. Each profile had different privileges and access control rules. SLA’s were ensured.

The Call Center login provided a dedicated interface which helped verify, that the request for the virtual visit had originated from the single authorized mobile number, registered in the hospital records. After Virtual Visit details were noted, the call center executive called the ICU cubicle Nurse to inform her/him of the registered request. Nurse accessed the software interface and clicked on “approve”. The nurse is also authorized to postpone or cancel a request and can even cancel an ongoing Virtual visit. Following Nurse approval, a software generated SMS and Email is sent to the authorized
patient’s relative, who in turn can forward this to the Virtual Visitor. This contains the URL, Username and Password to access the specific cubicle ICU camera. Automatic disconnection occurs 7 minutes after commencement of virtual visit. For Consultants, a 3 hour window is provided to make the virtual visit. The software’s Admin interface has the power to add cameras, check logs, download reports etc. Virtual visits can also be made from a dedicated room in the ICU waiting area.

Ranges of success defined for the project included development of a patient friendly, easily replicable, cost effective, need based, self sustaining service, which acted as a major differentiator in ICU’s. Preliminary feedback suggests a high level of doctor and patient satisfaction. To reduce CAPEX, mobile wireless I-SEE-U carts, are being deployed in other ICU’s to extend the reach. Innovations included seamless integration of an “open” I-SEE-U network, with a “closed” highly secure hospital network, subsequent designing of Wi Fi enabled mobile I-SEE-U carts to reduce CAPEX and increasing access to Virtual Visits. A Secure I SEE U Mobile App, for Android mobile phones, is under development.

Results

80% of the 597 virtual visits, made in the first 68 weeks, were by the immediate family, 3% were from relatives overseas, 10% were professional physician visits (Fig. 2 and 3). Initial technical glitches were addressed ensuring a subsequent seamless experience. Increased opportunity for relatives and friends for virtual visits (from anywhere in the world) and virtual interaction with nurses and doctors resulted in increased satisfaction. Opportunity for additional professional visits virtually, is expected to result in better patient management. Reducing an accepted source of infection is also expected to be helpful.
Fig 2: Virtual Visits by consultant (a, b) to ICU and from the waiting room (c)

Fig 3: Analysis of Virtual Visits Sep 2013 to Jan 2015 in Apollo Main Hospital

Conclusions
With nominal charges, no consumable items, high level of privacy and security, increasing utilization and an “excellent experience”, Virtual Visits will become self-sustaining. Though networking cameras have been used for multifarious purposes, a perusal of the world literature, failed to reveal any instance, where virtual patient visits to ICU, from anywhere in the world, were enabled with IP cameras. This original, creative and innovative project led to: a) additional round the clock Physician Visits, leading to better patient care and closer interaction with the family; b) reduction in number of allowed physical visits to the ICU, further lowering an established contributory factor towards ICU infection; c) Customer Delight – More visits allowed from anywhere in the world, leading to closer and better communication, authorized visits - A secure software ensures that patient privacy is maintained. This Value Added Service ensuring “customer delight” is self-sustaining, with a nominal charge being levied and a differentiator in ICU Patient care.

This facility has been replicated in the MD-CCU at Apollo Specialty Hospital at Vanagram, the Apollo Specialty Hospital at Anna Sali and the Apollo Hospitals Karaipakkam in Chennai. A mobile wireless I-SEE-U cart, has been designed and implemented here.

Table 1: Examples of Feedback

<table>
<thead>
<tr>
<th>Feedback</th>
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<tbody>
<tr>
<td>I was at least, able to see my closest friend in an ICU in another continent, before he passed away</td>
</tr>
<tr>
<td>It was absolutely fantastic - relatives from different states in USA having a VVV with the ICU doctor in Chennai at the patient’s bedside</td>
</tr>
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</table>

For the Physicians it has been very useful, to reduce the overall physical visits (late night visits, while outstation etc.). For ICU consultants, also this has been very useful to keep a watch on serious cases from their home. While on travel they were in touch with their patients virtually and guide the covering consultant. Support from Nurses, CCU Physicians, Primary Physicians, Apollo Call Center team and patients are critical for the success of the project. Regular training sessions are conducted for call center and Nursing teams. Daily announcements are made in the ICU waiting area for information to patient Relatives. Reduction in physical visits helps employees to concentrate on work better. Possibility of Virtual visits will keep ICU staff even more alert.
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Healthcare Strategies Using Telemedicine and Sharing Know-How in Open Source

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Introduction

Despite increasing investments in health societies are not becoming healthier and the global challenges either remain or new challenges arise. One of the main challenges is the lack of health care professionals especially in low resource settings. A patient usually requires the care of a multidisciplinary team of healthcare professionals. Experts are a scarce resource and cannot be everywhere, particularly in remote and developing regions.

Telemedicine, which already exists several decades, holds a great potential to alleviate this situation by providing expert knowledge over distance, by coordinating the work of health care teams around a patient and thus contributing to a more effective and efficient health care delivery. However, although many useful applications have been developed and many problems have been already solved, most of these solutions are not disseminated and adopted at a large scale and the implementation starts over and over again in different locations.

One possibility to overcome this “reinvention of the wheel” and the current fragmentation of solutions is the use of Free/Libre Open source software (FLOSS). FLOSS is software that is licensed in a way that grants the user the right to study, modify and improve the source code and thus gives the user the possibility to adapt the system to local needs and requirements. Some famous examples from other domains are the GNU/Linux operating system, the Android mobile phone operating system, the Apache Web Server and many other tools like Office Suites or Content Management Systems.

Free/Libre and Open Source Software in Health Care Delivery

As an example for the domain of telemedicine the project IPATH \cite{1} provides services to remote hospitals that can perform a surgery, but have no pathology expert on site to evaluate the meaning of pathology slides. IPATH is working for more than 12 years and is used by many different
medical teams to coordinate their work, to discuss cases, to use it for capacity building or teaching. IPATH has been first tested on the Solomon Islands [2] and now covers a global network with more than 4400 users and currently 172 different groups. The IPATH software is freely available and can be downloaded and modified, installed on local servers and adapted if needed. This is only one of many examples how FLOSS can serve the community. The MedFLOSS database [3] lists more than 300 software systems available under a FLOSS license. This database has been co-developed and is supported by the “Collaborative Care Team in Open Source (CCTOS) Working Group” of the International Society for Telemedicine and eHealth (ISfTeH) [4].

Sharing of Knowledge and Resources

Healthcare activities are similar in every region of the world, although taking account of some cultural differences. There is no reason to start from scratch again and again in every country. The goal is to share know-how not only about medical knowledge, but also about software, including the full documentation. Open source is a way to avoid dependency from any single informatics provider who could not provide the desired work or could raise the prices unilaterally. Open Source is a factor of quality making peer review easily possible. Moreover transparency allows to control that the software is doing what it is intended to do and nothing else. However Open Source limits the costs, but is definitively not completely free. Indeed every new installation requires support for installation and training of the first users. This means that regional professional support service is essential for the adoption of FLOSS solutions by health care providers.

Collaborative Care – A Team Based Approach

As outlined above health care professionals are a scarce resource. In order to be efficient, care teams need to share well documented patient records. Questions to a higher level of expertise and specializations need to be well formulated. The main objective is to help to solve patient problems. A "health issue" is here defined as any health concern requiring attention. At an early stage there is not enough data for a qualified diagnosis. When the health issue will become better understood, it may become a diagnosis. The main steps of a diagnostic procedure are:

1. To record complaints and observation,
2. To identify one or several likely issues,
3. In function of these issues, to take decisions about appropriate actions, more examinations and/or treatments.
These 3 steps are repeated in an iterative way, as soon as new observations become available.

Most of the available tools do not support this iterative diagnostic procedure and thus do not support the medical workflow in an optimal way. This leads to a lack of adoption of eHealth tools on the side of health care professionals and thus compromises the transition to a paperless and more efficient health care provision. The CCTOS WG works on a prototype that implements the workflow of a diagnostic procedure and reflects more the “medical methodology” that the traditional user interfaces that have been adopted by most of the eHealth tools.

As already pointed out health care delivery is similar all over the world and differs due to cultural and financial differences. However, health systems are very different and therefore Health Information Systems have to be adapted to local requirements. FLOSS is ideally suited for this situation since it allows the user to access the source code, study, modify, adapt, improve and redistribute the code. This also helps to build capacity in the regions. Since health care providers do need professional support services FLOSS provides the best opportunity to create local IT support companies that can take over the support and maintenance of health information systems. The OSCAR system developed at the McMaster University in Canada has grown into an ecosystem of companies providing support and an active user and developer community [5]. More than 1.5 Million patients are currently served by OSCAR. The Bika Open Source LIMS project provides an open source laboratory information system [6]. Bika LIMS is developed by Bika Lab Systems from South Africa. GNU Health is an award winning Hospital & Health Information System especially for low resource settings [7]. Jamaica is the first country in the world to choose a Free/Libre Open Source Software (FLOSS) system for their entire public healthcare system. In 2013, the Jamaica Ministry of Health opted for GNU Health, a Free Health and Hospital Information System under the GPLv3+ license. More installations of GNU Health can be found in Argentina, Malaysia, Kenya, Laos and the Philippines. The District Health Information System DHIS2 [8] is considered one of the largest health management information system and is used in more than 30 countries.

Conclusions

Collaboration is the key to solve the challenges of health care delivery on a global scale. This is true for the process of health care delivery where all stakeholders should work in a team-like fashion as well as in the process of developing software systems to support health care delivery. Free/Libre open source principles provide excellent framework conditions to develop
systems in a user-driven and evolutionary way as well as building regional
capacity in small and medium enterprises that provide professional support
services for health information systems.

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Mobile Phone Technology: A Boom for Interactive Telemedicine in Nigeria

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Introduction

Telemedicine is commonly seen as the employment of telecommunication and information technologies in order to provide clinical health care at a distance [1]. This product of 20th century telecommunication and information technologies essentially aids to eliminate distance barriers, improve access to medical services that would often not be consistently available in distant rural communities and saves lives in critical care and emergency situations. Above all, it enhances a confidential and healthy interaction between patient and medical staff at convenience and permits a reliable transmission of medical, imaging and health informatics data from one site to another [2].

Telemedicine can be beneficial to patients living in isolated communities and remote regions, without the patients having to travel to visit the Doctors or other health professionals. Recent developments in mobile collaboration technology can allow health care professionals in multiple locations to share information and discuss patient issues as if they were in the same place. Telemedicine can also facilitate medical education by allowing workers to observe experts in their fields and share best practices more easily. Telemedicine can also eliminate the possible transmission of infectious diseases or parasites between patients and medical staff.

Telemedicine can be easily categorized into three; store- and- forward, remote monitoring (real time) and interactive services. Simply put, store- and – forward telemedicine focuses on acquiring medical data (e.g. medical images, biosignals etc) and transmitting same data to a doctor, clinical psychologist or any medical specialists in need of them at a convenient time for assessment offline [3]. Remote monitoring permits medical professionals to monitor patients remotely via the use of various technological devices. Interactive telemedicine services permit real time interactions between patient and provider to mobile phone conversations, online communication and home visits [4].

Nigeria and Telecommunications

Nigeria is recognized as a major market for telecommunications
equipment and services on the African continent. With a population of more than 140 million, it remains Africa’s most populous nation. This potential was harvested during the civilian administration of General Obasanjo as the president of Nigeria in 1999. Since then Nigeria has pursued an aggressive market liberalization policy that has made it perhaps the most liberalized telecom market in Africa. Thus the attention of the global village is now on Nigeria as a nation with the highest ICT investment on the African continent. In Nigeria, the mobile phone has surely made interpersonal communication a lot easier. The facility is owned by almost everyone including village peasants. It is no longer exclusively for the wealthy class as initially seen. Primary school pupils, students in secondary and tertiary institutions, traders and even barrow pushers are always seen proudly displaying their mobile phones while making or receiving calls [5]. Nigerians tele density exceeds 50% with about 74 million subscriber lines as at the end of December 2009 [6]. Hence access to modern telecommunication services is now within the reach of more than 90 percent of the people who live within Nigeria today. Daily activities such as shopping, entertainment, banking, manufacturing, office work, education, medical care, governance and even commuting have become increasingly dependent on information and communication networks.

The Nigeria communication commission (NCC) has established a regulatory environment that has led to the creation of robust, pervasive and ubiquitous information and communication technology infrastructure across the nation. This has aided a fast growing socio economic development and enhanced living standards of the citizenry. Presently NCC has championed a new focus on broadband internet deployment in Nigeria in areas such as public safety, national security Telemedicine, e-governance, e-health, e-commerce, distance learning and utilities etc.

Mobile telephone services are having a positive impact on Nigerians by enabling greater information and bringing a wide variety of services to the majority of the country’s population. As at 2009, 73 million Nigerians were subscribers representing 49 percent of the population [7] and today about 129 million people are active
subscribers.

Mobile Phone Subscription Penetration of Nigerian Population

The Nigeria mobile market has boomed in the past few years, highly supported by a successful programme as well as positive political and economic government. The first set of GSM license was issued in 2001. At present there are five main GSM operators (MTN, Zain, GLO, MTEL, and Etisalat) as well a multitude of smaller CDMA operators. MTN, GLO, and Zain alone account for 85% of mobile subscriptions in Nigeria creating an influx of foreign direct investments, especially in the mobile services segment.

Advantages of Mobile Phones

1. Reduction of unnecessary travel and accidents
2. Internet access with a measurable beneficial impact on the development of the rural population.
3. End users’ positive reaction to the delivery of information in their local language.
4. Social transformations and hence, bringing connectivity to remote and sparsely populated areas and to lower-income strata.

Mobile technology has the potential to transform the Nigerian health sector. Today, new and innovative applications are emerging to improve the way healthcare is administered and managed. The most common use of mobile technology in the health sector is to provide access to emergency services and to increase awareness about the treatment and prevention of rapidly spreading diseases such as HIV and Ebola.

Presently, Nigeria is facing an increasing aging population with its
antecedent challenges. Aging of the population increases the need for healthcare and emergency response applications for the elderly. Products such as the Philips lifetime medical alert allow aging individuals and those with limited mobility to have access to emergency services with a touch of a button. These communicators are carried on the neck, wrist or pocket of the individual and connect to a fixed or mobile network in order to notify emergency services personnel about life-threatening situations. Once notified, emergency services personnel decide what the appropriate course of action will be.

Advantages of Mobile Phone Technology in the Nigerian Health Sector

- Quick information for health professionals;
- Prompt and adequate communication between health professions and, of course, with their patients their patients;
- Easy provision of care not previously available - Nigerian citizens dwelling in the rural and very difficult to penetrate remote areas are now easily reached via the use of mobile phones. There is now faster access to the health professionals, increased convenience and time savings for patients, improved quality of care etc.;
- Home monitoring and treatment - mobile phone technology has visibly helped in the home monitoring and treatment of patients suffering from a wide range of diseases such as diabetes and hypertension. Home nursing, emergency health situations and care for the elderly and chronically ill have reached a boom via mobile phones. Patients who are home-bound and would otherwise require an ambulance to move them to a clinic greatly stand in to benefit from the use of mobile phones. Remote patient monitoring through mobile technology can reduce the need for outpatient visits and enables remote prescription verification and drug administration oversight, potentially significantly reducing the overall cost of medical care.

Conclusion and Recommendations

All nations across the world often give the health sector a looming aspect of their annual budget. The developed nations may seem to be realizing the goal of their huge investments in the health sector but for the developing nations their efforts and pursuits measurably end up in a mirage especially in the face of their poverty, paucity of advanced technologies, absence of enough and qualified health professionals, aging population and distance between the cities and rural areas and available facilities and patients. Access, equity, quality, and cost effectiveness are key issues facing health care in both developed and less
economically developed countries. Modern information and communication technologies (ICTs), such as the computers, the internet and cell phones are revolutionizing how individuals communicate with each other, seek and exchange information, and enrich their lives. These technologies have great potentials to aid in addressing contemporary problems. Telemedicine, a 20th century product, is already penetrating the entire global village with the much needed solution to clinical health care at a distance, convenience and affordable costs. Mobile phone technology, an integral part of telemedicine, is affording Nigerians an increased access to information, communication and health education, facilities and services and a reduction and elimination of infectious diseases. However, the free night calls introduced by some GSM service providers has become a problem as many people especially the youths and the poor prefer to chat instead of having a sound sleep. Again there is still this controversy surrounding the effect of mobile phone radiation on human beings. We therefore recommend further studies on the exact scientific effects of mobile phone on human health to aid us conclude if it is really a boom or doom for Nigeria bearing in mind its large population presently involved in its use.

References


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Spontaneous Telemedicine Services – What Can We Learn?

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Introduction

A great deal has been written about the uptake of telemedicine and the factors that influence this. Current thinking advocates against the use of words like pilot and project, as these infer a limited lifespan. Rather we should be talking about telemedicine programmes or services built on sound needs assessment, business plans, implementation and change management strategies, and ongoing evaluation and monitoring to achieve sustainability.

Telemedicine is evolving in different ways in health systems and with different priorities, funding models, regulations and cultures. There is general agreement that telemedicine has reached the point of acceptance when it is an integral part of the everyday practice of a discipline [1]. Radiology is the prime example. We seldom hear of teleradiology except from developing world countries where digital radiology is still a novelty [2].

What is required to develop a successful telemedicine service? Yellowlees put forward seven core principles for successful development of telemedicine in 1997 [3-4]. This has grown to eighteen critical success factors, built around: strategy and management; organisation and management; legal, regulatory, and safety issues; and technical and infrastructural issues [5].

But what happens if a telemedicine service is unplanned and evolves spontaneously? Is it doomed because the various planning and implementation steps have not been followed, or is it an indication of a maturing field with acceptance by clinicians of everyday use of technology, i.e., their mobile phones, to the advantage of both patients and themselves?

This paper provides early reports of two mobile phone based telemedicine services which have evolved spontaneously without advance planning.

Setting

Both services have begun in KwaZulu-Natal in South Africa and involve staff at the local medical school and doctors working in government funded hospitals. About 85% of the population is dependent on government hospitals and many district hospitals are short staffed and lack specialists in
various disciplines. The doctors in government hospitals are salaried and not paid per patient attended. There have been several small scale telemedicine initiatives in the province which have been running for up to twelve years [6]. Videoconference based tele-education is widely used [7].

Case 1: Mobile Teledermatology

The Department of Dermatology at the Nelson R Mandela School of Medicine was an early adopter of synchronous teledermatology in 2003. Four district hospitals regularly conduct scheduled referral sessions with dermatologists at either the medical school or Inkosi Albert Luthuli Central Hospital in Durban. This has saved over 70% of patients a journey to Durban, a round trip that can take several days [6].

Previous attempts between 2000 and 2008 to establish store and forward teledermatology for rural hospitals failed because of lack of Internet access in hospitals. Doctors had email the patient’s history and clinical findings with attached photographs from home after work. Late in 2013 dermatologists reported that they had begun receiving store and forward cases from their trainees and rural doctors and that these cases had been photographed and sent from smart phones or tablets. They replied from either their mobile device or computer because they perceived that dealing with the case online meant one less person in their outpatient clinic.

What had changed? Technology and culture: access to and use of smartphones, with reduced data costs allows easy Internet access and a growing awareness of sharing images and data via social networks. Doctors had unwittingly worked out for themselves that they could develop a store and forward service that met their own and their patients’ needs. The service was unplanned and is growing.

Case 2: Teleburns Management

There are three burns units in KwaZulu-Natal with a total of 112 burns-beds. It is estimated that there are somewhere between 7,000 and 30,000 burns patients a year in the province, requiring at least 475 burns-beds be available [8]. Hospitals with surgical units are reluctant to manage burns patients, and inappropriate and delayed referral to burns units of adults (40%) and children (30%) is common. Additionally, clinicians who do not regularly manage burns tend to overestimate both the area and depth of the wound [8]. The unit in Durban has a policy of not accepting referrals for admission or to their weekly clinic without a prior discussion with the referring doctor to determine if the patient warrants referral or, when no beds are available, advising on immediate management. A paper record of each telephonic consultation is kept on a standardised pre-admission form.
It is not always possible for senior staff to be present when dressings are changed in the unit. To assist in making decisions on further management, for example readiness for skin grafting, junior staff began taking photos of the exposed wounds on their mobile phones and discussing the pictures with their seniors. The images were not transmitted but assessed directly from the stored photographs on the phone. This has been regular practice for over three years and nursing staff also take photographs with their phones if no doctor is present.

In mid 2014, a decision was made to request referring doctors to submit photographs of the burn wounds after the telephonic assessment and before making a decision on patient management. The clinical decision is then sent back to the referring doctor by SMS or WhatsApp. In many instances the images are sent using WhatsApp or MMS. If the decision is not to transfer the patient advice on further management is given, with a request for more photographs after initial treatment. In November of 2014, a database was developed to store the photographs and information from the pre-admission form. The database is currently on a consultant’s laptop and password protected. It is backed up on the hospital’s Intranet which is also password protected.

No planning for this service was made, other than a decision to require provision of photographs of the burn wounds before a decision to accept the patient was made. This decision was based on successful use of photographs during wound dressing and the desire to improve existing decision making based solely on verbal communication and completion of a pre-admission form. The database was seen as a more efficient way of storing the data and images and is the first step in further evolution of the service.

Discussion

The Health Professions Council of South Africa (HPCSA), a statutory body tasked with regulating the practice of medicine in South Africa, has been working on draft ethical guidelines for the practice of telemedicine in South Africa for over eight years. Both these services meet their definition of telemedicine.

The draft HPCSA guidelines require that telemedicine consultations should be restricted to situations in which a prior healthcare provider-patient relationship exists. This requirement is contrary to the goals of the National eHealth Strategy [9]. Further, in the burns service (Case 2), admission was previously decided on the basis of just a telephonic conversation; i.e., without a prior doctor-patient relationship. The addition of images actually improves decision making.
The ethical guidelines also have onerous requirements relating to written, signed informed consent with copies held by the referring doctor and the patient. The referring doctor must also keep detailed records of the patient’s condition and information transmitted and received from the specialist, and the specialist must keep detailed records of the advice given as well as the information received on which the advice was based. Whether the referring doctors are keeping adequate records is unknown. In the burns service the pre-admission form and the database fulfil that requirement. The dermatologists store their records on their phones or computers.

The HPCSA draft guidelines require that data transmitted should be encrypted, and this is not happening. Furthermore, where images are transmitted both the referring doctor and the specialist are said to be responsible for ensuring that there is no critical loss of image resolution from acquisition to final display. How either party is to achieve this is unclear.

These two spontaneous services have taken different approaches, neither of which follows the 18 steps for successful implementation of telemedicine or HPSCA draft guidelines. They currently succeed because the doctors see the benefits to themselves and their patients. But both need to be formalized so that they meet regulatory and legal requirements. However, inappropriate ethical guidelines need to be challenged and amended.

Is physician “need” the major factor for successful telemedicine implementation?

References

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Tele-Health Living Lab Framework Acting as a Proposed Solution for e-Health Strategy Implementation in South Africa

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Introduction and Background

South Africa (SA) is a relatively large country of 1,221,037 km2, lying at the Southern tip of the Continent of Africa and is bordered by six countries, Botswana, Lesotho, Mozambique, Namibia, Swaziland and Zimbabwe [1]. SA government have strong commitments to promote improved health services and the quality of life of its citizens. They have implemented the National Health Insurance System (NHIS) to provide all South African citizens with essential health care. The challenges currently SA is facing in the health sector are the shortage of health professionals, inefficient health record management, poor communication between the various health entities and poor disease control and surveillance [10].

Telemedicine has become an integral part of the DoHs E-health plan in SA, with more than R15 million being invested in various Telemedicine projects in recent years [2]. Despite these investments, it has been reported that the uptake of the technology has been limited with only 34% of Telemedicine sites operational [2]. According to [1], the poor uptake of Telemedicine is not unique to SA with many authors reporting similar results in other developing countries. Previous literature reported that the technology was not reliable due to frequent interruptions of electricity supply, poor connectivity and low bandwidth [7]. Telemedicine has been introduced at six district hospitals and 25 clinic sites around the Eastern Cape in the past five years. These pilot sites have not produced the desired results, and it was found that the technology was underutilised or not used at all. Therefore, an investigation is needed before any financial investment is made in further sites [3]. E-Health is the use of telecommunications and computer technology to transmit and provide medical information and services [9]. The term e-Health is more precise than telemedicine because it involves all aspects of e-Health services including health promotion,
prevention, education, research, population data collection and health management [4]. It is particularly valuable in remote areas. This overall technology covers a broad range of specific applications and technologies, suited to differing environments. This paper reports on current status of e-Health strategy implementation in SA and proposing the Tele-Health Living Lab Framework that will act as a solution for e-Health strategy implementation.

The Current Status of e-Health Strategy Implementation in SA

SA, like most African countries has limited health information systems infrastructure; some health information system components are implemented on an ad-hoc, piecemeal basis and are designed to solve specific problems [10]. Little attention is paid to how these components can be integrated into a national health information system [12]. In a survey of e-Health readiness of hospitals in the North West province of SA, [11] concluded that urban hospitals in SA have more Information and Communication Technology (ICT) equipment than rural hospitals. Internet connection is more reliable in terms of connectivity and speed in urban hospitals. In rural hospitals however, the connectivity and speed of Internet services are affected by poor telephone lines and interruption of electricity power supply [5]. The average ratio of computers to doctors in rural hospitals is 1:3 while it is 1:2 in urban hospitals [11]. However, doctors do not use computers for their clinical duties but for searching for information and sending emails. Computers are used by staff for capturing patients’ demographic information and revenue collection [8]. According to [7], there is no patient e-Health record system, e-Consultation, e-Prescription, e-Referral and e-Training in both urban and rural hospitals in the North West province. The ICT systems are not integrated to work together within and across hospitals to allow healthcare professionals to gain benefits of e-Health solutions and applications. This means that the e-Health maturity curve is at zero level and this is a picture that is repeated all over SA. Historically, health information systems in SA have been characterized by fragmentation and a lack of coordination, prevalence of manual systems and a lack of automation, and where automation has existed, a lack of interoperability between different systems [7].

According to [1], only a third of SA’s provincial hospitals have some form of functional electronic medical record (EMR) system and the several systems that are in place are not interoperable. The commercial EMR market in SA is dominated by Meditech, Medicom and Clinicom. In the Free State Province, for example, Meditech has an integrated patient management system implemented across the province. The proposed e-
Health strategy in SA aims to support the strategic objectives of the DoH in a way that is comprehensive, pragmatic and innovative [2]. It defines e-Health as a broad domain which includes m-Health, Telemedicine and all ICTs used to promote, support and strengthen healthcare. Linking its vision and mission to the health sector’s Negotiated Service Delivery Agreement 2010-2014, it aims to supports the medium-term priorities of the public health sector, pave the way for future public sector e-Health requirements, and lay the requisite foundations for the future integration and coordination all e-Health initiatives in the country [6]. The strategy adopts a set of principles which include getting the basics right, taking an incremental approach, building on what already exists and looking for early wins. According to [2], following are ten strategic priorities for e-Health that are identified and the key activities required for each of these priorities to be outlined: Strategy and Leadership, Stakeholder Engagement, Standards and interoperability, Governance and Regulation, Benefits realisation, E-Health foundations, Applications and Tools to support healthcare delivery, Monitoring and Evaluation of the e-Health Strategy. This strategy is a product of a concerted effort by a team of officials from the National DoH and the Medical Research Council (MRC) who worked tirelessly to develop it, in constant consultation with the NHIS of South Africa (NHIS/SA). The Technical Advisory Committee (TAC) of the National Health Council will provide the technical oversight required to ensure successful implementation of this strategy.

Research Methodology and Problem Identification

The content of this paper follows a simplified strategic planning process; it was conducted as a literature review which starts by introducing the current status of e-Health strategy implementation in SA and continues to research the existing literature in order to discover the current key challenges in relation to e-Health strategy implementation. This paper proposes a Tele-health Living Lab Framework that can act as a solution for e-Health Strategy implementation in SA.

Historically, health information systems in SA have been characterised by fragmentation and lack of coordination, prevalence of manual systems and lack of automation, and where automation existed, there was a lack of interoperability between different systems. Some of the key challenges identified by DoH in relation to e-Health implementation strategy are [2]:

1. Silos of information within levels of government departments and programmes within the national and provincial departments of health, resulting in duplication of effort and disparities in reporting:
2. Broadband connectivity is expensive and still out of reach of many citizens;

3. A low degree of cooperation, collaboration and sharing across all sectors;

4. A lack of cooperation between various groups resulting from lack of a clear understanding that e-Health includes all ICTs for health such as mobile technologies, telemedicine and electronic patient records. This lack of cooperation prevents urgently needed progress in using e-Health as an enabler.

Tele-Health Living Lab Framework

A Living Lab (LL) is a user-centric innovation milieu built on every-day practice and research with an approach that facilitates user influence in open and distributed innovation processes engaging all relevant partners in real-life contexts, aiming to create sustainable values [13]. This approach offers its client group with an opportunity to expand much deeper perceptive of how various mechanisms in their useful locations function and interconnect. The impression at the starting point of a LL, is to turn clients from being considered as merely subjects to whom new products or services are simple proposed into dynamic players contributing to the co-creation and experimentation of emerging ideas, breakthrough scenarios and innovative concepts [14].

Part of recommendation and suggestion in devising a plan of action for SA, is to pursue the development of Tele-health Living Lab Framework. Fig 1, illustrates this framework and it can be utilised for resource sharing as well as creative and innovative thinking. According to [14], explicate the main factors of Living Lab Framework are as follows:

The **Product Factory (PF):** this factory represents the processes and activities involved to deliver and create products in various forms. The objective of the PF is to apply factory thinking to the development of a “product” (physical, abstract, a service and artefact).

The **Network Factory (NF):** it helps to find people that you the community need and the primary objective of NF is to establish a platform for the engagement of various role-players within the Living Lab.

The **Knowledge Factory (KF):** it creates a dynamic set of knowledge objects implementing a Question and Answer Extrapolation Tool (QAET).

The **Service Factory (SF):** it produces all the web services needed in order for the LL to function.

Health related research continually produces and refines knowledge that has the potential to improve both the quality and efficiency of health services and bring significant benefits to patients. However, current studies
have shown that this knowledge does not reliably find its way into organisational or clinical practices. In addition to future work in devising action plan for SA, is to come up with Knowledge Brokers (KBs). The implementation of KBs will promote mutual understanding that gives researchers, decision makers and caregivers a better understanding of each other’s environments and this will help to spread the awareness together with adoption of innovations [15]. To make this happen, KBs will help Communities of Practice (CoP) to develop, operate and facilitate exchanges among people with similar concerns and interests. The end results will lead different team members of CoP to create, explore and supply knowledge in their practices. Hence challenges like of silos of information within levels of government departments, private sectors and universities can be addressed.

Acknowledgment

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The Challenges of Successfully Installing Electronic Medical Records in a Resource-Challenged Environment and How to Overcome Them

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Introduction

Despite the known benefits of having electronic medical records (EMRs) for patients in facilities with large client loads such as improved quality of patient care and increased efficiency in the care process to name a few, implementing electronic medical records has been quite difficult to do successfully in resource-challenged settings. While sufficient finances play a major role, and have been acknowledged as a fundamental and essential part of initiating an effective EMR program, in many developing countries, there are several other difficulties and operational issues that affect the successful implementation of EMR programs particularly in Nigeria.

This paper seeks to explore some of the institutional, societal, and socioeconomic challenges that plague the installation of electronic medical records in facilities in Nigeria, looking at some of the challenges that have been faced in the early stages of implementation of facilities supported by MSH (Management Sciences for Health) and at some of the lessons learned on the way to creating a better health system for Nigeria.

A Look at Previous Attempts

Despite previous attempts to successfully install EMR at certain MSH supported facilities, the road to implementation has been wrought with challenges that have made it difficult to get off the ground.

From the 41 comprehensive sites supported in 5 states across Nigeria, 3 facilities—Minna General Hospital, in Niger State; Usman Dan Fodio University Teaching Hospital (UDUTH) in Sokoto; and University of Ilorin Teaching Hospital (UITH) in Kwara - were chosen. These facilities offer treatment to the largest number of medical cases in their states. An initial evaluation showed that in each of these facilities, attempts had already been made to set up EMR. In Sokoto and Ilorin, an Implementing Partner of USAID had already set up hardware which had become outdated and...
needed maintenance to become useable. At Minna General Hospital, the electronic medical records system was set up by the state government, and was, upon first investigation, functional. Over seven thousand had been enrolled to the system, but presently the system is experiencing several infrastructural challenges; needs to be implemented in more units and departments in the facility, and needs key stakeholders to agree to adopt the system.

These problems encountered basically meant that the MSH team would have to begin again from scratch and take a fresh new approach to try to address the problems that arose.

Reasons for Unsuccessful Installation: A Closer Look

Upon closer examination, several factors which were left ignored, militated against the efficient and functional deployment of EMR, as observed from previous installation attempts, such as:

- **Inconsistent power supply**: As observed in Minna General Hospital, there was a need for generators and inverters to sustain the use of the hardware for the EMR, as many times, quick and sudden power changes can cause damages to the IT infrastructure.

- **Non-Interoperable software applications**: With the lightening quick changes and advances in software development there is always a newer and more update version available. With the current design of much of the software in place, it is nearly impossible to upgrade them; instead they must be replaced completely.

- **Poor funding**: This is perhaps the most well-known and expected reason for project failure, without sufficient funds, it is nearly impossible to set up an efficient and sustainable EMR system. Many donors, aware of this, are quick to provide money to help solve this issue, however funding alone is not enough to alleviate the other challenges that exist.

- **Lack of acceptability by health workers**: In many cases, there is also a fear and suspicion of technology. Many health workers are afraid that they would have to learn a new skill in addition to all the other work that they have. Many doctors have maintained that it is too tedious to try to deal with a new means of assessing patient information when there is a system that they are already comfortable with.

- **Insufficient capacity to deploy and use EMR**: The process to ensure the successful set-up of EMR is tedious and can take a lot of dedicated time and effort. Often, in an attempt to look good and get
something started as quickly as possible, there might be a failure to study what the best practices are, or people without a proper background might be hired. Additionally, after installation, improperly trained users can contribute to the quick demise of the entire system, as seen in the case of Minna General Hospital.

- **Confidentiality fears:** In line with fears present in places where EMRs have already been deployed, people are afraid that information stored electronically will be much easier to assess and hack into.

- **Political Support:** Although there is a push to get the government involved in such projects, there is still a lot of politics that comes into play. A politician, intent on appealing to certain people, might promise an EMR system, but when his replacement eventually takes over the position, there is no system in place to maintain and sustain what his predecessor has already begun, such as in the case of Minna General Hospital.

- **Policy Issues:** Since there are no laws or directives on the use of EMR in Nigeria, anyone can make whatever decisions they want regarding EMR implementation without any guidelines.

**Lessons Learned: A Different Approach**

Encountering these issues while attempting to implement a successful EMR system, and learning from them, have been enough to realize that a different approach must be taken in order to develop a sustainable EMR system that will be in use for many years to come. All of the above factors prohibiting successful installation were considered in the conceptualization and design stage of the current deployment. The deployment team met with and interviewed the management of GH Minna, UITH, Ilorin and UDUTH as well the users, in an attempt to find out their specific needs.

In light of this, some of the things to be done differently while still in the design phase are

- **Cloud Hybrid:** In order to address the infrastructural demands that have been instrumental in slowing down the implementation of EMR, the team has decided to use a cloud based system while at the same time providing an on-site version that will cater to the internet down-time period. This will greatly reduce investment in hardware and power supply to support the system.

- **Training Users:** An extensive training will be carried out after engaging all the critical stakeholders during the pre-deployment assessment with the software developers. The application would be
built around the existing workflow and essential processes in the hospitals.

- **Interoperability requirements:** This implementation hopes to take into account other public health priorities that also involve patient engagement. In order to ensure this, interoperability with other platforms present in the Nigerian healthcare space, would be essential.

- **Durable Equipment/power supply:** Energy efficient equipment would be procured. Power inverters would be supplied which would allow the systems to keep working for a certain period of time when there is a loss of power.

**Conclusion**

It is the hope that taking the time out to extensively review previous issues that have been encountered as well as to work together with stakeholders, politicians, and other experts to implement a working plan that will be beneficial for all involved. There is no doubt that the challenges faced in a limited resource environment are daunting, but that does not mean they are insurmountable. Detailed planning, awareness of the issues, and determination are essential tools to tackle the problems present, and can be done. By the middle of next year, it is the hope of entire team that this new approach will lead to a useable, and more importantly, sustainable EMR project that can be replicated across Nigeria and other resource-challenged environments with great success.

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Toward Developing E-Health Services for Emerging Countries: Current Status and Challenges

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Introduction

This manuscript presents our findings from a study conducted in 2014, on e-health in emerging countries in Africa and Asia, under the ongoing collaboration between NTT Labs and Orange Labs on e-health.

In many emerging countries in Africa and Asia, e-health can be a practical means to improve the poor healthcare conditions. Organizations including the United Nations (UN), Non Government Organizations (NGO), academic and research institutions, the government, telecom operators, etc. have already been piloting or offering some levels of e-health services. These include examples of Healthline phone call service, collection of health data and its storage and monitoring by qualified health professionals, remote consultation for skin disease or even for oncology etc.

However, there are various challenges toward deploying e-health services. These include availability of adequate communication bandwidth, training of manpower, standardization of the data so as to integrate the isolated e-health initiatives into a complete system, development of a payment infrastructure etc. We also identified several key domains in e-health that should be explored by a telecommunication or ICT actor.

In this manuscript, we report our findings in the light of the ITU/WHO outline [1] on potential benefits of e-health (Fig. 1).

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<th>Access to service</th>
<th>Health monitoring</th>
<th>Empowering individuals</th>
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<td>Efficiency gains</td>
<td>Planning/management</td>
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<td>Quality and safety</td>
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Fig. 1: Examples of e-health benefits outlined by ITU and WHO [1]
Healthcare: The African and Asian Contexts

Healthcare in many emerging countries in these two continents face the following common realities [2, 3].

a) Lack of infrastructure: In many countries, lack of qualified doctors or number of hospital beds severely affects the delivery of healthcare. There are countries where there is only one doctor per 50,000 people.

b) High maternal and infant mortality rate: Maternal and infant mortality rates are quite high in many countries. For example, in Mali more than 100 infants embrace death per 1000 live births.

c) Low life expectancy: Most emerging countries in Africa and some countries in Asia have low life expectancy between 50 and 60 years.

d) Rural population: Most people in emerging countries live in rural or remote areas. For example, in Africa, 63% people live in rural areas. It is difficult for them to access health facilities situated in big cities.

e) High poverty: More than 40% people in emerging countries of Asia and Africa are considered poor. Lack of financial abilities prevents these people from accessing healthcare even when it is necessary.

f) Major diseases/health issues: Diseases like Malaria, Cholera, Tuberculosis, HIV etc. are quite common in these countries.

Through deployment of ICT in healthcare or e-health, many of the above issues could be improved.

Major Activities in Favor of E-Health

Different UN and Non-Government Organizations (NGOs) have been working on expanding e-health services in emerging countries.

a) World Health Organization (WHO): WHO had urged the member countries to formulate own e-health strategy. By the end of 2013, most African countries have developed their own e-health strategies. Asian countries are also working on the matter.

b) UN for promotion of ICT in health: Other UN organizations like UNAIDS, ITU, the World Bank etc. have been using ICT to monitor diseases, manage patients etc. These organizations are also conducting trials of e-health services in a number of emerging countries.

c) NGO initiatives on e-health: Different NGOs, like Bill & Melinda Gates Foundation, Grameen Foundation, USAID, Vodafone Foundation, Orange Foundation etc. have been conducting e-health projects and developing technologies for the purpose in different countries.

E-Health Services by ICT Actors
Different ICT actors like telecommunication operators, makers and ICT service providers have been running a number of commercial or pilot e-health services. For example, Vodafone offers its “255 Healthline” service in Ghana for providing health advice over phone. In the first year of its launch till September, 2014, more than 80,000 people have been benefited from it. In South Africa, Samsung is offering a solar powered mobile health clinic mounted on a truck. A qualified physician on board the clinic provides eye, ear, blood and dental medical service. The system aims at supporting 5,000,000 people by 2015. Orange is offering mPedigree service in Kenya for detecting counterfeit medicine, Tele-Derma remote dermatology consultation over phone in Egypt, DJOBI service Mali for offering baby health data collection and remote health advice by a physician. In Asia, mClinica offers a mobile platform that connects drug makers with pharmacies and physicians.

It should be noted that there is no significant health insurance mechanism in most emerging countries. However, in African countries, some micro insurance schemes like Linda Jamii micro insurance [4] are being introduced for the mass population. ICT enablers are being considered as essential for offering such services.

Characteristics of E-Health Services

Most e-health services in the emerging countries belong to one of the following categories.

a) Information service: In several Asian countries like Bangladesh, India, China etc. and few African countries, voice [5], video [5] or SMS based Healthline service is offered by the telecom operators.

b) Quality Assurance: some e-health services help ensure better healthcare through offering trainings of health technicians or detecting fake medicine.

c) Health data collection: another stream of e-health services collect health related data in the database, get them analyzed by a qualified doctor and follow up with the patients. These services usually are provided through a local health worker.

d) Complete remote consultation: remote video consultation services are provided using mobile or stationery Internet access.

e) Payment: some solutions provide the infrastructure for electronic payment making access to healthcare simple in these countries.

Major Challenges

Deployment of e-health in emerging countries face several obstacles including, (i) lack of connectivity (3G penetration is only 11%), (ii)
shortage in trained medical experts who can administer such services, (iii) lack of standards, (iv) absence of legal infrastructure, (v) payment/insurance mechanism and (vi) sustainability of the services.

Conclusion

In our studies, we have observed that although there are several challenges and obstacles toward deploying e-health services, due to initiatives of different actors, the emerging countries in Africa and Asia are currently better prepared for e-health than ever before. As such, it is expected that e-health services will expand in these countries in the coming years.

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eLearning
Building Interaction Scenario Situation for E-learning Training, Stepped by Decision Tree: A Simple Training Game

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Introduction

The decision tree is graphic form to show the possible relationship between the choice of an option and its consequences. Decision-making is related to prediction and achieving a successful outcome, partial success or failure. In this context, they are being treated to promote a process of knowledge construction, taking into account the various ways that individuals choose to achieving a positive outcome and success [1].

Then, the decision tree use in distance learning interactive environments is educationally innovative. Furthermore, if used with health professionals, proposing new approaches to interaction with knowledge, this can be considered a different teaching strategy, as well as promoting a reflective exercise about the concepts, provides a meaningful learning, as it relates to real situations. It also enables a better understanding of the decision-making process in their professional reality.

The approach of the decision tree generates a challenging process, structured, reasoned, and based on a conceptual and accurate organization. Guided this principle, the decision tree is a component of automation that are based on a chain of actions and recursive structures. However, in the educational context, it can be used to promote learning, evaluate and detect difficulties and errors in the knowledge construction process.

One reason for this technique to be used within a pedagogical approach is that knowledge is represented by rules, hypothesis, probabilities, ratings, links etc.

To conduct training in the health area, only the view of this algorithm is not enough for memorizing and understanding of concepts and their use in real situations. In order to transfer of knowledge and its application, the creation of the decision tree should be develop in real situations. In this case (training system) the student can choose branches of the decision tree that lead to total success, partial success (which affects, but does not compromise on the final outcome) and avoid failure (that compromises the
final result). The higher student engagement is related with his interest and context.

Medical procedures can be organized in steps. Each of these steps can be decomposed into graphic schemes. These procedures have a logical sequence of execution, without which, one cannot perform them correctly. For example, to perform a tracheal intubation is necessary to open the patient mouth. This situation illustrates how procedures are accompanied by learning strategies.

The student is encouraged to understand what tutor is doing. Thus the system promotes a more constructive and meaningful actions.

The teacher can observe student performance, evaluate the knowledge application in the scenario presented and monitor the understanding process, identify the student's difficulties and misconceptions.

Objectives

The goal was to create decision trees to enable healthcare students, using a distance education platform, to combine the real scenarios, with appropriate punctuation and to evaluate the performance of the participants. This evaluation consisted in the establishment of the elements of its conceptual structure, knowledge and previous experiences of these students.

Methods

In our case, the decision trees were created in several scenarios:

- To classify victims in an accident with multiple victims,
- To proceed in accidents with toxic material,
- Tracheal intubation and
- Care of patients in cardiac arrest.

These decision trees were outlined in scenarios and scored using the SCORM standard. As part of this training, the decision tree can be revisited as many times as necessary for effective learning.

This strategy aimed to lead students to reflect on their practice: what to do and how to do, encouraging them to be more active and constructive during the process of learning. From this perspective, it is possible to evaluate the degree of knowledge of the student on the subject addressed thus obtain data for investing in the equity of information, on the appreciation of ideas and interpretations.

Results

The partial results showed greater student interaction with content. The application of this material in conventional classes provided the content of the discussion, encouraging greater interaction among professionals.

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Discussion

The decision tree allows understanding of outcomes, and in how the results were achieved.

The greatest difficulty observed in the design of this material was the development of scoring criteria. Unlike trees of classical decision with only two branches, in medical scenarios, some other alternatives are possible, to determine a worse outcome. Therefore, the appropriateness of the scores should be revised in future.

The decision trees do not create as an interactive learning tool only. It is important that they meet the needs of a real problem and properly identifying conflict or challenge. Otherwise, we will be seeking only a step by step learning, without the guarantee of the desired results.

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E-learning Training to Get the Ability to Obtain and Select the Appropriate Knowledge: Discussion Forum

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Introduction

The today’s facility to get information and knowledge brings a great challenge for educators: how to select and appropriately apply this information. On the other hand, the appropriate teaching of this process is difficult.

Traditional lectures reflect the teacher’s knowledge and skills on how to present it. However, the speed on how new information is posted makes it harder to refine and update all of it. Notwithstanding, students have access to information easily nowadays than in the past, and are used to select in a way that may conflict with that of a teacher’s content.

Tutorial is well documented way of teaching where an instructor guides the student on obtaining information, the process of research generates an orderly report, and the information is aligned with the professor’s expertise. In this model, students acquire an essential tool for their professional development: how to find and select the adequate information.

Distance education platforms provide some access that enables this training (to check, refine and synthesize the information related to a particular subject). One of these processes is the discussion forum.

Objective

To evaluate the efficiency of a discussion forum used by fourth-year undergraduate medical students to comment and learn about two health conditions.

Method

The discussion forum was available on a Moodle platform [1] for students who were matriculated in a core Discipline of Surgery and Anesthesiology from the University of Sao Paulo Med School (FMUSP). The content was presented by means of a 3D animation created by the Discipline of
Telemedicine, FMUSP, under supervision of an emergency specialist (FSCS). A total of fifteen questions about these diseases were presented and students had up to three weeks to post their responses and references (books, scientific journals, Internet or even a knowledge acquired in previous years). Teacher monitored and commented on the essays.

A qualitative questionnaire to evaluate the method was opened at the end of the process, comprising the sixteenth reward question.

Due to the experimental design, the participation was not mandatory, but was rewarded with grades.

![Grades earned by students](image)

**Figure 1:** Grades earned by students (max = 0.5)

**Results**

Eighty four students were previously enrolled and 49 accessed the platform (58.3%). Of these who visited the forum site, 34 (69%) posted, with a wide range of entries, from just one to fifteen (including the forum evaluation). From these entries and comments, they have earned their grades (Figure 1).

The evaluation of these posts’ contents showed that the students had carefully studied the subject and tried to best synthesize their knowledge. We believe this short experiment demonstrated students’ ability to search and process information in order to acquire adequate knowledge when stimulated to do so.

Qualitative questionnaire responses showed around 80% satisfaction.
Conclusion

Discussion forum allows a virtual interaction between teacher and students, allowing the best and personal suited use of time and efforts from both. Students were able to develop research and obtain adequate medical knowledge that received feedback, certifying the information. This process enriches not only the student, but also the teachers who may find additional sources of information.

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Introduction

Under the South to South co-operation policy of Government of India, Pan-African and SAARC telemedicine Network projects were being launched in the years 2007-08. These projects are being funded by Ministry of External Affairs (MEA), Government of India where in specialty hospitals are rendering tele-consultation and tele-education services. This paper intends to analyse tele-education experience involving both the above said international telemedicine networks for over five years at SGPGIMS, Lucknow, a tertiary level academic medical institution located in northern India. Telemedicine network under South Asian Association for Regional Cooperation (SAARC) was initiated by the MEA with the objective of connecting one/two hospitals in each of the SAARC countries with the Indian super specialty hospitals that include SGPGIMS, Lucknow and Post Graduate Institute of Medical Research and Education (PGIMER), Chandigarh. Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), Thimphu, Bhutan, Indira Gandhi Child Hospital (IGCH), Kabul, Afghanistan and Patan Hospital, Kathmandu, Nepal were connected with SGPGIMS, Lucknow in October 2008, August 2009 and July 2010 respectively. PAN Africa eHealth Network Project was launched in the month of February 2011 in SGPGIMS. Six English language tele-education sessions and two French language sessions were conducted every month. Mostly the sessions are dedicated to Power point educational lectures in a dedicated studio built for the purpose.

Background of Telemedicine and E-Health Activities at SGPGIMS

Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS) located in Lucknow, capital of Uttar Pradesh, a state in northern India, is a
tertiary level referral academic medical center involved in teaching and training of super specialist medical professionals with 23 academic departments. It is the first tertiary care hospital in public healthcare sector in India to adopt Information Technology (IT) for healthcare delivery. The Hospital Information System (HIS) was implemented in 1998 to record, store, process and retrieve health data of all the patients. This software was developed in-house in collaboration with Center for Development of Advanced Computing (C-DAC), Pune. In the year 1999, telemedicine activities were initiated in the form of testing the concept and the technology. The first research grant was availed of in the year 2001, which helped in creation of a dedicated infrastructure for telemedicine. Regular tele-healthcare and tele-educational services were introduced for the postgraduate students of medical colleges of Orissa. These services have now been extended to educate the doctors of other medical colleges and community centers in other states. Besides, the Institute is associated with organizational activities and in policy initiatives of the government at the national and international levels. All the activities are in project mode and are being financially supported by government agencies such as Indian Space Research Organization (ISRO), Department of Information Technology (DIT) and Ministry of Health & Family Welfare, Government of India [1]. Looking at the need of skilled manpower in the field of telemedicine and eHealth, a School of Telemedicine and Biomedical Informatics has come up in the campus [2]. Ministry of Health & Family Welfare (MoH&FW) has now recognized School of telemedicine & Biomedical Informatics (STBMI) as National Resource Center for National Medical College Network (NMCN).

International Telemedicine Activities:

International telemedicine programme is being sponsored by the Ministry of External Affairs, Government of India.

SAARC Telemedicine Network

Telemedicine network under South Asian Association for Regional Cooperation (SAARC) was initiated by the Ministry of External Affairs (MEA), Government of India with the objective of connecting one/two hospitals in each of the SAARC countries with the Indian super speciality hospitals that include SGPGIMS, Lucknow and Post Graduate Institute of Medical Research and Education (PGIMER), Chandigarh. Jigme Dorji Wangchuck National Referral Hospital (JDWNHR), Thimphu, Bhutan has been connected to SGPGIMS, Lucknow in October 2008, Indira Gandhi Child Hospital (IGCH), Kabul, Afghanistan was connected in year August 2009 and Patan Hospital, Kathmandu, Nepal was connected in July 2010.
Each institution in the SAARC network was provided with telemedicine equipment, one Mbps bandwidth and one site engineer. SAARC telemedicine network constitute two types telemedicine nodes namely Super Specialty Hospital (SSH) & Patient End. Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow & Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh are three SSH node in India and JDWRH, Thimpu, Bhutan, IGCH, Kabul, Afghanistan & Patan Hospital, Kathmandu, Nepal are three patient end Nodes in SAARC Telemedicine Network. Equipments installed under SAARC network include Telemedicine Computer, 26” LCD Monitor, Anycast® Video Switcher for integrating multiple video feeds for streaming, Streaming PC & Video Conferencing System. Studio setup with Wireless MIC, Ceiling Mounting speakers was installed for better audio communication. Initially Hybrid telecommunication link was used which includes terrestrial broadband line within India between SSH Nodes. All nodes are linked with Bharat Sanchar Nigam Limited (BSNL) Hub, Bangalore. BSNL Hub was connected outside India over Satellite with a download speed of 512 Kbps and upload link of 1 Mbps. Later-on reliability, availability and cost-effectiveness of terrestrial line over satellite made the entire network to shift to terrestrial network. Televital® Telemedicine Software is used for teleconsultation and tele-follow-up and tele-educational programme are mostly live interactive two-way communication in real time.

<table>
<thead>
<tr>
<th>Name of Hospital</th>
<th>Date</th>
<th>Total</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>JDWNRH</td>
<td>21 Oct 2008</td>
<td>66</td>
<td>22</td>
<td>25</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>IGCH</td>
<td>17 Aug 2009</td>
<td>184</td>
<td>8</td>
<td>23</td>
<td>44</td>
<td>36</td>
<td>35</td>
<td>38</td>
</tr>
<tr>
<td>Patan Hospital</td>
<td>19 July 2010</td>
<td>71</td>
<td>-</td>
<td>5</td>
<td>5</td>
<td>32</td>
<td>15</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 1: Year-wise activity under SAARC Telemedicine Network

**PAN Africa eHealth Network**

Pan Africa eNetwork was conceived by former President APJ Abdul Kalam in 2007. Tele-Medicine consultations are regularly being conducted from Super-Specialty Hospitals from India to the 47 African countries on need basis. Regular Continued Medical Education (CME) sessions have been started with effect from 22nd April, 2009 from 11 Indian Super-Specialty Hospitals. TCIL has established the Network with a Data Center
in TCIL Bhawan, New Delhi that acts as a gateway to the Hub Station in Dakar for connectivity of Indian institutions on the African side. Pan African e-Network (Telemedicine) Project was launched in the month of February 2011 in SGPGIMS. The aim of the project is to provide tele-consultation and tele-education services to 47 African Countries. Project was initiated by MEA and was implemented by Telecommunication Consultant of India Limited (TCIL). Two French Sessions and 6 English sessions are conducted every month. 28 departments of SGPGI participated in the programme. Equipment for Studio and PCR Room was installed in all the SSH. Equipments like White Board, Projector, Graphic Visualiser, Handy Camera, PTZ Camera, POTA Light, KVM Switch, Plasma System, Agent PC, Mic System integrated with Live Streaming technology through Anycast® Video Switcher, Televital® Software and iGrandee® Software for archiving all sessions in the Data Center of STBMI. Pan African eNetwork is based on streaming technology which is simultaneously transmitted to 47 African Countries. Content created under this network is stored in the local data center and users from all African countries can also access streaming video after providing user ID and password.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Department</th>
<th>No of Faculty</th>
<th>Session - English</th>
<th>Session - French</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anesthesia</td>
<td>11</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Cardiology</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CCM</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Clinical Immunology</td>
<td>3</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CVTS</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Endo Surgery</td>
<td>6</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Endocrinology</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Gastroenterology</td>
<td>2</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Hematology</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Hospital Administration</td>
<td>3</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Medical Genetics</td>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Microbiology</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>MRH</td>
<td>3</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Nephrology</td>
<td>6</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>Neuro Surgery</td>
<td>7</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>Neurology</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Nuclear Medicine</td>
<td>2</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>Ophthalmology</td>
<td>2</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Pathology</td>
<td>9</td>
<td>20</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 2: Department wise participation in PAN Africa eNetwork

<table>
<thead>
<tr>
<th>Department</th>
<th>English CME</th>
<th>French CME</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric Gastroenterology</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Pediatric Surgery</td>
<td>2</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Plastic surgery</td>
<td>1</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary Medicine</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Radiondiagnosis</td>
<td>4</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Surgical Gastroenterology</td>
<td>4</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Transfusion Medicine</td>
<td>5</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Urology</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

Results

Participation in Pan Africa eNetwork is not so encouraging might be because of difference in language accent, time difference & work load. Total 310 sessions (258 English CME & 52 French CME) were conducted in between 2011 to 2014 and were simultaneously transmitted to 47 African countries. During this period only 1505 participants has participated and raised just 130 questions in between the sessions.

In the SAARC Network 66,184 and 71 lectures were transmitted to Bhutan, Afghanistan and Nepal respectively. Interaction was good with former two countries.

Conclusion

The outcome of five years of experience in transcontinental and trans-border telemedicine programme focused on tele-education has brought in several issues which need deliberation to maximise output for the investment made.

References


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Knowledge Management Techniques for Building Best Practices Reference Library in the E-health Domain

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Introduction

The domain of e-health is always on the move. The majority of projects are pilot projects. They can’t be used as models or templates to derive frameworks or business models.

We have to gather comprehensive knowledge & returns of experience for these projects to become ever more efficient and relevant. Hence, we must aggregate the lessons learnt in such a way that Knowledge Workers will be decisively helping the projects achieve their objectives. It means that we need to build a capitalization system of knowledge and experiences (CapCoEx) which is the subject of this paper.

Context and Challenges

The relevance of content for continuous improvement and innovation depends on the ability to:

- Access to new knowledge (innovation, experiences feedback…);
- Broadcast the know-how quickly (integrating a new actor, harmonize practices…);
- Exploit and preserve areas of expertise (sharing of best practices, capitalization. . .).

In this context, the organizations must consider:

- Knowledge obsolescence (technologies, market, methods);
- The risk of loss of know-how (departure, mutation, etc.);
- The sociologic evolution: Generation X, Y or Z;
- The strong use of social collaboration tools;
- New technologies like pad or smartphones.

This means that the relevant knowledge must reach and be consistently used by the projects’ actors via the use of modern collaborative tools.
Our proposal

*CapCoEx, a collaborative KOS*

This means that our **Knowledge Organization System** (KOS) must:

- Be based on a «User Centric KM» paradigm because the targets are individuals or groups;
- Tailor models to the knowledge related to each **Community of Practice** (CoP);
- Position our social media as a point of differentiation and advantage to improve the "Platform Branding";
- Value **Collective Intelligence** (CI) and **Skill Improvement** (SI).

Our KOS «CapCoEx» (Fig. 1) must be identified as an **Organizational Memory** (OM) [1] built-in supporting tool for each CoP. An example being «Domomédicine» where knowledge is in continues evolution.

**Fig. 1: CapCoEx**

All the **private or shared resources** must be represented and organized in a **knowledge map**, allowing visualization in many dimensions; furthermore, a **common reference** must be defined to help navigate the capitalized resources in **different spaces and dimensions**. This map should be the basis for knowledge access for all the actors involved in the e-health environment.

CapCoEx must also be the **central reference tool** to help the parties new to a project to **be trained in the needed skills and/or processes** [2] which knowledge are required in a specific project.
This environment which allows valuing IC and MCI should become the natural repository for the CoP in Home healthcare or for any organizations in whatever mode they operated in (at the office, out on the field, centralized or networked, etc.).

Starting point MEMORAe
To test all the above-described functions, we used the MEMORAe (MEMoire Organisationnelle Appliquée au e-learning – Fig.2) platform. It has been tested in academic environments through a lot of research contracts awarded by various industries.

This web platform helps manage all the resources in a knowledge map. The resources come from a formal or informal process operated within a human group (team, service, project, etc.)

Fig. 2: MEMORAe Platform

The platform has been built to facilitate organizational learning and knowledge capitalization using a semantic approach [3] leading to a common repository. This platform uses the latest collaborative technologies (web 2.0, tablets, etc.) and supports the web semantic standards.

CapCoEx project’s steps
CapCoEx will be developed around the main following axis:
1. Setting up MEMORAe / CapCoEx environment;
2. Test with users in a real work situation;
3. Enhance the development by continuously testing the platform.

Axis #1 will be our 1st knowledge capitalization step and can be described in the following way:
a. Create or import a health-related ontology (e.g. OPSA, ASIP Santé or SNOMED) and a project management related ontology to define our knowledge map;

b. Integrate with knowledge bases containing ecosystem-related items (European directives, International and national norms, Clinical testing procedures, Medical references) or linked to projects (Library “Response of the bid bound” with all subsequent items, “Technical” reference, Practice and “storytelling” or main Use Cases (REX, KPI, deliverables,…);

c. Index the ontology links by content;

d. Create users and user groups for "in real life" testing with the use of computers, tablets or smartphones.

From this base, we will then build our project as to bring the right answers to the various following demands:

- Support a sustainable collaborative culture;
- Design a knowledge acquisition process (Expert System) and capture critical knowledge [4];
- Deploy gradually (brick by brick) the MEMORAn / CapCoEx platform for better adaptation to needs;
- Structure the experience feedback (REX) by integrating the lexical network, the conceptual network, the elements of experience and documentation;
- Develop a knowledge management workflow (obsolescence / relevance / maturity);
- Model the skills by analyzing professional practices and build the appropriate skills maps;
- Help skills self-development;
- Support individual training path customization;
- Collect clues left by the users [5] to enhance the ontologies, augment the recommendations for training courses, skills, profile search, etc. and have a better understanding of the internal and external trends.

Conclusion

The CapCoEx system must become a tool used by all the CoP Home healthcare organizations. We envision implementing the CapCoEx system using the Design Research [6] approach for a better emphasis on users’ needs leading to a far more adapted solution. We will also take into account the level of maturity of the relevant organization through the Knowledge Maturity Model.
References


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Marie-Helene Abel is a Professor in the Computer Engineering Department (UTC, France). She is in charge of the specialization “Knowledge Engineering and Information Media”, and leader of the Research Team ICI (Information, Knowledge, and Interaction) – UMR CNRS HEUDIASYC Laboratory. Her research focuses on Semantic Web, Social Web, Knowledge Management, and e-learning with more than 120 publications (journal and conferences) in these areas. She is the head of the MEMORAe project (http://www.hds.utc.fr/memorae). She is the president of the IEEE French chapter SMC028
National Research and Education Networks to Support Healthcare: The Brazilian Telemedicine University Network RUTE

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\(^2\)World Health Organization, shorbajin@who.int, Geneva, Switzerland

Introduction

National Research and Education Networks (NRENs) worldwide are expanding capacities forming academic telehealth community collaborations of health scientists, bridging science, technology, innovation, education, and assist health federal authorities to discuss, finance and work together. The World Health Organization - WHO promotes Universal Health Coverage as a goal for equitable access to health services without pushing people to poverty. Using information and communication technology to bring healthcare to people in remote areas and to those who most need health services, is one of the objectives of UHC.

RUTE, the Telemedicine University Network from Brazil, under the NREN RNP www.rnp.br, was launched December 2014 and includes 108 Telemedicine Units in University and Teaching Hospitals in all 27 states. The network operates 48 Special Interest Groups in health specialties with 2 to 3 scientific videoconference sessions every day and 150 participant institutions. It has just published the second book on its impact in the Brazilian Telehealth initiative and in Latin America (www.rute.rnp.br) [1, 3, 6]. As quoted in the foreword: “It is an example of what a country can and has done and what lessons the world can learn from them.” It might provide thoughts and even guidance to policy makers.

Brazilian National Initiatives

Rute is part of the Brazilian Telehealth Program www.telessaudebrasil.org.br, coordinated by the Secretariat of Work and Health Education Management (SGTES) of the Ministry of Health, that seeks to improve the quality of the service and basic care of the Unified Health System (SUS) and to promote teleassistance and teleeducation along with the Open University of the Unified Health System (Unasus) www.unasus.gov.br, facilitating the access and training of healthcare
professionals. The telehealth and telemedicine centers are equipped with cutting-edge equipment, for real-time communication, connected to high performance network infrastructure operated by the RNP. Currently, telehealth services are provided in 14 states with 30 000 professionals from the Family Health Program, in more than 2000 Brazilian municipalities.

Also newly composing the initiative, started in 2011, today (29), more than half of the federal university hospitals, are managed by the Brazilian Enterprise for Hospital Services http://ebserh.mec.gov.br/

In partnership with 18 Latin American Ministries of Health (Brasil, Colombia, Ecuador, México, Uruguay, El Salvador, Chile, Peru, Argentina, Guatemala, Costa Rica, Venezuela, Paraguay, Dominican Republic, Haiti, Bolivia, Panamá and Guiana) through the Telehealth Regional Project from IADB, Rute and the Brazilian Telehealth Program, among others, were certified for best practice of telemedicine by the Inter-American Development Bank (IADB) [4], the Pan American Health Organization (PAHO) and the Economic Commission for Latin America and the Caribbean (ECLAC). Taking into account that the eHealth Conversations coordinated by PAHO [5], and several regional telehealth events, participate also in the regional academic network RedClara, and the academic networks, RNP, Renata, Cedia, Cudi, RAU, Reuna, C@ribNET, Internet2, Innova|RED, Conare, Ragié, Raíces, RAAP, Reacciun/Cenit, ADSIB, RedCyT, Arandu, Radei.

Since 2012 the Health Ministry integrates officially the Program for Maintenance and Development of RNP, before integrated by the Ministries of Culture, Education, and the Ministry of Science, Technology and Innovation, to which RNP belong to as research institution.

Mainly the 9 initial states (Amazonas, Ceará, Pernambuco, Minas Gerais, Goias, Rio de Janeiro, São Paulo, Santa Catarina and Rio Grande do Sul) starting the National Telehealth Program in 2007, all developed to provide teleassistance and teleeducation at least to 100 municipalities each. Two of them, have their projects sustained and turned into services by the Health State Department from Santa Catarina and Minas Gerais [2], assisting respectively 250 and 700 Municipalities.

The National Research and Education Network RNP

RNP’s mission is to promote the innovative use of advanced networks in Brazil. Additionally to providing connectivity, RNP makes the interaction between people and resources distant from developed centers, enabling the deployment of new network applications and protocols, with great benefits to the public in areas such as education and health care,
Some data: ~3.5 million users; Among the 10 academic networks with the highest capacity in the world; 30 Multi-Gigabit links; >300 connected campuses with speeds starting at 1Gbps; >800 connected institutions; 27,500 research groups benefited.

**RUTE’s objectives are two folded:**

1. Implement infrastructure for the interconnection of faculty, university hospital and teaching units from different regions of the country, enabling the communication and collaboration between national and international educational and research institutions.

2. Improve care of populations in the most underprivileged regions without specialized medical care through the resulting benefits achieved by the exchange of specialized medical knowledge.

The following procedures were implemented to build an operational methodology at Rute:

1. Implement organizational and technological infrastructure: national coordination, advisory committee, interest groups, implementation, maintenance, communication, telehealth centers and certified infrastructure at national and local networks.

2. Each institution submits its project and formally establishes its Telehealth Center with a physical location and dedicated team.

3. The institutions propose, create and coordinate Special Interest Groups that promote the development of collaborative activities.
Collaborative scientific network using Special Interest Groups (SIGs)

Currently, there are ca. 50 SIGs collaborating in areas such as audiology, nursing, cardiology, psychiatry, ophthalmology, child and adolescent health care, pediatric radiology, neurology, dentistry among others. There are approximately 2 to 3 scientific sessions per month yielding 600 video and web conference sessions per year, recorded and available for consult (Figure 1).

Figure 2: The 4K technology allows the generation of images with resolution four times higher than that of Full HD

Global demands in the field of health care, recent researches, new ICT, establishment and expansion of each one of the 108 Rute Centers in Brazilian universities, university hospitals, research institutes and certified teaching hospitals guarantee the search for innovation, sustainability and the development of tools, services and processes for education, remote assistance and collaborative researches in advanced networks.

Since 2013, real-time surgeries and procedures among RUTE Centers are transmitted in Ultra High Definition, also to USA. The 4K technology generates images with resolution four times higher than Full HD (Figure 2). Other research projects such as mobile and applications are being developed.

Conclusions

RNP offers advanced communication infrastructure. Healthcare, R&E has demonstrated more interest and developed into a Telemedicine University Network RUTE. Important also for its sustainability lies on the participation, coordination, integration and financing from the Ministries of Science, Technology and Innovation, Education, and Health.

The model taken into consideration shows how an academic network manages to bring together a number of health institutions to work together
to utilize information and communication technology to bring healthcare to people in remote areas and to those who need health services most, remotely manage, collaborate, educate, monitor and evaluate.

Healthcare has been delivered by the Telemedicine network as a multidisciplinary specialty approach. This brings the power of multiple institutions in a networked model to get the best of each one of them, bringing not only its expertise but also resources to make the scientific network a successful social innovation, presenting many lessons to learn.

RNP/RUTE’s unquestionable statement is its ICT and Health proved qualification for remote assistance, education and collaborative research.

References


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Introduction

This project commenced with the hypothesis that providing authenticated, validated, topical health information to the rural public in health issues is necessary and possible on a large scale, using Information and Communication Technology. Considering the paucity of experienced, qualified healthcare providers, competent and willing to talk in the local language to hundreds in rural areas, it was felt that multi-point video conferencing and 2-way audio/video would add value in a one-to-many transaction. If a preliminary PoC validation was successful, this could be escalated and the ultimate benefits quantified. Health literacy and knowledge empowerment would eventually translate into Patient Empowerment, leading to betterment of health outcomes. Separating facts from fiction, demystifying myths and apprising the community of the necessity for a DIY (Do It Yourself) approach was a major component of the project. Demonstration to citizens of rural India, using technology, they are becoming familiar with, that they could and should play a proactive role in their own healthcare and sensitizing them to health concerns was another objective. Culture sensitive, customized lectures were tailor made to suit the specific needs. To ensure maximum attendance time and dates primarily suitable for the attendees were agreed to. MSSRF (www.mssrf.org) a globally respected and renowned NGO with a strong presence in the community was chosen as a partner with ATNF (www.apollotelehealth.com) a unit of Apollo Hospitals (www.apollohospitals.com).

Background

The primary objective was to validate the hypothesis that citizens of rural Tamil Nadu could “stay healthy” through ICT-enabled e-Wellness Programs. To quote Sir Muir Gray, Chief Knowledge Officer of the NHS: “Would knowledge empowerment be more important than antibiotics in
healthcare”. Could one quantify the result of such intervention? Would knowledge empowerment be equal to patient empowerment and would this lead to better patient compliance and adherence?

Methodology

To understand this, an initial visit was made to three villages, to comprehend the level of interest, requirements, internet facilities available and the possibility of mobilizing members of the community to gather at a pre-determined center, on days and times convenient to most of them. Internet enabled Village Knowledge and Village Resource Centers of MSSRF were identified. A wide variety of topics were chosen to cater to the community needs. Aware that the contents need to be available off line as well arrangements were made to digitally archive all the lectures and make them available in U tube as well (e.g. https://www.youtube.com/watch?v=pHqocmVDE-0&feature=youtu.be, https://www.youtube.com/watch?v=dvzU44WuePs&feature=youtu.be). The recorded sessions were also made available on electronic media (memory stick, DVD, etc.), to the villagers, in the respective ICT-enabled Village Resource Centers or Village Knowledge Centers of MSSRF. Articulate physicians well versed in the local language (Tamil) delivered lectures fortnightly. MSSRF mobilised the community. Identifying the nitty gritty and mobilizing volunteers, who would ensure that the villagers physically assemble, at an Internet-enabled area with audio/visual infrastructure (LCD, Screen, etc.) was itself a herculean task.

A “Responsibility Matrix” was prepared where the entire project was divided into 16 specific areas and individuals in the team (ATNF and MSSRF) identified, with a view to establishing responsibility and accountability. The project started with identifying 125 topics for the Telehealth Educational Session. The entire project was executed without specific funding. All the stakeholders had to be enthused and a voluntary spirit of cooperation made part of their DNA. Easier said than done! Busy consultants had to be persuaded to prepare and deliver the lectures. These talks had to be customized to the rural public. The attendees were spread over 12 to 18 villages. In spite of all efforts, glitches in technology like audio video breaks occasionally occurred and these had to be accepted. The entire team consisted of individuals, willing to put in effort and time, from a voluntary perspective with the single goal of trying to do good to the community. Profusely illustrated PowerPoint presentations, with animations and video clips, were used. The original English version from the consultants was translated into Tamil, simplifying technical terms and at the same time maintaining accuracy by an IT conversant project coordinator. A
flier was prepared in Tamil, briefly summarizing the contents of the lecture and with a brief CV of the speaker. Due to low bandwidth availability in the Villages the MCU bridge, was replaced with a licensed “Go to Meeting” software. The 25 minute talk was followed by a 35 minute Q&A. The Village Knowledge Center staff ensured that information about the talk was circulated through to voice and text SMS, announcements through Public Address System by volunteers, distribution of leaflets, advertisements in local dailies, sending post cards to previous participants, personal invites and attention to local logistics including serving refreshments to participants. The very concept of answering MCQ’s is alien to the culture of the attendees. Formula unambiguous MCQ’s customized for the rural population is a labour intensive work. Explaining the nuances of MCQ’s and in the case of illiterates personally explaining to them made the process of evaluation even more challenging. As this involves a number of individuals it is extremely difficult to ensure total compliance and adherence.

Print-out of Multiple Choice Questions (MCQ) with answers and feedback forms were distributed to all the attendees before the lecture actually commenced. Volunteers assisted in filling the forms. The forms were refilled after the lecture and an attempt was made to document long term knowledge retention 6 months later. These sessions are currently being held on alternate Wednesdays from 2 PM to 3 PM, to suit the convenience of the majority of the attendees. User satisfaction questionnaires in Tamil were also distributed to all attendees. The raw data collected by MSSRF was converted to an electronic format for subsequent data analysis by the ATNF project coordinator. The MCQs enabled the community to realize their knowledge gap in various common health issues. Within 24 hours of a lecture, village volunteers are expected to send details of the number of attendees in each village with their gender distribution.

Observations

8236 individuals (2828 males and 5408 females) attended 40 sessions over 21 months. Average attendance was 212 (102 to 458). An average of 7 (4 to 12) villages participated. Knowledge levels increased by 15.3% (31 to 86). The wide scatter was attributed to unfamiliarity with MCQ mode. Feedback from 72%, indicated a high level of acceptability of the e-talks (55% good, 12% excellent).

Conclusions

This preliminary study has led to rectification of the occasional technical glitches encountered. The major challenges in assembling villagers for tele lectures and making them view this as a Value Added Service were
identified. Video demonstrates the enthusiasm of the teacher and the taught. An unexpected result was knowledge diffusion among the non attendees leading to community empowerment.

Acknowledgment

Ms Geethanjali R. Asst. Manager ATNF coordinated the programme and provided assistance.

Table 1: Sample of topics covered and attendee details

<table>
<thead>
<tr>
<th>Topics</th>
<th>Sessions Participants: Feb '13 - Jan '15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction &amp; Management of Diabetes</td>
<td>Male 3399</td>
</tr>
<tr>
<td>Menstrual disorders</td>
<td></td>
</tr>
<tr>
<td>Diabetes in Pregnancy &amp; Prevention</td>
<td>Female 5765</td>
</tr>
<tr>
<td>Common problems in gastroenterology</td>
<td></td>
</tr>
<tr>
<td>Skin Wellness</td>
<td>Total 9164</td>
</tr>
<tr>
<td>Common urinary problems</td>
<td></td>
</tr>
<tr>
<td>Heart Disease Prevention</td>
<td></td>
</tr>
<tr>
<td>Thyroid and other hormones</td>
<td></td>
</tr>
<tr>
<td>Kidney Disease Prevention</td>
<td></td>
</tr>
<tr>
<td>Cancer in woman</td>
<td></td>
</tr>
<tr>
<td>Common Urological Problem</td>
<td></td>
</tr>
<tr>
<td>Occupational health</td>
<td></td>
</tr>
<tr>
<td>Vitamin D deficiency</td>
<td>Causes and early detection of Cancer</td>
</tr>
<tr>
<td>Jaundice</td>
<td>Back pain and prevention exercises</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Rheumatoid Arthritis</td>
</tr>
<tr>
<td>Burns</td>
<td>Liver Health</td>
</tr>
</tbody>
</table>

Figure 1: Responsibility matrix & screenshot of participants
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The Utilization of Online Bibliographic Databases by Medical Professionals in Rwanda: Case of University Teaching Hospital of Kigali

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Abstract: Introduction: This study carried out to assess the utilization of online bibliographic databases by Medical professionals at University Teaching Hospital of Kigali for evidence based practice. A quantitative cross-sectional design was used. Chi-square was performed to determine the association between variables. The results of this study indicate that the most used online bibliographic database at University Teaching Hospital of Kigali is PupMed (Medline) at the rate of 94%. More than 92% of medical doctors have computers with internet in their office. 89% of them know how to enter HINARI. 91.5% of medical doctors have only basic searching skills. Almost all medical doctors are computer literate at 82% and the majority of medical doctors 63% have been trained on evidence based medicine literature search. Medical doctors at the rate of 97.6% have used online bibliographic database in the past six months and 95% were satisfied with their expectations. It argues that training in evidence based literature search (P=0.632), proficiency in computer (P=0.166) are not the factors that justify the use these e-resources. The study concludes that the use of the online bibliographic databases is still limited among Medical doctors at University Teaching Hospital of Kigali, and recommends continued sessions for training in evidenced based literature search.

Introduction

Online bibliographic databases have the potential to facilitate the clinicians who adopt an evidence-based approach by providing them with the information they need in a timely fashion [1]. However, studies indicate that even though developed countries have great access to internet and rich online bibliographic databases, their utilization is still low [2].

In developing countries particularly in Africa the use of online bibliographic databases is still facing a significant challenge to medical professionals whereby in Nigeria there was found to be lack of confidence
to download full-text articles from online resources [3]. Current literature indicates that medical professionals do not routinely use the available evidence to support clinical decisions [1]. Nevertheless, there is still limited information relating to the availability and utilization of the online bibliographic databases in Rwandan health facilities by the medical professionals.

The purpose of this study therefore, was to find out the extent and how medical professionals at the University Teaching Hospital of Kigali, utilize the online bibliographic databases in their clinical activities.

Methodology

A cross sectional with census method, using both quantitative and qualitative approach was used to meet the objectives of the present study. 153 Medical doctors were recruited and the response rate was 55%.

Results

Most used online bibliographic databases

Medline (PubMed), Up to Date and Google scholar are the most used online bibliographic databases by medical doctors at University Teaching Hospital of Kigali because they are freely accessed via HINARI. Up to Date is however not freely accessible. Within past the six months, medical doctors at University Teaching Hospital of Kigali used the online bibliographic databases at the rate of 97.6%.

Use of online bibliographic databases within past six months

Only 38% search information to guide treatment on daily basis. This study however did not analyze the duration of searching information per one round and the effectiveness of the information seeking.

Basic Searching skills

89% of medical doctors have knowledge to enter into HINARI and shows that around 50% of medical doctors are not able to search books via HINARI; it also indicates that that 90% of medical doctors are able to download the full article via HINARI.

Advanced searching skills

Only 8.5% of medical doctors have advanced searching skills. It means that they are able to use advanced searching options namely Boolean, truncation, filters tiab, and MeSH. In this study, there is no association between being male or female, proficiency in computer skills, training in evidence based literature search, computer procession and regular access to
internet and the utilization of online bibliographic databases at University teaching hospital of Kigali.

Conclusion

Regarding utilization of online bibliographic databases at University Teaching Hospital of Kigali, the proficiency of use is low among medical doctors where a low number use these resources on daily basis; to guide treatment of patients, searching skills among doctors is still low.

PubMed (Medline) is the most used electronic resource by Medical doctors. A positive point emerging from the study is that the respondents are interested in utilization of e-resources and this would definitely help any intervention to improve the proficiency in using online bibliographic databases. Training in evidenced based literature search, should be a module in all curriculums for all health professionals schools for ensuring long life learning and patient care skills, but also availability of these resources is still a challenge to the users at University Teaching Hospital of Kigali.

References

Empowering Women in eHealth and Telemedicine through Education
Introduction

Domestic Violence represents one of the main problems that occurs worldwide in society of all countries regardless of cultural differences. It is shown that the background of the aggressor is one of the key factors that make the risk.

Given this increasingly common problem, the goal of this work in this progress paper is to apply and compare Big Data and Data mining techniques to classify or distinguish similar patterns in accused individuals.

Methods

This section describes the methods used to analyze the data, and the features of the database.

A) Database Description

The sample of this research consists of 352 cases obtained from 885 records in “Unidad de Valoración Forense Integral” (UVFI) of Bizkaia (Basque Institute of Legal Medicine - IVML), incurred in the years 2011 and 2012. The database contains records of individuals of a violence crime against women.

a) Inclusion criteria: all requests for forensic examination of accused over 18 years by gender violence that had led to the opening of files in UVFI of IVML, with or without attendance of the accused to recognition.

b) Exclusion criteria: file duplications collected of the same accused and examination cancellation.

For this study, the authors have differentiated two types of violence: psychological nature and physical and / or sexual way.

The authors have selected the most relevant variables to achieve the goals desired to study the type of aggression: drug use in the assault, use of objects
or weapons, the presence of witnesses in aggression, nationality of the accused and his criminal records (they can be seen, in detail, in Table 1).

Table I. Variables Description

<table>
<thead>
<tr>
<th>Variable</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nationality</td>
<td>The accused Nationality: Spanish or foreign</td>
</tr>
<tr>
<td>2</td>
<td>Drugs</td>
<td>Alcohol or any psychotropic substance at the time of the commission of the alleged abuse or during events</td>
</tr>
<tr>
<td>3</td>
<td>Presence of a witness</td>
<td>Presence of a witness at the time of aggression or assault. The presence of witnesses being necessary in all the attacks to be considered as an affirmative.</td>
</tr>
<tr>
<td>4</td>
<td>Weapons</td>
<td>Using some sort of weapon or object for abuse by grouping the three main types of weapons: the blunt, edged weapons and firearms.</td>
</tr>
<tr>
<td>5</td>
<td>Children</td>
<td>Children in common between aggressor and victim</td>
</tr>
<tr>
<td>6</td>
<td>Criminal Records</td>
<td>Police records and / or penalties of any kind.</td>
</tr>
</tbody>
</table>

B) Data Mining Methods

B.1 Decision tree

A decision tree (DT) is a decision support tool for finding and describing structural patterns in data as tree structures. A decision tree does not require the relationship between all the input variables and an objective variable in advance [2]. Each branch of the decision tree represents a possible decision or occurrence. The tree structure shows how one choice leads to the next, and the use of branches indicates that each option is mutually exclusive. The paths from root to leaf represent classification rules.

A tree can be learned by splitting the source data into subsets based on an attribute value test. This process is repeated on each derived subset in a recursive manner called recursive partitioning. The recursion is completed when the subset at a node has all the same value of the target variable, or when splitting no longer adds value to the predictions.

There are two main types of DTs:

[1] Classification Trees  
[2] Regression Trees  

We can find many references about this technique utilization [3-5]

B.2 Bayesian networks

Bayesian networks (BNs), also known as belief networks (or Bayes nets for short), belong to the family of probabilistic graphical models (GMs).
These graphical structures are used to represent knowledge about an uncertain domain. In particular, each node in the graph represents a random variable, while the edges between the nodes represent probabilistic dependencies among the corresponding random variables. These conditional dependencies in the graph are often estimated by using known statistical and computational methods. Hence, BNs combine principles from graph theory, probability theory, computer science, and statistics [6]. This technique is widely used in [7-9].

Results and Conclusions

The architecture proposed can be seen in Figure 1, a High Performance Computing Cluster (HPCC). This kind of systems distributed data intensive open source computing platform and provides big data workflow management systems, and it build multikey and multivariate indexes on a Distributed File Systems.

The results have established that both techniques achieve a high accuracy regarding the different parameters. The results of the techniques are evaluated in terms of performance to classify the causes and the type of aggression. In this study, BN have provided (a priori) better and faster results.

In both methods, similar results regarding the impact of the variables have been obtained. Although this study will remain extended by the authors in the near-future, there are two variables which have been very significant: nationality and criminal records.

Other variables to be considered would be the age and accused labor situation. Although this paper presents a preliminary study, it shows that using the techniques described previously, the type of physical aggression can be classified in terms of some significant variables.
Acknowledgment

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References


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She currently works as a forensic psychiatrist in the Department of Psychiatry, including the division of Domestic Violence Unit, at the Basque Country’s Institute of Legal Medicine (IVML). Her main topics of professional interest include sexual assaults and intra-familiar violence.
eHealth, Women’s Health and the Legal Framework for a Successful Clinical Program: A View from Across the Atlantic

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Introduction

The incorporation of eHealth into the clinical specialty of Women's Health is one of the most important advances in remote medicine and is one of the most challenging fields from a legal/regulatory and clinical perspective. The populations in the US, EU and throughout the world face an ever growing shortage of qualified Women's Health physicians, geographic barriers limiting traditional in-person visits, a multitude of complex clinical issues that are specific to Women's Health and a fluid and often undeveloped set of legal rules for delivering quality Women's Health care via eHealth models. This article summarizes the legal and regulatory framework surrounding the provision of eHealth in the US and provides an example of the University of Pittsburgh Medical Center’s (UPMC) robust eHealth community initiatives related to Women’s Health clinical services.

eHealth Legal and Regulatory Framework

*eHealth laws and regulations overview*

The health care attorney’s perspective regarding the provision of new eHealth clinical services, including Women’s Health, is one of challenge and diligence. The clinical, scientific, and technological advances related to eHealth remain very far ahead of the legal precedents and standards that were developed by the US federal government and the fifty (50) state governments. Until recently, the rules for the practice of medicine were based on the universal assumption that the patient was being seen in-person by his or her physician. Nonetheless, in 2015, momentum is well underway by US governmental entities at the federal and state level to catch up with the clinical and technological innovations and advances associated with the practice of medicine which incorporates eHealth technology.
Despite the fact that the US federal government has primary responsibility for regulating Medicare—the largest health care reimbursement system in the US—the fifty (50) individual states also play a critical role in developing laws and regulations around the provision of all health care delivered to citizens residing in each state. The U.S Supreme Court has held that each state has the full power and authority to protect the public health and safety of citizens, and, importantly, to establish standards for licensing practitioners, including physicians and to regulate the practice of medicine and nursing [1]. Listed below is a summary of the primary rules and the governmental agency responsible for adopting and enforcing such rules when applicable to eHealth clinical service programs. Of note for EU-based providers, while the EU legal and regulatory framework for eHealth varies from the US framework, each of the items listed below also need to be considered and vetted by an EU health care attorney supporting an eHealth clinical program.

Summary of primary eHealth legal and regulatory rules

(1) Physician Licensure
The fifty (50) individual state medical boards regulate physician licensure. The specific state location of the patient dictates which state medical board has jurisdiction over the eHealth physician. For example, if the patient is located in Los Angeles, California and the eHealth physician is located in Charlottesville, Virginia, the physician will likely need a California medical license to treat the patient via eHealth technology.

(2) Physician Credentialing
The US federal government and the individual states both have multiple agencies that are responsible for regulating the credentialing of physicians in order to practice in-person or via eHealth in a hospital or similar health care facility. Each hospital also has specific bylaws and rules for appointing physicians to its medical staff. Provided the hospital’s bylaws allow for what is now commonly known in the US as “telemedicine proxy credentialing”, the physician desiring to practice via eHealth at a hospital may be eligible for a streamlined credentialing process which was specifically designed to afford eHealth physicians to practice at numerous hospitals on any given day.

(3) Establishment of the Physician-Patient Relationship
Each US state has unique standards for the establishment of a bona fide physician-patient relationship prior to the physician lawfully diagnosing, treating and prescribing medications to the patient via eHealth technology. While peer-to-peer (i.e. physician-to-physician)
consultations related to a patient generally did not require the eHealth physician to obtain a medical license in the state where the primary treating physician and the patient were located, many US states now require a medical license absent emergency or other limited circumstances. Further if the patient is not in the presence of another health care provider (e.g., direct to consumer E-Visit model), most US states now require as part of the minimum of standard of care to be followed that the physician and the patient interact via live audio and videoconferencing to replicate a traditional face-to-face visit prior to diagnosis and treatment. As of 2015, the majority of US states and their medical boards continue to grapple with this important threshold issue for the delivery of eHealth clinical services directly to the patient. A recommended summary of the emerging minimum standards of care for providing direct to consumer eHealth services is listed below [2].

(4) Patient Privacy and Appropriate Handling of Medical Records and Protected Health Information (PHI).

The US federal government has enacted several restrictions and safeguards for the protection and security of patients’ PHI. At the federal level, the Health Insurance Portability and Accountability Act (HIPAA) sets the minimum standards and requirements for the protection and security of PHI. In addition, several US states have even stricter privacy laws as HIPAA serves as a floor in the US for the minimum protection and security of PHI. Importantly, the cross-border transmission of patient data will invoke not only HIPAA but potentially the privacy laws of the state where the patient resides and the privacy laws of the state where the eHealth physician is located. Also, for EU-specific privacy and patient data, the EU has an even more complex set of rules and regulations. Readers are strongly advised to work with EU legal counsel. A recommended summary of the complex nature of EU privacy rules is listed below [3].

(5) Reimbursement

As set forth above, the US federal government regulates the Medicare program which is the largest payor of health care services in the US. To date, reimbursement for eHealth clinical services is fairly limited to live audio and video eHealth services and only when the patient is located in a very rural area of the US. However, numerous US state governments and private payors have begun recognizing that critical patient needs can be handled via eHealth clinical services and are now reimbursing physicians for eHealth clinical services. A reasonable prediction can be made that by 2020 most eHealth clinical
services will be reimbursed by all payors, including for patients in the Medicare program, as eHealth clinical delivery programs are fully integrated in hospital systems and rural communities throughout the US.

Fulfilling an Academic Medical Center’s Community Mission through the Appropriate Use of eHealth for Women’s Health Care

eHealth Overcomes Impediments to Women’s Health Issues

Beginning in 2008, the Department of Obstetrics, Gynecology and Women’s Health began to welcome formerly private practices into the Department with the goal of achieving improved value for the patient by improving quality and access to specialized care. The resulting Community Practices Division now has more than 100 providers practicing out of more than 38 clinical sites and five hospitals. To help achieve this goal, the Department has successfully launched and expanded eHealth clinical initiatives into the rural communities of Western Pennsylvania. The most developed of initiatives are Fetal Imaging and Maternal Fetal Medicine (MFM) eHealth programs.

As practices were added to the Department, a substantial variation in the quality of fetal imaging was identified. Beginning in 2012 a program of centralized imaging for the Department was initiated to improve the reliability and quality of imaging studies. Imaging sites outside of Pittsburgh were identified in affiliated hospitals and provider offices for inclusion in the eHealth project. Utilizing a combined approach of Department-trained technicians, standardization of ultrasound equipment, and transferring images in real-time to dedicated OB ultrasound subspecialists who communicate directly with on-site technicians, fetal imaging in the Department has improved to the point where more specialized imaging is now routinely accomplished without the need for the patient to travel to the academic medical center in Pittsburgh. eHealth Fetal Imaging is now available in five hospitals and 12 provider offices outside of the greater Pittsburgh area.

The development of the eHealth Fetal Imaging service was foundational in the development of the MFM eHealth program. The Division of Maternal Fetal Medicine provides high-risk pregnancy consultations for patients in the Community Practices Division. These patients are spread across a wide geographic area, and are often at a financial disadvantage when compared to patients in more affluent metropolitan areas closer to the academic center. Patients in rural communities who require MFM consultation face many impediments in order to regularly see a sub-specialist consultant in-person. These impediments include: (1) the geographic distance between their home
and the physician’s office, often 1-2 hours driving time each way; (2) the physical difficulty of travel given their physical condition; (3) transportation impediments, including lack of availability and cost; and (4) the financial impact of lost work day(s) of the MFM patient and any support persons who accompany the patient. Fear of traveling to a major metropolitan area, navigating complex urban geography and imposing facilities can also be an impediment. Without an eHealth option for patient visits, many MFM patients would either forego in-person visits partially or in whole, or would suffer economic harm for lost work time and travel costs.

In order to assist MFM patients as well as other patients in overcoming these significant impediments, UPMC and its affiliates established eHealth consult centers at several of UPMC’s rural hospitals and health care facility settings. The consult centers are dedicated outpatient medical offices and include the following important components:

1. Electronic scheduling for eHealth visits;
2. State-of-the-art secure audio and videoconferencing equipment that allows the MFM physician specialist to remote into the consult center room;
3. A licensed provider (physician assistant, nurse practitioner or registered nurse) who is present with the patient at the time of the eHealth consult; and
4. A fully centralized electronic health record solution which allows the MFM physician to review in advance the MFM patient’s medical record and to add to the medical record the notes, findings and treatment plan agreed to during the eHealth consult.

The number of MFM eHealth consults and the patient satisfaction ratings of these consults are impressive. Since the first MFM eHealth consult center went live in June, 2012, UPMC’s MFM physicians have completed over 400 consults for MFM patients. 92.2% of all MFM patients have reported being very satisfied with their eHealth physician and the content of the eHealth consult.

Encouraged by the success of these ventures, the Department is initiating two new consultation services. Beginning in March, 2015 First Trimester Screening (FTS), which requires a combination of highly specialized ultrasound and laboratory evaluation to detect fetal abnormalities, will be offered at remote sites. Because of the highly specialized nature of the imaging, and the advanced training required to produce these studies, this testing was formally only offered at the academic center. Beginning in April, 2015 prenatal genetic counseling will be offered via eHealth at the remote consult centers. Future plans include consultation for Oncology
genetic consultation, Gynecologic Oncology, and Reproductive Endocrinology and Infertility eHealth programs.

Conclusion

The mission of UPMC is to provide the highest quality clinical services to the entire community in Western Pennsylvania and beyond. UPMC embraces eHealth technology and affords its physicians and other providers the opportunity to re-define the practice of medicine to include eHealth clinical services. The Department of Obstetrics, Gynecology and Women’s Health at UPMC fully embraces UPMC’s community mission and provides an outstanding example of how the integration of eHealth into an already thriving medical practice can not only increase the quality of care that patients receive but also eliminate many of the impediments that patients located in rural communities are otherwise challenged by in order to receive world-class clinical care.

Acknowledgment

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References


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Mentoring Young Scientists and Engineers in Interdisciplinary Domains

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Introduction

In last decades the effort to increase the number of women applying for studies at technical universities, and consequently for a job in the field of technology and engineering, can be seen in European countries. However, the amount of female students and subsequently graduates in technical fields is still quite small. One of the possible ways how to support them both in their study and career development is mentoring. Mentoring is a process of continuous and dynamic feedback between two individuals to establish a relationship through which one person shares knowledge, skills, information, and perspective to foster the personal and professional growth of the other. It is a different relationship than supervision which is usually pre-established and does not necessarily lead to the personal growth of the individual.

Mentoring and Models of Mentoring Programs

Mentoring is a powerful personal development and empowerment tool. It is an effective way of helping people to progress in their careers and is becoming increasingly popular as its potential is realized. It is a partnership between mentor and mentee normally working in a similar field or sharing experiences. It is a helpful relationship based upon mutual trust and respect.

The main aim of a mentoring program is support of professional development of postdocs and PhD students and help to start their scientific career. This complex aim consists of several partial goals: help young researchers to identify their career goals and steps to reach them; ease orientation in scientific career system; mediate them important contacts with the peers and more experienced researchers and extend their professional network; strengthen mutual exchange of experience among program participants; support self-confidence of young researchers.

Mentoring is quite frequently used within an institution to help new members of staff. It is interesting that active and successful mentoring programs can be found in life sciences but not so frequently in engineering or strongly interdisciplinary areas, in particular on the edge of engineering
and medicine or biology. Mentoring programs can be based on different models of interaction. Some forms could be better adjusted for newcomers, some for more experienced employees. A group peer, collaborative mentoring model founded on principles of adult education is a good example of the latter mentoring form.

With fast development of interdisciplinary R&D, interdisciplinary mentoring has become more important and prevalent over the recent years. Interdisciplinary mentorship is the tool of scientists to help produce synergy in group, and to generate multifocal ideas and complex solutions to complex challenges. We should mention that it is frequently more useful and enriching if the mentor and mentees are coming from different disciplines and even from different institutions because they can view all the issues from slightly different points, bring new opinion and perspectives, and are not bound by processes and relations in the institution of the mentees.

The areas covered by mentoring are extensive and diverse: networking (professional, educational, supporting); career support; role model; communication skills; research progress; supervision; scientific writing; presentation skills; combination of professional and private life. However, we have to note that the coverage of these areas in a single mentor–mentee relation need not be exhaustive. The content must be individualized based on the situation and previous experience of the particular mentee.

Relation between Mentor and Mentee

A mentor is a guide who can help the mentee to find the right direction and who can help him/her to develop solutions to career issues. The mentor relies upon having had similar experiences to gain an empathy with the mentee and an understanding of his/her issues. Mentors are usually experienced researchers or university teachers from the same or similar scientific discipline. However, it is recommended that they come from a different institution than the mentee. As mentioned above, in interdisciplinary areas it is welcome when mentor and mentee come from different disciplines. Mentoring provides the mentee with an opportunity to think about career options and progress. A mentor should help the mentee to believe in himself/herself and boost his/her confidence. A mentor should ask questions and formulate challenges, while providing guidance and encouragement. Mentoring allows the mentee to explore new ideas in confidence. It is a chance to look more closely at oneself, one’s own issues, opportunities and what he/she wants in life. Mentoring is about becoming more self-aware, taking responsibility for one’s own life and directing the life in the direction he/she decides, rather than leaving it to chance.
Mentoring has several specific features: It works off line which means that the mentor is someone from outside the mentee’s reporting hierarchy at work. The mentee cannot have an open mentoring relationship if his/her mentor knows the mentee’s boss well. It is highly recommended that the mentors come from completely different organizations. Issues between mentor and mentee are confidential. Mentoring is mentee driven: The mentee must take the initiative and does the leg work in the relationship. The final responsibility for actions taken, as a result of mentoring, lies with the mentee. Mentoring should not be based on bureaucratic work: Mentoring means work with individuals and not institutions and so the mentors and mentees have to carry out the mentoring relationship in their own time. Since they are all busy people they should spend meeting time with productive discussion and not filling forms.

Person focused and personalized: We realize that women, particularly working mothers, often need to balance their working lives with responsibilities at home. We recognize that issues outside the workplace may be hampering progress at work. Mentors and mentees should match using their own criteria—career considerations or aspects of their personal circumstances. Most of the mentoring programs provide guidelines and training for both mentors and mentees, but the issues discussed will vary depending upon the issues being faced by the mentee.

Examples of Mentoring Programs

Recently several professional engineering societies, e.g. [1-3], and many American universities have started to organize mentoring programs. They have different forms with relations to type of mentees addressed. Many American universities organize mentoring programs for their students. They offer special programs for women in engineering and various programs for students of different years of study. Mentors and mentees is a peer mentoring program where freshmen are matched with juniors, and sophomores with seniors, in the same major. Grad mentoring program is a program providing peer mentoring for incoming graduate students. Professional mentoring matches undergraduates with professional female engineers from industry.

The IEEE Student-Teacher and Research Engineer/Scientist (STAR) Program was developed to address the growing concern that, at a young age, girls are discouraged from careers in mathematics, science, and engineering. This program promotes involvement of IEEE members with local junior high and high schools in order to create a positive image of engineering careers. Through a one-to-one interaction between society volunteers and a Student-Teacher Team, STAR’s aim is to create a technical
support network for teachers and a mentoring program for students. In Europe, the network SCIENTIX based on previous successful EU project has been established and has similar aim: to attract primary and secondary school students to science, technology, engineering and mathematics.

Conclusion

This paper presents briefly several aspects of mentoring and relation between mentor and mentee. We tried to point out that the relationship is based on mutual trust, respect, mentor’s experience and mentee’s commitment. It is important that the mentor demonstrates proper professional behavior, shares what he/she knows, and develops a shared connection with the mentee. Mentoring helps to deal with new experiences, tackle problems, and manage time better.

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References


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Sexual Abuse in Adolescents in Owerri: The Family Characteristics and the Long Term Implications

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Introduction

A key factor associated with optimal child wellbeing is the parent’s ability to provide children with safe, nurturing and stable environment that supports the development of their cognitive, emotional and social skills [1]. Cultures in sub-Saharan Africa value children highly [2]. Yet, children suffer at the hands of their parents who should offer them protection.

The risk for Child Sexual Abuse (CSA) is higher in families that are dysfunctional. CSA is associated with depression, poor language and mathematics proficiency.

Materials and Methods

Setting of the study:
This was a cross-sectional study, carried out among students in public secondary schools in Owerri metropolis, the capital of Imo state, Eastern Nigeria.

Study population
Only senior secondary students participated in the study mainly because they are literate enough to be able to understand and complete questionnaires with little or no assistance.

Sampling technique
A multistage, systematic random sampling of schools and students studying in male only schools, female only schools and mixed schools was employed. Eight schools and 1128 students participated in the study.

Instruments
- The Sociodemographic questionnaire. This was self administered, comprising of simple questions with respect to gender, age, etc.
- The Adverse Childhood Experience (ACE) questionnaire;
• The Patient Health Questionnaire (PHQ 9) modified for adolescents (PHQ-A).

• The academic performance rating measured results in English and Mathematics from the three previous years which included the end of the year examinations and the scores in their third year of the Junior Secondary school period. The West African Examination Council (WAEC) scoring system was adopted.

Procedure
Following approval by the Ethical Committee from Federal Medical Centre Owerri, the permission from the education and school authorities, as well as parental consents and participants’ assents were obtained. All the recruited participants had the study questionnaires self administered.

Results

Sociodemographic profile
The participants’ age ranged from 10 – 19 years, with a mean age of 15.92 ± 1.4 years, median of 16 years, mode of 16 years.

Patterns and prevalence of Adverse Childhood Experiences (ACEs):
(a) Sexual abuse:-
Two hundred and twenty eight (20.2%) participants reported sexual abuse. More females 137 (60.1%) than males 91 (39.9%) reported ever having had sexual abuse. All the perpetrators were known to the victims. One hundred and eleven (49%) of the sexual abuse perpetrators were neighbors, 47 (20.6%) were older relatives living in the same house with the victim, 48 (21%) were family friends, 18 (8%) of the perpetrators were house helpers, while the rest were parents, pastors, teachers and home security guards.

(b) Family Dysfunction
Close to 70% i.e. 157 of the participants with sexual abuse history came from dysfunctional families. Sixty seven (43%) of the participants witnessed domestic violence in their family, 37 (24%) had at least one parent who had mental illness, 43 (27.4%) had experienced the separation of their parents at one time or the other, 22 (14%) came from a divorced home, 38 (24.2%) had a parent who abused substance, 31 (20%) reported that their fathers had died and 12 (8%) reported that their mothers were dead, and 15 (10%) have experienced the incarceration of one of their parents.

Patterns and prevalence of depressive disorders among the sexually abused
One hundred and two participants (45%) of those who suffered depressive disorders had Major Depressive Disorder (MDD), while 44 participants (19.3%) had sub threshold depressive disorder.

Discussion

Patterns and prevalence of Adverse Childhood Experiences

20.2% of the participants reported sexual abuse which is comparable with 26.2% reported by Jekayinfa and Oluwapo [3] among secondary students in Nigeria. In the present study nearly half of the perpetrators (48.7%) of sexual abuse were from the participants’ neighbors. A report by UNICEF [4] in a Tanzanian study, gave the prevalence rate of 48.8% of sexual abuse from neighbors.

60% of the participants, who experienced sexual abuse, were females. The statistics for female sexual abuse vary from 27% in North Central Nigeria in a study by Envuladu et al [5] to 87% from a study by Akinlusi FM et al. [6] in Lagos Nigeria.

43% of the participants, who were sexually abused, and who were members of dysfunctional homes had also witnessed domestic violence in their families. The estimated overlap between domestic violence and child physical or sexual abuse ranges from 30% to 50% in USA [7].

45% of those who were sexually abused had Major Depressive Disorder (MDD). One study reported that 37% of those who had depression had experienced sexual abuse when they were below 16 years of age [8].

In the current study 48% of the participants who had been sexual abused had grades below the credit level. This agrees with a study in the United States which reported that 26% of 7-12 year-old girls with a history of child sexual abuse reported that their grades dropped after they were abused and 48% had below-average grades [9].

Conclusion

Sexual abuse is prevalent in dysfunctional families in Owerri and Major Depressive Disorder and poor academic achievements are very important aftermaths.

Recommendations - Implications for Education

Africans in general and Nigerians in particular, seem to have a great trust in their neighbours and extended family members. It is often assumed that these familiar individuals would act as parent loci. The close kinship system, while not as strong as perhaps it was over forty years ago, is still much relevant. It is often said in Africa that the child belongs to the community not to an individual parent. Yet these familiar people could turn
round to wreck havoc on innocent children, ruin their future mental and academic well being. It would be necessary for parents to know the potential sources of child sexual abuse so that adequate measures can be put in place to protect the children. There is need to have forums for educating parents on good parenting practices and good family relationships to enable them make informed decisions for their actions. The use of cell phones and internet facilities for educational purposes to parents can give the widest coverage. For example, in Nigeria as at 2013, there were 165,716,078 connected Global System for Mobile communication (GSM) connected lines. This is a huge resource that must be use to educate parents and children and prevent and diminish sexual abuse.

Introducing a psychology course that teaches on parenting and family matters as part of a university curriculum can leave a lasting impression on these future parents. Such courses may also be applied virtually or become part of virtual/distant/lifelong lasting education.

It is important that children and adolescents are taught age appropriate sex education by parents and teachers, whom they can trust. Cyberspace could also be an important tool. School curriculum may need to have information on child and sexual abuse, to create awareness among both teachers and students.

The study is a first step towards the development of a wide virtual education on sexual protection in children.

References

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The Women Observatory for eHealth (WeObservatory) Develops an Intelligence MOOCs Commons for Women and eHealth

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Background

The Foundation Millennia2025 “Women and Innovation”, PuF, is the pursuance of the Millennia2015 "Women actors of development for the global challenges", a foresight research process implemented in 2007 by the Destree Institute [1]. The Foundation is committed to implement the Action Plans for women's empowerment and gender equality. The Women Observatory for eHealth (WeObservatory), one of these Action Plans, seeks to highlight the crucial role of women in global health, eHealth and telemedicine, as well as their recognized capacity as builders of alternative futures.

Introduction

Capacity building has been identified as a key factor for socio-economic development and women’s empowerment. Yet, in many countries, women’s access to tertiary education remains extremely low, due to inequitable access to lower levels of education, cost, distance, cultural restrictions, and language barriers, among other factors [2]. Increased penetration of Information and Communication Technologies (ICTs) and access to more affordable mobile and broadband services worldwide can help overcome some of these barriers, by providing women new ways to access free educational resources using the Internet.

Offered by an ever-growing number of platforms and in a great variety of topics, Massive Open Online Courses (MOOCs) provide anyone with an Internet connection, open access, for free, to online educational content developed by higher education institutions. MOOCs are also characterized by their scalability, as their design allows for an indefinite number of people to participate from anywhere in the world [3].
To raise awareness and help women and health professionals take advantage of this valuable resource, the WeObservatory launched in 2014 its Intelligence MOOCs Commons for Women and eHealth (WeMOOCs hereafter) [4]. The WeMOOCs provides access to a selection of online courses addressing the areas of global health, women, and ICTs. In this way, the WeObservatory aims to serve as a unique Resource Center on eHealth and telemedicine, promoting the use of ICT by women and healthcare professionals for improved health outcomes.

The Intelligence MOOCs Commons for Women and eHealth

The WeMOOCs seeks to strengthen a corpus of specialized advisors to improve the selection and number of MOOCs on women and eHealth. The goal is to facilitate the access of women around the globe to online education in those areas. To this end, twice a year, specialized advisors and members of the Foundation scan online course offerings from some of the largest and most widely recognized MOOC platforms—such as Coursera, edX, Alison, FutureLearn, and MiriadaX—, educational institutions and research centers from around the world (e.g. FUN and MITOpenCourseWare), as well as development organizations (USAID).

The selection of courses listed in the Commons is based on three criteria: (1) they should be accessible for free, either on demand or at a regular schedule specified by the educational platform; (2) cover one or more of the three areas of interest to the WeObservatory: Health, women, and ICT (excluding programming courses), and (3) be offered in English, Spanish, and/or French—three of the six UN official languages.

Trends in MOOC Offerings in the Areas of Women, Health and ICT

In 2014, the WeObservatory advisors identified and selected 72 MOOCs in English and a handful of courses in the other two languages, covering various topics of interest to women, such as nutrition, nanotechnology, diabetes, AIDS, and nursing. In February 2015, the list of course offerings for 2014 was revised, extending the number of MOOC platforms included in the search from 10 to 21. As a result, the total number of courses selected increased almost five-fold to 340, incorporating courses from 18 countries in America (6), Europe (8), Asia (2), the Middle East (1), and Oceania (1).

Course language

Given that most of the academic institutions partnering with the largest MOOC platforms are located in the United States and the United Kingdom, it is not surprising that, like in 2014, most of courses selected for the Commons are offered in English (276), sometimes with subtitles in other languages (Fig. 1). Even so, the number of courses offered in French and
Spanish has grown steadily, thanks to an increasing number of universities in Spain, Latin America and France providing MOOCs, and to the creation of MOOC platforms specifically for courses in those languages, such as mooc.es and Solerni. The updated list for early 2015 includes 36 courses in Spanish and 28 in French (Fig. 1).

**Topical areas of interest**

In terms of the areas of interest to the WeObservatory, a trend continuing from 2014 is the prevalence of courses covering diverse health topics. As illustrated in Fig. 1, 70% of the courses selected for the WeMOOCs refer to health, 28% to ICTs, and only 2% to women and gender issues. Of the 340 courses selected for the Commons, only 39 (12%) referred to women’s health issues, including reproductive health, antenatal and postnatal care, family planning, cervical cancer, HIV, and human trafficking. Nine per cent (29 courses) focused on the use of ICT for health, covering topics such as eHealth, mHealth, bioinformatics, nanotechnology, communities of practice and the Cloud, Big Data, and data visualization. Finally, two courses (1%) referred to the analysis of gender implications on the use of technology, such as videogames.

Interestingly, none of the 21 platforms searched offered courses that focused on the use of ICTs for health by women or for women’s health. This is an important gap that, although covered by diverse organizations, such as GSMA Connected Women, through projects and research, it is just starting to be addressed as a topic for online course offerings by organizations like the Millennia2025 Foundation.

![Fig. 1: Distribution of courses selected for the WeMOOCs by language, topic and type of course (%), as of February 2015](image-url)
Ease of access

Compared to the 2014 selection, there has been a significant increase in the number of MOOCs offered on demand. In 2015, 156 of all the selected courses (46%) were offered on an ongoing basis (Fig. 1). Although missing the interactive component of regularly scheduled online courses, self-paced courses provide greater flexibility in terms of access, allowing students to cover the material on their own time, instead of during specific windows of availability.

The mobile component

The ubiquity of mobile technology and its health applications are already permeating the selection of MOOCs offerings. Of the 94 selected courses focusing on ICT and ICT for health, 19 had a mobile component, of which eight referred specifically to mHealth. These courses are clearly indicated in the lists of selected MOOCs offered in the WeMOOCs.

Online courses at the Millennia2025 Foundation

The Foundation is currently working towards two goals: First, developing a digital platform in collaboration with WePromis, the European Commission initiative for digital jobs [5]; and secondly, developing a closed online course to educate professional midwives and healthcare professionals on the use of ICT for maternal health and midwifery. To advance this latter goal, in September 2014, the WeObservatory worked with CASA, a nonprofit organization in rural Mexico, to develop the closed online course with funds from the Foundation Sanofi Espoir [6]. The course composed of 7 modules—including two modules focused on ICT for health and ICT for maternal health and midwifery—also covered content on midwifery practices, gender equality issues and adult education. This year, the Foundation plans to expand the reach of this online course to other Latin American countries by developing specialized modules on ICTs for midwifery and nursing.

Conclusion

The analysis of MOOCs offerings in the areas of health, women, and ICT highlights the broad range of topics currently covered in the three languages, and the important role that such courses can play as means for building capacity among women and health professionals worldwide. Identified gaps in the areas of multilinguism and courses focusing on gender issues, as well as the lack of course offerings on women’s health and ICT indicate that there is still work to be done to facilitate the access of non-English speakers to higher education courses, and move towards a more in depth coverage of gender equity issues. With a combination of projects,
applications, and the Intelligence MOOCs Commons for Women and eHealth, the WeObservatory seeks to provide an innovative e-platform at the service of women and health professionals in the Post-2015 framework and the Sustainable Development Goals to be defined later this year.

References

[1] The Destree Institute is a European pluralist research center, NGO official partner of UNESCO (consultative status), and in special consultative status with the United Nations Economic and Social Council since August 2012.


Dr. Lilia Pérez Chavolla has specialized in the analysis of telecom policies and the application of ICTs for development. She acts as Senior Advisor in ICT Applications for the Millennia2025 Foundation’s WeHealth International Working Group, promoting the empowerment of women through innovation in health services.

Dr. Veronique Inès Thouvenot is Co-founder and Scientific Director at the Millennia2025 Foundation, where she heads the “Women and eHealth” International Working Group (WeHealth), the Global Network of Women in Telemedicine (WeTelemed), the WeObservatory, and the Zero Mothers Die Initiative. She has worked for the International Telecommunication Union as eHealth Advisor, and for the World Health Organization as scientist in the eHealth unit.
Where There Is No Hospital: Mobile Sonography Devices to Reduce Maternal and Foetal Mortality and Morbidity

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Abstract: Pregnancy is complex and unpredictable. High-risk pregnancies, where complications are likely, require managed care in a hospital with emergency obstetric facilities, and in populations with limited access to professional health care women and babies die at significantly elevated rates. In Australia the mortality rate is 6 per 100,000 but women in rural and remote areas and indigenous women suffer 3 times that mortality. In Timor Leste where 75% of women live in areas with limited access to trained health professionals or hospitals, the maternal mortality rate is 600 per 100,000, 100 times greater than Australia [1, 2]. In both contexts an inexpensive mobile device that would allow the remote recognition of risk factors early, thus allowing time to intervene and provide the emergency care needed, would save the lives of women and their babies. Key tools to assist Obstetricians and Midwives in their clinical decision making are diagnostic information obtained through sonography devices such as stethoscopes, fetoscopes, Doppler and ultrasound. We have developed and validated a design for an inexpensive stethoscope (ca. $10 cost) that connects through the headphone jack of a mobile phone. The diagnostic information captured and converted through a transducer to digital form can be sent over regular mobile networks. This diagnostic system allows the health worker with the patient to maintain communication in real time with an expert and be guided as to placement of the scope to capture the diagnostic information. The expert, able to hear and interpret the information, can then make a diagnosis based on accurate information. Since Doppler and ultrasound are also analogue based systems, we anticipate that our approach will readily be extended to these modalities. The expense of diagnostics is in training radiographers to evaluate data interpreted by expensive equipment. Cheap available technology can be used to simply capture the data and transmit it via mobile phone to the facility with the interpretive capacity. Anyone with a mobile phone will have access to life saving expert diagnostic information.
Introduction

Cloud Babies is working to develop effective, low cost telemedicine support using sonography devices with a mobile phone as the sound transport method. The proposed device allows for diagnostic information to be communicated between two users with a mobile phone, whilst maintaining a conversation. This would improve support for health workers in the developing world and provide real time remote diagnostic services without significant equipment expense.

Background

Lack of access to high quality obstetric care results in high maternal mortality rates (MMR) and MMR’s are highest in remote areas [1, 2]. In Timor Leste, the WHO reports a MMR of 300 per 100000, however according to UNICEF the MMR is 600 per 100000 births. This is 100 times more than in Australia [1, 3]. In Timor Leste the majority of women live and birth in remote areas where access to obstetric care is limited due to lack of trained personnel, infrastructure and the availability of diagnostic equipment [4, 3]. The use of skilled birth attendants (SBA) is increasing which has been shown to improve MMR but their education and resources are limited [5]. In remote areas they often work alone without the support of colleagues or access to sophisticated diagnostic information interpreted by experts to support them in their clinical decision making.

This paper proposes that using mobile phones and the proposed technology, SBA working remotely can be better supported in clinical decisions and thus provide quality obstetric care and reduce the MMR.

Telemedicine Stethoscope

Sonography diagnostic equipment, stethoscope, Doppler and ultrasound use sound waves to capture the internal working and structure of the human body. The probe or transducer is not complex or expensive. They are invaluable in obtaining information on the growth and development of the fetus and the health of the pregnant mother [6]. They allow for screening that identifies risks such as ectopic pregnancy, placenta praevia, multiple pregnancies, and intra uterine growth retardation prior to labour. These pregnancies are high risk and require management of the intrapartum period in a facility with emergency obstetric care [7]. By interfacing transducers with a standard mobile phone the SBA can be guided as to placement to capture accurate data and transmit it in real time. The remote specialist can interpret the data and support clinical diagnostic information. Since the hardware is inexpensive and the specialists interpreting the data are centralized, such a system would be cost effective to employ.
Fetal distress, especially during early labour is an early sign of complications such as obstructed labour or sepsis, two of the leading causes of MMR [3]. Auscultation of the fetal heart rate (FHR) is the preferred method to assess fetal wellbeing in utero using a fetoscope or Doppler [6]. It takes experience and skill to locate correct placement for auscultation and to discern acoustic differences as diagnostically important [8]. This is further complicated in FHR monitoring as it is not just the FHR but also the FHR in relation to the timing of contractions that is necessary to determine fetal distress [6]. SBA working remotely may not have the skills or experience to recognise the complex clinical picture and the decision to act is often made too late [8]. With a telemedicine stethoscope they could consult a remote midwife or obstetric doctor, share the diagnostic information, including the actual sound of the FHR in real-time which would support a better clinical decision.

**Technical challenges**

The stethoscope itself is already highly developed so it is expected that technology already available is sufficient. A fetoscope works on the same principles of sound magnification and transmission. The challenges are interfacing the mobile phone to the stethoscope, removal of background noise and keeping costs to a minimum.

**Audio challenges**

The primary audio challenge is removal of background noise from the sound acquired from the stethoscope prior to it being transmitted via the mobile phone. The appropriate technology for low cost noise cancellation uses multiple microphones and mixes the ambient microphone signals “out of phase” with the main stethoscope signal to cancel the ambient sound [9]. Electret condenser or silicone microphones are small, low power, low cost and readily available.

**Audio mixing / switching**

The next challenge will be allowing the SBA to also converse with the remote health practitioner without having to plug and unplug the stethoscope. The easiest way to achieve this is by the use of audio mixing or switching where the SBA can either switch between voice and stethoscope or mix the 2 sounds together to allow both to go to the remote health practitioner. This is also conventional technology.

**Power supply**

All mobile phone sockets provide sufficient power to drive the proposed microphones and also provide the amplification so it is likely that sufficient power can be derived from the headphone set to power the unit. At most a
small battery might be needed. Power is a concern in low resource environments.

**System challenges**

Development and testing of telemedicine sonography requires support of a health care system. Integrating this into current models of care poses a number of challenges: 1) Remote diagnosis needs to be based on quality information; 2) Availability of specialists to monitor phone calls; 3) The quality of cellular networks in remote areas.

**Software**

Software is not necessary as the stethoscope signal will appear to be the same as a regular headset microphone signal to the phone. This makes it independent of the model of phone being used. Software to manage the higher frequencies required by Doppler and ultrasound may be necessary. To minimise cost this could be applied at the remote end.

**Possible Product Format**

Future Direction

Cloud babies goal is to find funding source to develop diagnostic sonography transducers at minimal cost to ensure availability in low resource environments. Goal is to complete development and clinical trials by end of 2015.

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Fiona Marlow, Director of Cloud Babies is a paediatric Occupational Therapist. She has completed a Masters of Nursing Practice and is currently completing a Graduate Diploma of Midwifery. Her goal is for all women to birth safely, no matter where they live.
Home Healthcare & Remote Patient Monitoring
3Ecare® Concept
HTrainer® a Use Case in High Altitude Race in Nepal

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Introduction

Since 2005 our Institute has been instrumental in developing appropriate IT care solutions to conditions specific to isolated mountain areas. Despite the success of our telemedicine case [1] and our IT suite Res@mu®, finalist in the 2008 World Summit Awards, even with the success of remote tests (wilderness medicine, health clinics) and although, the enthusiasm of some manufacturers, it was clear that this model was not economically viable. In the current version, using biomedical sensors linked to a private cloud network, the challenges lie in the fact that some manufacturers require the use of a proprietary gateway to communicate with their sensors. In addition, most of the sensors not being stamped with the medical CE label nor FDA approved, it is difficult to find a mass market for the solution.

3Ecare® Concept

Because IT healthcare should be accessible everywhere, implemented by everyone, for everyone, we created the 3Ecare® concept. As early as 2008 we launched a complete overhaul, using only open technologies (Java®, Spring®, Hibernate®, MySQL®, PostgreSQL®) implemented as a neutral network. This new software suite, called ResaCore (European program ResaMont [2]), is entirely based on code injection [3]. This high level abstraction has allowed the use of an MDA approach [4] to secure its architecture. This project has been the subject of a national research project, the SELKIS project [5-9]. This new core was supported by any environment (Windows, Linus, and IOS), managed a complete medical record, could achieve an HL7 mapping but was still too heavy for our final target: Smartphones. To integrate ResaCore with SQLLite®, we were obliged to wait till 2010, when the Spring® extension was added to Android®. Meanwhile, our architecture, based on open technologies and carried on a free (or almost free) gateway, using an Android® Smartphone, was ready and responded fully to the 3Ecare® concept.
The Smartphone and Universal Gateway

The first tests undertaken by the Resamont program [10] clearly showed the users adoption of our Smartphone applications. A consensus quickly emerged and above all, applications grew rapidly and in 2013 there were nearly 11,000 downloaded from Google Play® [11]. The interest in m-Health has also been confirmed by the European commission which, in its green paper of April 2014, confirmed its contribution to health and evoked the future importance of big data through the development of personal sensors [12]. The Commission recommended the need to have a clear legal framework, the need for safety of m-Health applications, and the need for interoperability. If we add that the market has exploded with over 97,000 m-Health apps currently available across multiple platforms on the global market [13], it is important to propose solutions to these problems. This is the main objective of the 3Ecare® project.

Implementation for 3Ecare®?

To implement and test our concept we have chosen three user cases: sport/fitness, isolated worker and a tele-medical platform (European project SOSMAM [14-15]). In this case the term “sports” is defined as “improved physical conditions for the largest number”, such as the option of “SportHealth on prescription”, a French initiative in Strasbourg, whereby physicians may prescribe sports, supported by health insurance. Connected to the 3Ecare® cloud, we have developed a training application for health called HTrainer® (Smartphone and web application), the first pilot test for our project. HTrainer® manages a limited number of physical parameters and uses only CE medical or FDA approved sensors. Above all our entire development chain is ISO 13485 compliant, placing us in a medical device context.

HTrainer® Testing Methodology

For more than a year (2013 – 2014) we tested the use of HTrainer® (connected to the 3Ecare® Cloud) by sports teams (a Swiss hockey team), and individual athletes. We recorded all the workouts and some competitions games. By applying algorithms derived from the work of Morton and Banister [16], by monitoring the change in the athlete’s medical parameters and particularly heart rate variability (HRV) [17], the 3Ecare® cloud flagged unsuitable preliminary practices as well as underlying pathologies masked by athletes (30% of overtraining in the team, 6% hidden pathology). It also works as an indicator for amateurs or semi-professionals (non-professional teams) who undertake sports as a secondary activity. In this first case, which involves an ice-hockey team, and in which the athletes...
do not have access to the results nor analysis, the data are transmitted over the Internet and analyzed after the fact. The prognosis provided by E3care has been verified by individual medical interviews. The second case was more unusual and isolated. We equipped 10 competitors competing in the SoluKhumbu Trail, a trail run at high altitude in the Everest region covering 330 km over 28,000 meters of positive vertical drop. Each runner wore a bespoke chest sensor which tracked some 10 parameters recorded on his HTrainer device (heart rate, respiratory rate, core temperature, HRV etc.). The system also activated automatic functions within the application to alert the athlete of any overtraining or high altitude disease risk. The data was transmitted to the E3care cloud every night via satellite (Bluetooth network between the antenna and each Android® device). Every athlete had access to his own individual basic dashboard of information. The race doctor and medical experts (remote expertise) had access to all the dashboards. In this second stage, all athletes who followed the advice of HTrainer® algorithms completed the race with an improved aerobic capacity (70%); according to the dashboards. The race doctor, having examined the athletes came to the same conclusions (fatigue, overtraining, high mountain sickness). The opinions of remote experts, based only on the dashboard results, matched 60% of the pathologies and the predictions, based on HRV screening, of acute, stage 3, mountain sickness in 2 out of 10 runners.

Conclusions

This latest study, although based on a study of a cohort of 10 athletes, using some 20 parameters stored in the 3Ecare® cloud (over many Go in database) demonstrates the power of m-Heath based on medical methods and sensors. Most of the runners improved their health management and were able to be totally autonomous in using application. The data provided by 3Ecare® helped to enrich the dialogue between each athlete and the race doctor. The experiment was able to support the expected results evoked in the green paper of the European commission [12]. The 3Ecare® project continues with the implementation of complex methods combining its telemedical platform, the Cloud and the data from HTrainer®. Based on these findings and using new technologies, new applications are being devised for industrial workers, called HWorker®.

Acknowledgements

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Introduction

The selection of medical equipment has always been far from easy and the selection of equipment for telemedicine is even harder. The Russian-Norwegian project “Qualitative improvement of medical service of the indigenous population of Nenets Autonomous Okrug (NAO)” includes the measures aimed at introduction of a system of monitoring of patients in the most remote settlements of the region. It was planned to purchase two hardware/software complexes (HSC) for registration of physiological parameters and automatic data transfer.

In studying the market of medical equipment we selected an HSC for screening psycho-physiological and somatic health status, functional and adaptive human reserves. It was a mono-block, small size HSC with detectors connected via the interface for registration of physiological parameters. The complex allowed the examination of cardio-vascular, respiratory, central nervous systems, eyesight, hearing, and an assessment of physical fitness. Any paramedical worker can easily operate the complex.

To assess whether the HSC meets the requirements of the functional and technical characteristics of equipment specified in the project, the representatives of State Healthcare Institution NAO “Nenets Regional
Hospital” tested the HSC in the routine work mode. The testing showed that this equipment does not meet the project needs and should be re-addressed.

To select an alternative HSC and a list of equipment that can be purchased and installed in the settlements of the Nenets Autonomous Okrug, we worked out the adequate requirements (by groups) for HSCs to fit a fully-fledged and informative distance use.

Objective: improvement of the quality and access of health care to people living in remote settlements.

Tasks

Systemic assessment of physical, psychological and psychic development, status of cardio-vascular, respiratory, central nervous, locomotor systems and adaptive abilities, development of a preliminary opinion based on examination findings, transfer of data to a diagnostics center (multi-profile medical organization, etc.) for data review, assessment of the state of health, formation of a mobile team for medical check-ups, formation of a cohort to be monitored in a diagnostics center (multi-profile medical organization, etc.) and preventive work.

General Requirements for Equipment

1. Small size;
2. Attributes required by potential equipment:
   - Basic configuration (a set of equipment for a mandatory, planned examination)
   - Supplementary equipment for extended, in-depth examination
3. User-friendly interface;
4. Screen tips for each test;
5. Possibility to use WKS by paramedical workers;
6. A detailed user manual. An important and necessary condition of effective work, detailed descriptions of procedures (they are numerous) – which will enable avoidance of mistakes in their application. The procedures should contain sufficient number of tests;
7. Necessary software components and drivers for different operating systems present in the supply package with setup instructions;
8. In case of delivery without a computer the system requirements for the PC should be given;
9. The patients data and examination findings should be stored and sorted by:
   - Date of examination (with a possibility of further comparison in dynamics),
   - Age,
• Gender,
• Full name – name – patronymic name;
• Place of residence (school or educational institution)

10. Possibility for import/export of research data in the file to be transferred to another workplace and stored;
11. Possibility of information transfer via protected communication channels (for archiving, processing and decoding) to a multi-profile medical organization in the form of a file for individual patient (examination), group of patients (examination), with the further storage of information in a common database; and of the whole database;
12. The control examinations should be automatically added to a patient’s file and stored under a different date;
13. High information level of the examination (including questionnaires);
14. In assessment of physical fitness through hardware/software complex in remote locations where there is no medical doctor (only a paramedic) it will be possible to plan and perform preventive medical examinations. Thus, a centile assessment and one of three types of conclusion (N, above N, below N) and a degree of deviation from the average would be enough. The conclusion concerning a physical state is a main point in the use of a HSC.

The Requirements for the Formation of Examination Findings

1. Documentation of findings in the form of conclusion (e.g., physical development average, harmonious, etc.). In case of deviation from the norm – automatic indication of the degree of deviation (for spirometry – the degree of obstruction, for ECG – automatic detailing of deviations, and if a medical specialist must perform a correction, a detailed, user-friendly and graphical instruction should be supplied);
2. Preliminary assessment of the examination findings in case of clinically significant deviation from the norm. The clinical significance of deviations should be determined (by an expert) for each methodology, for each test, for each examination;
3. Development of general recommendations for diet, motion, lifestyle, dynamic monitoring, etc.;
4. A possibility for assessment of adaptive resources and functional reserves of a body.

In addition, the issues of organization of health care in cardiology were discussed (pursuant to the Order of RF Ministry of Health No. 918n “On approval of the procedure of delivery of medical help to cardio-vascular patients”). The analysis of the level of medical equipment and consumables status of the regional medical organizations of all levels (district hospitals,
out-patient clinics, paramedic-obstetric stations) and organization of medical care for cardio-vascular patients was conducted.

Results

Subsequently, the proposals were worked out aimed at a qualitative improvement of the level of cardiological services provided to the indigenous population of the Nenets Autonomous Okrug in remote regions. This includes:

1. Conducting Troponin-T test to determine the content of troponin in blood in all NAO medical organizations of all levels (district hospitals, outpatient clinics, FAPs) for the medical staff to perform OCS diagnostics in accordance with the algorithm of medical care;
2. Providing all NAO medical organizations with portable caogulometers (CaoguChekXSPlus) to control (at the place of residence) the blood indicators in antithrombotic therapy;
3. Provide phased fitting of all NAO medical organizations with modern electrocardiographs (for 6/12 leads) with a capability to transfer the electronic data (electrocardiograph Schiller CardiovitAT – 102).

The brand and model of the equipment was approved by the specialists of the Norway Center of Telemedicine. In accordance with the project 3 sets of equipment were purchased (Caogu Chek XSPlus, Schiller CardiovitAT – 102). The equipment was delivered to the settlements of the Nenets Autonomous Okrug - Nes’, Karataika, Bugrino, where the medical personnel were trained how to use it. Currently we are developing interaction between medical organizations concerning data transmissions and arrangement of telemedicine consultations in delivery of medical care in ACS.

After testing of such organizational solution in three pilot medical organizations, this scheme of logistics support and organizational arrangements will be offered for joint use in medical organizations of the Nenets Autonomous Okrug.

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CyMED: A Platform for Supporting Coordination and Scheduling of Homecare Teams Using a Process Oriented Approach

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Abstract: The ageing population, rising healthcare costs and increasing number of chronic diseases requiring long term care have been the major challenges of healthcare systems for the last decades. Nowadays, to handle this issue, more and more patients are treated and taken care of in their own homes. However delivering homecare services is not an easy task because of the large number of actors that participate in homecare processes, characterized by their mobility and their schedule variability. The main difficulty is then to synchronize human and material resources at patient’s homes and avoid unwanted conflicts. Moreover, modern homecare propose new technology based services (sensors, etc.) that also require coordination and collaboration with the services provided by humans via the exchange of data or the synchronization of actions. To handle these kinds of difficulties, we are developing a coordination platform called CyMED (Cyber Management of Elderly and the Disabled), which use a mix of scheduling and process oriented tools, in order to facilitate the cooperative work of health and social care actors.

Introduction

Home healthcare (i.e., homecare) includes all healthcare services (e.g., medical, para-medical and nursing), social services (e.g., domestic home-help) and financial services (e.g., insurance) provided for the needs of the patient at home. Family members and relatives are also involved in the care delivery. Moreover, modern homecare servicers propose new technology-based services (sensors, robots and applications) to monitor patients at home. Homecare services (human, technique, technological) are often delivered completely independently by stakeholders belonging to various organizations from the public or private sectors [1]. The coordination between these stakeholders gets more complicated due to their mobility and
their schedule variability. Typically, homecare workers need to coordinate their schedules so that unwanted conflicts are avoided, and so that desired meetings are possible [3]. From our viewpoint, the needs of homecare stakeholders are more focused on improving the coordination of their activities rather than on increasing the use of tele-monitoring solutions via sensors and robots at home. To handle the coordination issues in homecare, we are developing a platform called Cyber Management of the Elderly and the Disabled (CyMED), for the orchestration of the different kind of homecare services [2]. The suggested solutions are based on a patient and process oriented perspective to emphasize the importance of the organizational aspect. Managing homecare processes with traditional workflow systems is a complex task, given their specificity and inherent flexibility. Indeed, homecare processes are personalized, collaborative, time-constrained, dynamic and resource-intensive.

Architecture Design

The architecture of the CyMED platform [2] is based on the following main components:

- A multi-modal communication system, combining tablets, PCs, TVs, sensors, robots, fax, telephone and healthcare applications;
- A workflow management system (Bonita system) to orchestrate the different services (i.e. technical and human resources) on our platform;
- An Enterprise Service Bus (ESB) such as Mule which guarantees the interoperability and integration of the data sources and applications.

The personalized planning service

Usually, a patient’s homecare request triggers an evaluation of his/her situation by a social assistant and a doctor and who elaborate a care plan [1]. A homecare coordinator contact then the different required homecare participants and organize the patient intervention planning. The CyMED platform encapsulates a scheduling service to organize the appointments and events of the patients and all the homecare participants [2]. In our approach, we consider sensors and robots used at home as other homecare participants which need to coordinate their actions with social and healthcare providers. For instance a homecare robot has to do a specific action (take biological signs or proposes brain exercises to a patient) two hours after an appointment with a nurse. We use the workflow technology (e.g. Bonita workflow engine) to orchestrate the tasks between these different participants. Some of these tasks may be scheduled (e.g. appointments) while others are not (e.g. validation of a medical prescription). CyMED encapsulates a collaborative social network tailored
to homecare services coordination and exchange of information. A patient agenda is shared between all the members of the patient’s community with different views on its details. The planning service can also provide optimization functions if the users require optimizing their daily scheduling. The goal is to maximize the number of appointments taken by the homecare providers while minimizing both their traveling time and the dissatisfaction level of the patients. In this case, several criteria are taken into account representing preferences of the different participants, expressed in terms of: unavailable time slots and mandatory breaks, maximal working time duration, geographic areas of availability, maximal distance between appointments’ locations. The preferences of the patients are also expressed in terms of: unavailable time slots, resting time between two appointments, maximal number of appointments per day per type of service.

The inherent planning engine

The planning service proposes schedules according to a horizontal dimension (sequencing of tasks and appointments) and a vertical dimension (optimal choice of people and means). The homecare participants are introduced in the system including a number of resources used by them in their daily activities such as means of transport (ex: ambulance), health and technical materials (e.g. armchairs, sensors, robots) and diverse healthcare consumables. There is an interaction between the planning engine, implemented on the constraint programming tool CHIP-V5, and one or several planners, who can validate the schedules and adjust them if necessary. The global constraints of CHIP (e.g. cumulative, cycle, sequence …) are the main internal objects of the solver. These objects allow expressing different kind of constraints between the planned resources such as the succession of tasks via a “Cycle” objet. The constraints related to the succession of task are implemented in the workflow engine (e.g. Bonita) who orchestrates the tasks of all the homecare participants following the established care plan. The planning engine reschedules appointments when the defined constraints are violated. An appointment may be either cancelled or rescheduled when a homecare participant unavailable. To avoid unnecessary rescheduling, the appointments have to contain enough margins.

If an appointment is cancelled, the planning service will propose the nearest homecare provider as a replacement relying on a participants’ locator within the set of rules defining the homecare process.

Discussion

We believe that it will be relevant to define a structure with a number of planners in connection with a call center attached to a region. The
geographical criterion will often be the most relevant to distribute the patients between the planners. It is also possible to have planners dedicated to areas of medical specialization, and to distribute the patients by type of medical specialization area. However, it is frequent that the patients suffer from several pathologies. The planner/coordinator role may be assigned to different homecare participants or structures following the homecare context, the politics and the homecare ecosystem of the regions where they are deployed.

Fig 1: Global Constraints / Problem domains

Fig 2: Integration of a workflow engine and the Cosytec planning engine

Conclusion

An efficient coordination of homecare participants can be done only via an integrated approach using advanced technologies for data sharing, communication, process orchestration and resource planning [3]. The CyMED platform is under construction and a first version containing the healthcare social network is already available. The real efficiency of our approach will be tested after deploying our platform in real-life environments.

Acknowledgment
The CyMED (Cyber Management of the Elderly and the Disabled) project is initiated by Altran research. The scheduling service is developed by Cosytec (Complex Systems Technologies).

References


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Design of a Technological Solution for the Analysis of Sleep Quality Using Biomedical Signals

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Introduction

The aim is to carry out sleep monitoring that can be performed at home and is not too costly. In order to achieve such an aim, biomedical sensors are needed. These take signals representing biomedical variables and convert them into electrical signals so that they can be used as an interface between biological and electronic systems. There are several types of sensors that can be used in biomedical applications. This research work uses biopotential electrodes. To be more precise, the Electrooculogram (EOG), air flow (AS), galvanic skin response (GSR) and body temperature. The first is used as the principal signal to determine whether the patient is asleep or not, and the others are used to determine why sleep is disturbed. AS records changes while the patient is breathing in and out, so it is essential in the detection of apnea and hypopnea disorders [1]. GSR records the moment when the nervous system gets overly excited and the sweat glands' activity increases, which causes skin conductance to increase and can affect rest [2]. This is related to body temperature which, during nocturnal sleep, drops further [3].

In this study, the Arduino microcontroller [4] and the cooking hacks e-Health shield [5] have been used. There is a wide range of devices equipped for sleep monitoring on the market. Nonetheless, this sensor was chosen because it works with free software and is also the most complete on the market since it offers up to 9 different types of sensor. The processing software used is the Matlab ArduinoO package.

Methods

This section describes the methods used to develop the proposed solution which have enabled a system capable of monitoring sleep to be created and its level of quality determined.

Five people had their sleep monitored, two of which were male and three, female. The subjects' ages were taken into consideration, including people aged between 18 and 25 years and between 50 and 55 years, in order to detect variations in sleep quality depending on age. The recordings made
are two hours in length, which is long enough to detect a complete sleep cycle - 90 minutes.

As part of the evaluation, the subjects complete two questionnaires: the Epworth Sleepiness Scale (ESS) [6] and the Pittsburgh Sleep Quality Index (PSQI) [7].

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
<th>Subject 4</th>
<th>Subject 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESS</td>
<td>4</td>
<td>20</td>
<td>7</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>PSQI</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

On the ESS, if the score is lower than 6 points, diurnal sleepiness is low or absent; if it is between 7 and 8, it is the average for the population and if the score is over 9, sleepiness is excessive and a specialist should be consulted. In the PSQI, the total sum of each item can vary from 0 to 21 points. The cut-off point would be 5, where it would be considered that the subjects enjoy good sleep quality.

The EOG, GSR, AS and body temperature were monitored to acquire the data.

System Design

This section specifies the design developed so as to provide a reliable

Figure 1: High-level diagram

sleep monitoring system. In order to better interpret how the system works, figure 1 shows a diagram of the high-level design components, the architecture of which is based on two main blocks - Hardware and Software - which help to achieve the objective set out, with each block being divided into sub-blocks. The first block deals with data acquisition via EOG sensors, body temperature, air flow and GSR to monitor the subject's sleep.
All the data obtained from these sensors are pre-processed with Arduino software, which conditions the signals in order to achieve greater data accuracy.

The first block corresponding to the software begins once the signals have been obtained. These are processed in Matlab using the appropriate filtering, depending on the signal type. The second block is responsible for collecting the filtered signals in order to conduct a quantitative analysis of the subject's signals. The results obtained are finally displayed on screen, and the signals the user wishes to view.

Results

The following table shows the average data for each subject, where every change is recorded separately, as well as the changes in common that occurred during the course of recording.

The Figure 2 shows the significant changes occurring in each signal. The first four columns record all the signals' significant changes. However, what is truly important are the changes in common occurring in each signal type. When a large number of disturbances in the EOG is detected that coincide with changes in the other signals, it is thought that the subject's sleep has been disturbed due to sweating, body temperature or abnormal breathing.

![Figure 2: Each subject's average data](image)

Conclusions

By analyzing the significant changes experienced by each subject, we conclude that there is a relationship between the changes occurring at
moments in time close to the subject's level of rest. It has been observed that
the number of jumps in conductance and resistance, and the changes arising
from temperature, do not always have a direct relationship with the subject's
rest. The relationship arises when the changes occurring coincide in the
same period of time in which disturbances are detected in the EOG signal.
Furthermore, it can be seen that the air flow signal suffers greater variation
if the EOG signal displays a larger number of disturbances. Moreover, it has
been noted that, on days when the subject has reached the REM phase, the
number of coincidences between signals is better in relation to the days
when they have failed to reach this phase. It is therefore thought that these
are the days when a higher level of sleep quality is achieved.

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eHealth Application: Home Monitoring System

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Introduction

Home Monitoring is a new trend in the health sector that is based on patient monitoring in out-of-hospital conditions. It has been attracting a plethora of attention from researchers and healthcare practitioners in hopes of reducing the medical costs. Many surveillance systems have been developed so far, and the market trend lies mostly on video-based surveillance systems nowadays.

This paper proposes a Home Monitoring System that performs surveillance on especially old and walking-impaired patients by benefiting from a specific acceleration-based fall detection algorithm that detects a fall of a patient by measuring the acceleration level. With knowledge of the acceleration level of the patient, a medical practitioner is more likely to be notified once the target patient is fallen on the ground. The patient can be monitored by either a PC or Smartphone, which are two of the most-commonly used devices for monitoring purpose. Both devices communicate with an external accelerometer-included kit over Bluetooth Low Energy interface and thereby obtain the monitoring by receiving acceleration values from the kit. The monitoring device will get alerted upon a fall detection, and then immediately parse the fall-detection information to a public-accessed Web Service, which a local hospital can gain access to in order to obtain statistical fall detection information about the targeted patient.

Why Bluetooth Low Energy?

Bluetooth Low Energy (BLE) is a part of Bluetooth 4.0 (Bluetooth Smart) and Bluetooth 4.1 specification and is known for its relative low power consumption compared to the classical Bluetooth protocol (Bluetooth 3.0). It has the efficiency to reduce power consumption with energy efficiency up to 20 times higher than classical Bluetooth [1]. Thus, the energy efficiency allows BLE chips to work with a single coin cell battery for a year and more. This ability leads this protocol to be the most preferable one, as the market for wireless communication systems is heading towards cheap and efficient protocols.

System Design
Capabilities of the kit are one of the key factors that have to be considered. Therefore, it is important to choose a kit, which includes all technical capabilities required for this Home Monitoring Service. Fig. 1 shows a sketch of possible services, the kit has to include a BLE antenna, microcontroller, three-axis accelerometer sensor and a battery/voltage sensor. Determination of the appropriate device for this purpose is based on quality and cost. The quality of the kit is required to be sufficient, which means that it should be able to measure the acceleration without any hardware issues. The cost is an important factor to consider since a single kit is needed for every patient, thus it will not make sense to buy an expensive one. Based on research, the CC2541 BLE- SensorTag kit from Texas Instruments (TI) is the preferable for this purpose. SensorTag is very efficient and cheap as well (25$ [2]) considering its capabilities.

![Diagram of kit components]

**Figure 1: Required capabilities of the kit**

Since the three axis accelerometer sensor measures the acceleration value for each axis, a final common acceleration value can be calculated by finding the absolute value of the acceleration values from all three axes. This is obtained by using following formula:

\[ Acc = \sqrt{X^2 + Y^2 + Z^2} \]

This is the final acceleration independent of a certain axis. From the formula, it is clear that the default value is 1g, when the kit is in idle state, since it will be influenced by the gravitational acceleration in all cases. The final acceleration value is an important factor, since it is the first value to consider in a fall detection algorithm. It is not sufficient enough to use the final acceleration value as fall detection, as the value becomes high if a patient starts running for instance. Therefore, there is a need to combine the final acceleration value with the direction of the kit. If the kit for instance is vertically placed on a patient, and he/she suddenly falls down, then the kit will also lie down horizontally. Since it is possible to obtain the direction of
the kit when it is in idle state, this opportunity has to be used afterwards. If a
patient wears the kit, and falls down with the stomach on the ground or with
the back on the ground, the z-axis will be influenced by the gravitational
acceleration as shown in Fig. 2. The application will continuously calculate
the final acceleration value and check whether it reaches a certain limit. If
the value reaches the limit, then the application will wait for two seconds of
delay and check whether the z-axis is influenced by the gravitational
acceleration with +1g or -1g. If this is the case, it will detect a fall.

![Figure 2: Axis definition for the CC2541 (SensorTag) [3]](image)

**Monitoring by a PC or a Smartphone**

A Database is required in order to store information regarding every fall.
Microsoft SQL Server Express has to be used for this purpose, since the
data has to be accessed globally using a Web service. Fig 3a illustrates the
process of monitoring by a PC. Another approach is to perform the
monitoring with a Smartphone, as Fig. 3b indicates.

**Web-application to collect all information**

The Web application has to include all fall detection information gathered
from both the PC and Smartphone. The stored data has to be accessed
publically in the Web application. Thus, there is a need to deploy the
application to a public cloud, so everyone can gain access to it.

**Discussion**

From the results and testing, it is clear that both monitoring devices can
perform an acceleration-based surveillance and parse every fall-detection
information to a public accessed Web Service. However, if both devices are
compared to each other, a Smartphone solution will be a better approach
due to following three advantages:

First, the scanning functionality can be implemented programmatically,
which allows the Smartphone to perform an auto-connection establishment
algorithm. Second, the Smartphone has a higher quality BLE antenna
compared to most of the PCs. Thus, the Smartphone can communicate with the peripheral device up 40-50 meters distance, whereas the limit for the PC is around 25-30 meter. Third, it takes much lesser space than a PC, and weighs much lesser. Thus the neighbors which performs the surveillance will benefit from wearing the device and always and perform monitoring using the advantages as notifications and vibration. A PC does not have those benefits, so the neighbors are forced to keep an eye of the PC, which is located at a static location.

Figure 3: (a) PC monitoring, (b) Smartphone monitoring

Conclusion

By following the instructions and recommendations of this paper, the health sector can provide an efficient Home Monitoring Service, thus saving a lot of money. Possible extensions have to be considered and implemented in order to increase the efficiency of the system. The testing of both Functional- and Non-functional requirements specification has been performed successfully and is more or less approved for the Smartphone and Web application, whereas many Use Cases are not approved for the PC due to lack of scanning functionalities. As a result of the comparative analysis, it is clear that the health sector must definitely go for a Smartphone as a monitoring device rather than a PC. The main issue using a PC, is the BLE connection Establishment which has to be performed manually thus leads to a non-user-friendly solution.

References

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From a Green Field to a Telemedicine Service Supporting 400 Patients in One Year: The Slovenian Experience

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Introduction

Until 2014 home telemedicine services (based on business-to-patient model) were not available in Slovenia. Slovenian partners in an European R&D CIP PSP project United4Health (U4H) [1], namely GH Slovenj Gradec (GH-SG) and Healthcare Centre (HC-Ravne), have been pioneering in the area. Since April 2014 CEZAR centre for telehealth, located in GH-SG hospital provides telemedical support to patients with Diabetes Mellitus type 2 (DM2) and/or patients having Congestive Heart Failure (CHF). Currently the services are available in Carinthia region covering 1.300 km², a rural area with over 100.000 inhabitants.

Telemonitoring Service Infrastructure

The technological and organisational infrastructure was set-up in 2014 based on the U4H project service model (Fig. 1). The technological solution was provided by Health Insight Solution [2]. The solution is mobile and does not require any patient intervention when taking measurements using devices at home (weight scale, blood pressure meter, oxymeter, glucometer). Each patient uses a smart mobile phone that serves as a mobile gateway. Data are transferred from the measuring devices to the gateway via Blue-tooth and then over a mobile network to a telemedicine service centre at GH-SG. The gateway and the measurement devices are matched and personalised prior being provided to the patient.

A web portal was designed enabling patient data management. A virtual server was set-up at the SB-SG hospital data centre to host the portal and the database. The hospital environment ensures an adequate security level for sensitive medical data.
Patent inclusion/exclusion criteria were determined within the United4Health project [1]. The DM2 patients fulfilling the project inclusion criteria were recruited from 1,200 patients registered in the region. The CHF patients were recruited from 700 patients registered in a database of the SB-SG hospital. The enrolment process started in March 2014, since when their number has been increasing as presented in Fig. 2. At the end of Feb. 2015 to 280 DM2 and 120 CHF patients were included.

Telemedicine Support Service Provision
The patients receive telemedical support from the CEZAR centre as a part of the existing long-term care programme, so that they are able to continue doing their daily/weekly measurements at home. The only change for them is that their standard devices were replaced by their modern equivalents containing a Bluetooth interface. Patient’s data are now automatically (within a minute) sent to the hospital server without the patient’s intervention. The DM2 patients measure their whole blood sugar profile weekly (6 measurements) and the CHF patients measure their weight, blood pressure, heart rate and blood oxygen saturation on a daily basis. The received data are monitored through the telemedicine programme.

The existing patient treatment workflow process in the GH-SG hospital has been minimally adjusted to integrate the new telemedicine service. A new response scheme has been introduced for interventions suggested by the telemedicine system. When a patient’s data falls outside an individually determined value range or there is an adverse trend, the CEZAR centre operator is alerted. Patients are then contacted by the centre staff to confirm that the data provided relate to their health condition. If an intervention is required the operator contacts a corresponding medical specialist who decides on further action – e.g. a change in therapy or an invitation for a visit to the hospital. The patient receives an oral report over a phone by the centre operator and a written report by post on every change in the therapy. The medical specialists also periodically examine patient’s data and where there is a need for an advice to the patient or a change in therapy, a written report is prepared and sent to the patient. The patients are not charged for the service as it is a part of the United4Health project.

Descriptive statistics of the telemedicine service are given in Table 1.

Table 1: Descriptive statistics of the telemedicine service on 20th Feb. 2015

<table>
<thead>
<tr>
<th></th>
<th>DM2 patients</th>
<th>CHF patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of supported patients</td>
<td>294</td>
<td>117</td>
</tr>
<tr>
<td>Average patient’s age</td>
<td>68</td>
<td>71</td>
</tr>
<tr>
<td>Telemetrically registered measurements</td>
<td>25143</td>
<td>80563</td>
</tr>
<tr>
<td>No. of the operator’s phone calls to the patients</td>
<td>36</td>
<td>128</td>
</tr>
<tr>
<td>No. of therapy changes suggested due to telemetrically received data</td>
<td>458</td>
<td>203</td>
</tr>
<tr>
<td>No. of home visits by the CEZAR nurse</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>No. of medical reports for patient’s health record</td>
<td>304</td>
<td>4</td>
</tr>
</tbody>
</table>

Discussion

The telemedicine service described was set-up in a relatively short period of one year. This was due to several supportive factors:
• The service model and the patient’s inclusion/exclusion criteria were determined before (within the United4Health project);
• Prior experiences of telecare services were used;
• The project has had strong support from the hospital management;
• Key medical staff involved were determined to introduce the new services to support their patients;
• All technology components were provided by a single supplier (HIS) and had been proven in other projects;
• The project partners had been working on establishing conditions to provide the service beyond the U4H project end in 2016;

Some recommendations for service development include:
• Selection of an experienced technology provider – the key solution elements should be ready, not in the development phase;
• Avoidance of a public procurement where the lowest price is the only criterion - select technology partners via an alternative legal way;
• Secure a local technology support service for the service provider;
• Thinking about the post-project period and the ethical issues that relate to service sustainability.

Acknowledgment

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References


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HealthAnalyst – Complex System for Medical Data Mining

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Introduction

The development of HealthAnalyst has started more than 20 years ago in former Czechoslovakia. At the beginning, the main goal was to develop a cognitive cluster analysis of several biochemical parameters. Measurements of basic vital signs, like blood pressure, ECG, pulse, etc., were included later. Finally, new gene expression patterns analysis was added with the goal of creating a “healthcare portrait” of a given person.

HealthAnalyst consists of three basic software packages or modules:

- BioAnalyst
- CardioAnalyst
- GeneAnalyst

Complete application of these modules on tested persons can create their up-to-date “healthcare portrait” and dispatch a “disease warning message” within few minutes.

System HealthAnalyst is not intended to be a substitute of a physician but to be his/her sophisticated tool.

HealthAnalyst – Complex Data Mining Tool

HealthAnalyst was designed as a complex data mining tool for early stage disease screening and monitoring of therapy. As already shown above, it consists of three software packages (modules): BioAnalyst, CardioAnalyst and GeneAnalyst. Parallel use of all three of them covers the most frequent diseases, responsible for 80% of deaths: cancer, cardiovascular diseases and diabetes.
**BioAnalyst**

BioAnalyst is very efficient statistical software specifically designed and focused on differential diagnostics of various groups of diseases. It could be classified as data mining tool. It is based on multivariate analysis of biochemical and other para clinical data. Diagnostics is based on a priori knowledge of selected biochemical parameters, obtained from reference groups of probands. The program analyzes specific biochemical parameters of a patient and finally suggests a particular diagnosis. BioAnalyst is a unique tool first of all because of its new, original calculation methods of discrimination analysis, which are very efficient compared to other standard methods.

Several applications of this software package are ready, based on thousands of clinically verified results:

- **CANSCREEN** – Early stage cancer screening, especially for prostate cancer;
- **CARDIOSCREEN** – Monitoring of cardiovascular body system, allowing prediction of heart attack risk;
- **DIABSCREEN** – Evaluation of subgroups of diabetes mellitus – see Fig.1.

BioAnalyst module features also a unique interactive 2D and 3D visualization of results, allowing fast evaluation – see Fig.2.

![Fig. 1: DIABSCREEN – Subgroups of diabetes mellitus](image)

**CardioAnalyst**
Photo-plethysmography (PPG) is used to investigate skin blood flow under infrared light. This measurement method is more and more used due to its advantages as non-invasive, inexpensive and convenient diagnostic tool. Traditionally, it measures only oxygen saturation and heartbeat rate. PPG is, however, also a promising technique for early screening of various atherosclerotic pathologies and could be helpful for regular GP-assessment. Unfortunately, full understanding of diagnostic value of its different features is still lacking. This observation became one of the motives for development of CardioAnalyst software package with the objective of finding potential information embedded in the PPG waveform signal and to develop new diagnostic applications beyond current pulse oximetry and heartbeat rate calculations.

These new pieces of information that can be collected are:
- Heartbeat rate variability;
- Changes in the shape of PPG waveform signal – Fig. 2
- Diastolic and systolic pressure;
- Mild mental stress.

*Fig. 2: PPG waveform changes during aging*

*New mathematical approaches*

Instead of describing graphical features and peculiarities in the recorded pulse (like minima, maxima, slopes, etc.) suggested by many authors, we have employed a new approach based on finite orthogonal Fourier-type parametrization of the pulse waveform. Contrary to graphical features, which often cannot be identified, these parameters always exist. Fourier parameters form a linear space, which is much more suitable for classification of cardiovascular system state and possible diseases (Fig. 4).

*Future developments*

PPG Phase Diagrams and Differential Bilateral PPG monitoring is currently being researched in connection with early diagnostics of atherosclerosis, diabetes and other diseases (Fig. 3, Fig. 4).
Fig. 3: Two patients with different diagnoses in Fourier parametric space (each point represents one pulse)

Fig. 4– PPG Phase Diagrams, suggested diagnostics support for diabetes

GeneAnalyst

Last year we have developed an applied classification approach in gene-supported early cancer diagnostics. This approach is based on transforming the gene expression into high-dimensional space and subsequently applying a gene selection algorithm called differential stage-wise regression proposed by T. Hastie (Stanford Univ.). Then we used a Support Vector Machine (SVM) classifier developed by V. Vapnik (NEC, Princeton) to predict different types of oncological diseases (breast, ovarian,
lung, prostate). We reached misclassification rates of 13% with simple linear classifier and as low as 9 to 3% misclassification rates with Taylor-type and Radial Base Function (RBF) classifier.

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Home Telerehabilitation Service for Persons Following Lower Limb Amputation

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Introduction

Disability level and incidence of amputations has been increasing in most European countries [1]. Rehabilitation should start immediately after an acute phase of illness/accident and should continue until the full reintegration of the patient into his/her community.

In Slovenia and in some other countries many patients do not receive adequate rehabilitation, or their rehabilitation program does not start early enough due to the lack of capacities and professionals. A solution to this problem might be telerehabilitation – a support service for a patient at home enabled through modern information and communication technologies (ICT). In the paper a technological solution and its evaluation is presented aiming at supporting a telerehabilitation service that will enable patients following lower limb amputation continuous rehabilitation within their home environment after their discharge from a surgical ward.

Methods

A model of an interactive telerehabilitation Cloud based multimedia (movie) service was designed that supports patient’s comprehensive rehabilitation within home environment under remote supervision of a therapist. The service is based on movies presenting exercises to be practiced at home. The multimedia contents are available to patients over the Internet by using a tablet PC. The service was tested at the University Rehabilitation Institute in Ljubljana.

Five patients following unilateral trans-tibial amputation were included into the system evaluation. Each patient was physically and functionally assessed through standardised physiotherapy (PT) and occupational therapy (OT) tests before and after using the service. He/she received a tablet PC (Samsung Galaxy Tab 10.1) linked to a mobile network and Internet. For each of them an individualized program (training) was prepared consisting of a group of movies. The exercises were grouped and delivered
consequently with the rehabilitation progress. The patients were remotely supported by a distant therapist (PT, OT) who visited each patient on a weekly basis using Skype videoconference system. The objective of the tele-visits was to check exercise performance. Based on the results of the training the therapist determined the next group of exercises (movies) to be practised by the patient until the next visit.

Results

The telerehabilitation service model was designed as presented in Fig. 1. A web-based portal was designed enabling therapists to maintain patient records, multimedia contents management, therapy prescriptions and teleconferencing.

Much effort has been devoted to the design of a user interface for a tablet PC. Simplicity of use was the paramount requirement (see Fig. 2). The user accesses video exercises with max four touches to the screen. Navigation is used only from the movie selection screen to play mode. Response to a therapist’s Skype call is made by one touch only.

26 videos were prepared (13 from PT, 14 from OT) each prescribed to at least one patient, some to all. Individual therapy contained 7-17 different videos on exercising. Patients watched them as presented in Table 1. The therapist had 2–7 videoconferences per patient. The service was used by the patients up to 2 months (mean 23.0 days, min 8 days and max 50 days). The standardised therapeutic FT/OT tests revealed that using the telerehabilitation service helped some patients to improve their physical condition, some did not, but in none of them the conditions deteriorated. The results of the study will be presented elsewhere.

Table 1: Use of multimedia contents at home telerehabilitation by type of exercises

<table>
<thead>
<tr>
<th>Video contents</th>
<th>No. patients</th>
<th>No. views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandaging</td>
<td>3</td>
<td>0 – 11</td>
</tr>
<tr>
<td>Trunk + hip muscle strength</td>
<td>2 – 3</td>
<td>0 – 3</td>
</tr>
<tr>
<td>ROM – hip flexors</td>
<td>5</td>
<td>1 – 9</td>
</tr>
<tr>
<td>Quadriceps strength</td>
<td>1 – 4</td>
<td>1 – 10</td>
</tr>
<tr>
<td>UL strength</td>
<td>2 – 3</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Transfers from-to wheelchair, bath etc.</td>
<td>1 – 5</td>
<td>0 – 9</td>
</tr>
<tr>
<td>Stand up, sit down</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
Fig. 1: Telerehabilitation service model

Fig. 2: User screen on a tablet PC with a set of videos with exercises
Discussion

In the paper a telerehabilitation service developed at the Ljubljana Rehab Institute for patients following lower limb amputation is presented. The service was evaluated within a research study. In this paper only the outcomes of the technology solution are presented.

The study confirmed that the implemented service model and the technology solution suited the purpose and were well accepted by the patients and therapists. The therapist’s user interface is simple so only one hour training was sufficient for effective management of patient records, therapies and Skype visits. Also the patients found their interface simple to use and intuitive. Only four finger touches to the tablet screen were needed to watch the exercise.

The patients involved in the evaluation used the service from 8 to 50 days before they entered a classical rehabilitation at the Ljubljana Rehab Institute. The statistics of the watched exercises reveals that the number of played movies was the highest at those presenting transfers from and to a wheelchair, bath etc.

The preliminary results of the service test are encouraging. All the patients and the therapists found the solution interesting and useful. The therapists want to extend them to new patients and also other patient groups. Such an attitude would enable a transition from the existing rehabilitation to more advanced practices embedding telerehabilitation services.

Conclusions

Our results indicate that the telerehabilitation approach was adequate and can fill the gap in rehabilitation.

Acknowledgment

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References


Dr. Drago Rudel, Univ.Dipl.Eng. leads a private research company MKS Ltd. in Ljubljana, Slovenia. His expertise is in designing and establishing telecare and telehealth services delivered to disabled and chronically ill population in their home environment. Dr. Rudel has also rich experiences in European projects as a partner and as an EU expert reviewer and evaluator for the European Commission.
Some Obstacles in Medical Biosensors Implementation in Russia

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The need to modernize economics in developing countries seems to be doubtless. New technologies demand both new consumers’ behavior and new governmental policy. The main response to the existing health challenges (both in Russia and in other countries) could be fundamentally new development strategy: transition to a value-oriented preventive medicine. The medical biosensor (preferably, universal one) is seen as a tool to achieve this aim.

High-tech in medicine can be regarded now as a world-wide trend: for developed countries it is the way to sustain high life quality standards, for developing countries it is the opportunity to modernize the lifestyle with affordable funding. In Russian Federation, the telemedicine development is listed as government priorities, with peculiar attention paid to the treatment and diagnosis of social diseases.

Most experts predict the rapid growth of corresponding markets (devices, applications to operate with data, etc.), but this forecast is rather uncertain. Most analysts suppose the very problem to be technological, and do not take into account obstacles that would arise after the device is ready for fabrication.

During our study we encountered a number of obstacles that prevent biosensors to become the large-scale market in nearest future.

First to mention, problems derived from technological aspects. Due to the complexity of such systems, designers have to address numerous issues: packaging, material selection, energy efficiency, signals acquiring and processing, biocompatibility, etc. Upon studying existing technical solutions we formed a list of technological problems encountered for each specific device.

The second obstacle is the data handling. Up to date there has been developed and applied a number of tools to gather the information, analyze it and draw conclusions. However, medical data obtained from biosensors differ from “usual” information. Their characteristic trait is individuality.
These data are referred as private ones, and the problem is whether it could be revealed for doctors, authorities, etc. If a biosensor is supposed not to only monitor, but also to act as a therapeutic tool, the question is what algorithms should be used to take the decision, and to what extent could we transfer this option from a man to the computer.

Third obstacle is in the ethical aspects of biosensors. Many experts see biosensors as a tool to control people, or as a challenge to nature, an attempt to improve the human (creating a cyborg). However, these issues are rather exaggerating, and more important is the access to telemedicine service: it could be expensive or selective. Thus eHealth can deepen existing social problems rather than hinder them.

Fourth, and to our viewpoint, the most important problem, are the institutional aspects of biosensor market development. It has not formed yet: the economic and technological agents that form stable types of behavior in the market, both in the short and in the long term, act independently. Institutionally, the market of high-technology medical care in Russia, as in many other countries, is not a classic one. It is not the consumer (patient) who defines what to develop and implement, but the government (main actor in this field). The problem of corresponding laws, standards, as well as financing, could be solved only within governmental programs.

Public opinion also applies to this issue. To promote eHealth in Russia it is also important to define the readiness of the population to accept the innovations. Based on sociological data not performed in open sources but available for our team we undertook the analysis of people’s inclinations. Main challenging problem is the lack of trust to medical personnel, and doubts on quality of healthcare. 57% in Russia are not satisfied with existing medical service, 40% would prefer to go abroad for medical treatment. 21% of people point at poor equipment as the reason for weak medical service, 23% sees the incompetence of the staff as main source of bad health care, and only 6% suppose Russia develops high-tech economic sectors.

Furthermore, medical staff expectations are not met. In the end of 2014 All-Russian Public Opinion Research Centre conducted a number of surveys among physicians. It revealed that positioning plays the crucial role in their work. The aim of medicine is to help people, to serve the society, cure its diseases. However, nowadays it is substituted by “service”: the idea “pay-and-get” is seen (at least in Russian medical society) as flawed.

Thus, there is a contradiction: on the one hand there is dire need to establish and promote personalized treatment, but on the other it is
represented as a personalized service that supposedly cost higher. The society in Russia seems to be not ready for telemedicine implementation. Therefore we conclude that nowadays the position of experts’ community is crucial: they can influence the future of medical care. To our mind, value-oriented healthcare could be successfully applied in Russian with paying attention to the risks and problems mentioned above.

Acknowledgment

This work was supported by RFBR grant 13-02-12111.

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Telemedical Monitoring of People Using Fruit and Vegetable Diet

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Introduction

Pulse oximeter is a small device which placed on the finger gives information how well the arterial blood is oxygenated as well as the pulse rate value.

Pulse wave itself carries a lot of information which in a standardized test are unfortunately skipped. The parameters of pulse wave and eventual pulse disturbances are usually not analysed. The study developed a computer analysis of recorded digital pulse waves by linear transformation method to enhance resolution of pulse wave signal (high signal resolution HSR, Fig.1) [1]. In previous works the usefulness of this method in the diagnosis of cardiovascular disease has been shown [2, 3].

The aim of this study was to check how this method can be useful in assessing the efficacy of the diet treatment.

Methods

The study involved fifty patients in the age of 55 – 80 years staying on a rehabilitation holiday on a fruit and vegetable diet. They were monitored using ECG and high signal resolution pulsoximetry (HSR-PW). Using this method not only pulse rate and oxygen saturation but also such parameters like: parameter describing ventricle/aorta volume ratio, aorta valve, pulsatility index, k1/k2 index ventricle/aorta and arteries dynamics, can be determined. They are sensitive indicators of cardiovascular abnormalities such as increased vascular resistance, atherosclerosis, arrhythmia, heart valve defects, etc. [2, 3].

351
A standard CMS-50E digital pulse oximeter localized on the left hand index finger was used. The standard pulse wave has been recorded, transferred by the Internet to the analytical server (telemedical system MONTE, www.monte.net.pl) and the HSR-PW analysis has been performed. HSR-PW method is based on increasing the resolution of standard pulse wave signal. To increase this resolution the linear transformation method is used [1].

Each patient was performed three examinations: at the beginning of staying, after 7 days and after 14 days. At the same time the level of urea, potassium, sodium and other electrolytes was controlled.

Results

Among people starting the rehabilitation holiday there were also few people with normal pulse wave shape and HSR-PW parameters however most of them had some abnormalities. Typical HSR-PW result for a healthy person is shown in Fig.2.

In subsequent studies performed during the staying on the fruit and vegetable diet (second examination) and before leaving the Institute (third examination) there was an improvement in the pulse wave shape and its parameters (Fig. 3). Key changes were observed for the following parameters: ventricle/aorta volume ratio (parameter 3), aorta valve (parameter 4) and k1/k2 index ventricle/aorta (parameter 6). The parameter 3 value has improved in 28 patients, parameter 4 – in 14 people and parameter 6 – in 24 people. In 26 patients high signal resolution pulse wave shape has also improved.
Figure 2: Exemplary HSR-PW record for healthy person before a) and after diet program b)

Figure 3: Exemplary HSR-PW record for unhealthy person before a) and after diet program b)

Fruit and vegetable diet, on which were patients in the Institute, is a diet rich in potassium. Therefore it leads to an increase in potassium content, and from the literature [4, 5] it is known that the potassium content effects relaxant on blood vessels through the increased amounts of nitric oxide.
secreted by endothelium. This leads to a reduction in vascular resistance. The diet also causes increased diuresis which leads to a reduction in fluids volume. This effect may also contribute to improving the circulatory parameters by a decrease of blood pressure.

Conclusions

Telemedical monitoring of basic parameters like oxygen saturation and other parameters like ventricle/aorta volume ratio, aorta valve, pulsatility index, k1/k2 index ventricle/aorta and arteries dynamics changes of the cardiovascular system is useful in assessing the efficacy of the diet treatment and improve cardiovascular parameters

References


Ryszard Krzyminiewski – professor, head of Medical Physics Division Faculty of Physics A. Mickiewicz University. The main field of his research is a medical physics, an application of spectroscopic methods EPR and ENDOR to investigate electronic structure of free radicals in biologically active compounds, numerical signal processing of electrophysiological signals and telemedicine. He is the author of an original computer method for enhancement of spectral resolution of electrocardiography and pulse wave records.

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Introduction

In Cystic Fibrosis (CF), the natural history is characterized by recurrent episodes of respiratory infection that causes a progressive pulmonary damage, with decay of long-term lung function leading to death [1].

Spirometry shows over time in these subjects a reduction in FEV1 (Forced expiratory volume in the first second), and then also a reduction in FVC (Forced vital capacity), which is around 2% of the expected value every year [2].

In case of pulmonary infection, an early antibiotic treatment helps to prevent more serious complications and consequently limits the pulmonary damage in the long term. Early intervention also allows us to use advantageously less invasive antibiotic therapies, even using the oral route of administration [3].

Since 2001, in the CF Centre of the Pediatric Hospital Bambino Gesù in Rome, we use Telehomecare (THC) in the follow-up of our patients at home. The first results of this work have been encouraging. We found a statistically significant reduction in hospital admissions and a tendency over time towards a better stability of the respiratory function [4].

In the present study we examined the data related to the monitoring activities on behalf of our CF patients followed at home for a period of 5 years, in order to understand the evolution of clinical trend. The study has the potential to be of great benefit to clinicians as the effectiveness of Telehealth in CF population has not previously been reported.

Methods

This is a case feasibility study on using telehomecare in follow-up of CF.

We performed an open label trial in a population of CF patients followed in our reference centre for CF from 2011 to 2014. Patients were eligible if they have completed the follow-up by THC for the whole period indicated. The intervention study consisted in administering THC in adjunct to standard therapy. A group of controls was chosen among patients seen on the same period, matching for respiratory function, bacterial colonization,
sex, age, and complications. The main outcome measure considered in the study was FEV1 values over time. Patients included in THC program were still followed and treated with the usual protocols, similar to those who do not practice [5].

A clinical diagnosis of CF was given in all subjects, confirmed by study of the CFTR (Cystic Fibrosis Transmembrane Conductance Regulator) gene and the sweat test.

We used Spirotel™ instrumentation, which provides and transmits remotely data from spirometry and overnight pulse oximetry. The workflow was as follows: at home, data are recorded on intervals scheduled with the CF centre physicians, depending on the patient's clinical situation, on average twice a week. Patient may autonomously decide to transmit even without notifying before. Patients perform at home the registration of oxygen saturation and heart rate by night. In the morning, after chest physiotherapy and mucus drainage, a spirometry is performed, after answering a simple questionnaire regarding some pulmonary symptoms. Data are transmitted by e-mail to a dedicated server. Healthcare professionals trained in telemonitoring download data in hospital once a day using the dedicated software working on a Personal Computer connected by the hospital intranet to the Net. Data are manually downloaded and then stored in a local database [6].

As intervention criteria, we considered acute reductions of FEV1 (>10% compared to previous value recorded in stable clinical conditions [7]. With regard to the nocturnal pulse oximetry, a fall below 90% of the maximum value of oxygen hemoglobin saturation, reduction of mean SaO2 and increase over 5% of T90 are considered significant.

Every patient is called back by phone to recall anamnesis data and to share the results.

Anamnesis data and graphs obtained are discussed in a briefing between CF Centre healthcare professionals for an overall evaluation and to decide on any therapeutic action.

Patients showing significant data changes are invited to transmit soon further tests. In some cases, if suggested by anamnesis or by data collected, antibiotic home therapy is prescribed based on the last sputum culture. In other cases patients are invited to attend to the CF Centre for a clinical evaluation, to perform further testing, or to be admitted. In any case the next data transmission is scheduled.

Since February 2010, we started keeping an electronic register, in spreadsheet format. For each transmission, the main parameters and the measures are recorded. A monthly statement of assets and the calculation of the average percentage of Adherence to the recommended frequency of
transmissions (defined as the ratio transmissions / total patient days) is automatically performed.

Table 1: Characteristics of subjects participating in the study

<table>
<thead>
<tr>
<th>#</th>
<th>sex</th>
<th>telemedicine+</th>
<th>bacterial colonization</th>
<th>C02 dependency</th>
<th>#</th>
<th>sex</th>
<th>bacterial colonization</th>
<th>C02 dependency</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>C</td>
<td>f</td>
<td>MSSA</td>
<td>73</td>
<td>n</td>
<td>1</td>
<td>C</td>
<td>PA</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>f</td>
<td>PA</td>
<td>79</td>
<td>n</td>
<td>2</td>
<td>D</td>
<td>PA</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>M</td>
<td>MSSA</td>
<td>65</td>
<td>n</td>
<td>3</td>
<td>C</td>
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<tr>
<td>4</td>
<td>C</td>
<td>R</td>
<td>PA + ST</td>
<td>85</td>
<td>n</td>
<td>4</td>
<td>L</td>
<td>PA</td>
</tr>
<tr>
<td>5</td>
<td>C</td>
<td>F</td>
<td>MSSA</td>
<td>85</td>
<td>n</td>
<td>6</td>
<td>M</td>
<td>PA</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>N</td>
<td>MRSA</td>
<td>39</td>
<td>n</td>
<td>6</td>
<td>D</td>
<td>PA</td>
</tr>
<tr>
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<td>82</td>
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<tr>
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<td>G</td>
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<td>n</td>
<td>8</td>
<td>P</td>
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<td>ST</td>
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<td>10</td>
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<td>M</td>
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<td>90</td>
<td>n</td>
<td>10</td>
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<td>PA</td>
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<td>45</td>
<td>n</td>
<td>16</td>
<td>P</td>
<td>MRSA</td>
</tr>
</tbody>
</table>

The general characteristics of the subjects who participated in the study are shown in Table 1. Continuous variables, including age at enrolment, FEV1 at enrolment, follow up duration and the relative averages on the FEV1 were compared by the Student T test and chi-square test, once verified the normality of the distribution.

Table 2: Summary of 2010-2014 activity

<table>
<thead>
<tr>
<th>period</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>patients n.</td>
<td>30</td>
<td>29.7</td>
<td>26.5</td>
<td>24.6</td>
<td>24.6</td>
<td>28.7 (mean)</td>
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<td>days</td>
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<td>257</td>
<td>243</td>
<td>235</td>
<td>188</td>
<td>726</td>
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<td>transmissions</td>
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<td>669</td>
<td>831</td>
<td>868</td>
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<tr>
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<td>985</td>
<td>1060</td>
<td>957</td>
<td>730</td>
<td>2599</td>
</tr>
<tr>
<td>pulse oximetry</td>
<td>162</td>
<td>211</td>
<td>292</td>
<td>168</td>
<td>44</td>
<td>665</td>
</tr>
<tr>
<td>symptoms</td>
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<td>709</td>
<td>755</td>
<td>637</td>
<td>496</td>
<td>964</td>
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<tr>
<td>adherence</td>
<td>23.19</td>
<td>23.09</td>
<td>32.34</td>
<td>37.41</td>
<td>42.00</td>
<td>28.98 (mean)</td>
</tr>
<tr>
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<td>745</td>
<td>672</td>
<td>493</td>
<td>2429</td>
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<td>564</td>
<td>430</td>
<td>1612</td>
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</tr>
<tr>
<td>% answers/call</td>
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<td>83.93</td>
<td>87.22</td>
<td>84.40</td>
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<tr>
<td>n patients n.</td>
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<td>15</td>
<td>49</td>
<td>38</td>
<td>24</td>
<td>110</td>
</tr>
</tbody>
</table>

Results

The data are related to the activity carried out in the period from February 15, 2010 to June 30, 2014. Table 2 shows the summary of all activities.
We received 1966 transmissions containing 2599 spirometry and 665 pulse oximetry. Since April 2011 we received 964 questionnaires regarding symptoms. We carried out all over 2429 phone calls, getting immediate response by the patient or family in about 85% of cases. The average adherence to treatment showed an increasing trend over time (from 21.96 in 2010 to 42.00 in 2014) We made 110 recalls in hospital which affected 24 patients.

Was calculated the mean annual FEV1 and linear regression in telemedicine and control groups. Results are shown in Table 3. The performance of the average annual FEV1 in both groups was examined, assuming as 0 the value of the annual average relative to 2011. Results are shown in Table 4. The comparison of relative averages on the FEV1 showed a significant difference in both groups (p=0.0021) (Table 5).

Table 3: Mean annual FEV1 and linear regression

<table>
<thead>
<tr>
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<th>2012</th>
<th>2013</th>
<th>2014</th>
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<tr>
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<td></td>
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<td></td>
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<tr>
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<td>78.45684</td>
<td>78.7556</td>
<td>80.11367</td>
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<tr>
<td>Media Fev1(&lt;50)</td>
<td>88.07811</td>
<td>87.35684</td>
<td>86.96313</td>
<td>88.05083</td>
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<tr>
<td>Media Fev1(&lt;50)</td>
<td>41.35266</td>
<td>40.06009</td>
<td>43.344</td>
<td>44.727</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
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<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Media Fev1</td>
<td>75.60332</td>
<td>72.77134</td>
<td>67.65034</td>
<td>71.23679</td>
</tr>
<tr>
<td>Media Fev1(&lt;50)</td>
<td>83.25</td>
<td>76.43601</td>
<td>72.72400</td>
<td>75.43333</td>
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<tr>
<td>Media Fev1(&lt;50)</td>
<td>43.71557</td>
<td>43.57557</td>
<td>34.52033</td>
<td>43.51429</td>
</tr>
</tbody>
</table>

Discussion

Patients followed in telemedicine showed a significant lesser decline in lung function than those in follow-up with the traditional method.

The activity data show an increase in the time of the examinations sent and downloaded despite the number of patients in the telemonitoring has remained virtually constant.

Table 4: Mean annual FEV1 relative
In our experience, one of the critical aspects in the follow-up of chronic patients is a poor adherence to therapy. We highlighted in time a significant increase in adherence to the telemonitoring.

The home telemonitoring, intended as innovation in the follow-up has been accepted positively by patients. This is made evident by the increase in daily telephone responses (as if the patient expected to be contacted by the Centre).

Patients followed in telemedicine showed a significant lesser decline in lung function than those in follow-up with the traditional method. Pending that institutions are "noticing" the usefulness of telemonitoring, it would be
appropriate systems and procedures are designed and validated a total of experienced and qualified staff.

In our experience, gained over a relatively long period, telemedicine is a method certainly useful in the follow-up of chronic disease because it allows:

- A better quality of life;
- Less deterioration of lung function, with consequent less need, in the long term, to employ invasive therapies;
- A radical change of the motivations of the accesses to the hospital, they become more rational and less demanding for both the patient and for the staff attending.

References


Fabrizio Murgia, 1948, medicine doctor, ICT free professional, is Research Contractor in Special Service for Continuity of Care in Chronic Diseases of Bambino Gesù Pediatric Hospital – IRCCS – in Rome.

Sergio Bella, 1962, medicine and economic management doctor, is Chief of Special Service for Continuity of Care in Chronic Diseases of Bambino Gesù Pediatric Hospital – IRCCS – in Rome.
Teletest: Development of a Telematics Test Device for Biomarkers of Health

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Introduction

One of the consequences of longer life expectancy in Europe over recent decades has been a rise in people with chronic diseases. This in turn increases the frequency of assessment of the parameters of these patients’ pathologies. Usually, patients have to travel to hospitals or clinics to undergo necessary medical tests. In severe cases, hospitalization is necessary to assess critical parameters.

The main objective of this project is to develop a new portable device for monitoring critical health parameters in-situ. The user can carry out a test of a blood or urine sample at home and clinical staff will receive the test result instantly and electronically.

The new diagnostic tool is based on immunochromatographic detection techniques. Most immunochromatographic strips currently available on the market provide only qualitative results (positive / negative, presence / absence). But the market for in-vitro diagnosis is increasingly demanding quantitative results for certain health parameters. One of the main technological objectives of the project is to develop a new class of quantitative immunochromatographic tests based on fluorescent microspheres. In order to do this, the device in question is concerned with the quantification of Procalcitonin in blood (PCT). Procalcitonin blood content correlates with the severity of the inflammatory process and provides information about the possibility of progression or regression of infection. In patients undergoing cancer treatment, lengthy stays in hospital can have negative effects so efforts should be made to keep these times to a minimum. Having a tool that helps us to reduce the long-term stay is not only for improvement the quality of life of patients in hospital but also saves money for Health-care system.

Methods

This section presents the method used for developing a hardware and telecommunication device.
**Raspberry Pi**

The Raspberry Pi is a credit-card sized computer that plugs into your TV and a keyboard. It can be used for many of the things that your desktop PC does, like spreadsheets, word-processing and games. It also plays high-definition video. The original Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, VideoCore IV GPU, and was originally equipped with 256 megabytes of RAM, later upgraded (models B and B+) to 512 MB. The system has Secure Digital (SD) (models A and B) or MicroSD (models A+ and B+) sockets for boot media and persistent storage [1].

**WiFi**

There are currently three WiFi transmission standards, IEEE 802.11a, b and g. IEEE 802.11n was recently ratified, and will eventually replace these. Top speeds are 11 or 54 Mbps, but with protocol overhead the effective speeds will be around half that. If the signal is too weak to transmit reliably at top speed, the radios automatically slow down, increasing reliability. Like car radios and TV sets, broadcasts are on different channels to avoid interference. To avoid interference, the radio power, and therefore transmission distances are short. The power levels are set by the FCC. Much longer links can be achieved with specialized antennae and amplifiers. Note that the distance is lower for higher frequency transmission. The frequency ranges are referred to as 2.4GHz and 5GHz, and the exact ranges are shown in parenthesis [2].

**C++**

C++ [3] is a programming language designed by Bjarne Stroustrup in the mid 1980s as an extension to the C programming language. C++ is regarded by many as being the most powerful language, due to the fact that it allows the operator to work at both high and low levels. However, at the same time it is one that bears the least number of automations (as with C, almost everything has be done manually), which makes it difficult to learn.

**System Design**

A device consisting of a fluorescence sensor, a data-receiver board and a communication router has been designed (see Figure 2). This hardware controls the fluorescence sensor and transmits data through Internet. Real time data transmission to the medical center is required.

An ESELog fluorescence sensor, Raspberry Pi and WiFi communication system based on a model TL-WN422G antenna has been selected. The Raspberry Pi and fluorescence sensor are connected via a mini USB cable.
WiFi communications have been chosen for its wide range possibilities, and thanks to this communication standard we can communicate with the patient computer through different connections: RS-232, USB, wireless, etc.

Results

The prototype of the product was made using all the technologies described above. In order to connect the Raspberry Pi with other devices of the prototype, a multiport hub has been used. The inputs of the hub are the Raspberry Pi, WiFi antenna, PC and the ESELog fluorescence sensor, as you can see in Figure 2.

Test results are sent out electronically to health-care workers without the patient knowing the results in order to avoid self-diagnosis. These results are accessed via a website and are stored in the databases of the health centers.

Conclusions

The objectives of the project have been met, i.e. to contribute to the autonomy and improving the quality of life of patients requiring continuous monitoring of health parameters. The same technology developed for the selected parameter in this project, Procalcitonin, may be used in the determination of other parameters of interest in health, such as cancer markers and CRP.

This technology can also indirectly improve the quality of life of patients’ families, who often have to care for and watch over their relative.

![Flowchart of the prototype](image)

Figure 1: Flowchart of the prototype
Acknowledgment

This project has been partially funded under the grant IG-2014/00484 and Basque Government Department of Universities and Research. The authors also wish to thank to the companies Onkologikoa, Ikerlat Polymers, Enkoa, Kernet and Gaiker for their support.

References


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Utilization of e-Health System in Awareness and Rehabilitation of Schizophrenia Patients in Southern Punjab

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Background

Punjab is the biggest province of Pakistan and is called the bread basket of Pakistan. The province can be divided in to two parts, North-central Punjab and South Punjab. The economic condition of the people living in North-Central Punjab is relatively better then people of South Punjab. The South Punjab includes the Districts of Multan, Rajanpur, Dera Ghazi Khan, Bahawalpur, Cholistan Desert, Rahimyar Khan etc. \([1]\). Industries include cotton production and processing, ginning, pottery, handicrafts, agriculture, embroidery and livestock herding. All these industries are of very small scale. 58% people live below the poverty line 69% people earn less than half a dollar/day. Literacy rate is below 23%, which also include those who can only write their name \([2]\).

As a result of the de-centralization and de-institutionalization, mental health services have been shifted from mental asylums to teaching hospitals with an intention to reach at the door-step of the sufferers. The last few decades particularly, have witnessed rapid changes towards rendering of mental health services in Pakistan, yet the situation is not up-to-the-mark both in terms of trained staff, patient's care and facilities. There are very meagre number of mental health professionals including psychologists and social workers with about 2 or 3 psychiatrists per million of population. Moreover, almost all of them are in the large cities despite the fact that majority of our population belong to the rural regions \([3]\).

Mental health rehabilitation facilities are limited to big urban centers. Many people who suffer from mental illness don't have access to help. The existing hospital-based psychiatric services are also poorly utilized and are confined to large cities \([4]\). For the population of 57.5 Million, South Punjab has only two hospitals with active Psychiatry departments where the number of consultants are too low if compared to the population of the area. There is no Psychologist or psychotic available at District hospital level.
Due to poverty, illiteracy and non-availability of medical facilities, majority of the population consult Faith healers, Hakims and witch doctors [5].

Because of social stigma attached with the psychiatric patients and popular misconception about mental illnesses i.e. mental illnesses are considered to be due to possession by evil spirits, black magic and supernatural evil forces, the society and even the family members sometimes abandon their loved ones due to stigma problem [6].

Table 1: Factors responsible for psychological disorders in south Punjab

<table>
<thead>
<tr>
<th>Problem / issue</th>
<th>Factors helpful in acceleration and creation of problem</th>
</tr>
</thead>
<tbody>
<tr>
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Psychiatric problems in Pakistan are increasing in the background of growing insecurity, poverty, violence, terrorism, economical problems, political uncertainty, unemployment, etc. Sinking below poverty line by almost 39% of the individuals is an alarming factor worth noting. In view of the poverty, low health budget, high cost of medicine, there is huge economic burden on the patients. These are the major factors which have contributed in the rapid increase of mental illness in the last 15 years [7].

Role of Faith Healers and Witchdoctors in Schizophrenia Treatment

In Pakistan there are lots of patients who are suffering from schizophrenia but they never come in contact with psychiatric services because about 70% of the population lives in rural areas. The literacy rate over there is low and they don’t have any knowledge of schizophrenia. So whenever anyone of them is suspected of this disorder they always attribute it to magic or possession of spirit or demon. As they have their own etiology so they have their own therapies and therapists [8]. Instead of consulting psychologist or psychiatrist they go to faith healers and religious quacks who gave them
holy water or sanctified ointment. Sometimes they visit holy shrine and believe that their visit can help them in getting rid of possession of spirits. Sometimes patients are punished brutally by their so-called therapist with the notion that they are inflicting pain to evil spirit and not to the patients and their punishment will force demon to run away and leave the possessed. Some even believe that marriage is the best remedy for schizophrenia [9].

Consultancy Plan for the Psychiatry Patients in South Punjab

Since the beginning of the telemedicine system at Mayo Hospital, an extensive telepsychiatry program was launched with the department of Psychiatry Mayo Hospital Lahore for Southern Punjab. First psychiatry case was registered on November 3rd 2008. Two days in a week were fixed for the psychiatry clinic in which 3 consultants were present. The patient was registered at remote end and a doctor took the history of the patient for record and presented it to the psychiatrist. At hub the consultant had full liberty to interact with the patient and his/her attendant. An individual case study of the patient was made.

In this study, we will discuss how this technology has been used to address the unique challenges associated with treating this population. Overall, telemedicine technology has become more interactive, less costly and, importantly, more available to healthcare providers as means of treating chronic medical diseases. Telepsychiatry included videoconferencing, computer-based internet tools and is especially important for chronic mental illnesses such as schizophrenia as the latter is associated with considerable morbidity and mortality [10]. Treatment involves pharmacologic and psychosocial approaches and avoids the long distance travelling that is a financial burden [11].

A Success Story of Schizophrenia Family

Schizophrenia is characterized by gross distortion of thought and perception. Patients experience hallucination, hallucinations, voicing and mistrust. The patient becomes violent and aggressive and emotional, is also prevalent in Pakistan with all its symptoms and dramatic features [10]. About 1.5% of the population is suffering from this ailment. Schizophrenia occurs in both male and female with same frequency and the onset usually occurs between the ages of 15-40 years. Out of all four types of schizophrenia catatonic, hebephrenic, paranoid and undifferentiated, paranoid schizophrenia is the most common. 6% of the schizophrenics run the risk of committing suicide due to depression which sets in when problem aggravates and due to lengthy treatment, patient loses hope [12]. The various causes of schizophrenia are hereditary, personality type like
schizoid and paranoid, un-balance level of dopamine and serotonin, brain abnormality. Other factors are virus, endocrine factors, metabolic and environmental factors and stress. Schizophrenia management program consisted of antipsychotic drug, supportive and behavior psychotherapy and family psychotherapy, electro-convulsive therapy and rehabilitation [13].

During the teleconsultation we came across a family of which three persons were suffering from schizophrenia. Muhammad Jameel Belong to Rahimyar Khan District which is 64 km from Rajanpur district. He was a retired air force personal. The source of income is his pension. The family of Muhammad Jameel consisted of him, father (58 yr), wife (45 yr), two sons (elder 25 yr, younger 19 yr), 3 daughters (28, 24, 21 yr) and uncle from father’s side (43y). The family environment is clouded by poverty and domination of father in decision making. His brother is unmarried. His elder son is married but unemployed. Uncle is also dependent on him. Among the three daughters the elder is divorced and is dependent on him too. The other two are married but living with him along with their husbands. The life quality of the test family was measured on [14] guidelines based on quality interview: history of the patients, treatments in the past, socio economic condition, family problems prevalent, family environment, family moral values and pressure factors [14]. Function scales were assessed on “Quality of Life Interview” [15]. According to the information provided the problem has much to do with the socioeconomic condition of the family and their deteriorating living standards. According to M. Jameel his brother and wife were suffering from this problem for more than a decade. His younger son’s problem started when he was 17 years old. During his problem he started taking drugs and became more violent and aggressive. Jameel also told us that he visited numerous shrines consulted many faith healers and even went to witch doctors and black magic practitioners but the problem consisted and worsened. He told us that his colleague told him about the Telemedicine facility and the treatment available through the system.

Consultation Plan for the Patients

A comprehensive plan was formulated for the treatment of this family. The head of the family was called and was asked to provide information about the duration of the problem, history, economic condition of the family, their social interaction in the society and their cultural values.

Pharmacotherapy included the psychotropic medication to the patient, adjusting the dosage and changing of medicine accordingly. Initial sittings at 7 days interval, each sitting of 45 minutes. Mother’s consultation was made during the 2nd sitting of the son, uncle’s consultation was made during the 4th sitting of son. During the treatment it was noted that the
problem with family has something to do with abnormal balance of the neurotransmitters dopamine and glutamate. The dopamine theory suggests that psychosis is caused by dysregulation of dopamine in the brain [16].

The most important aspect of the management was educating the family/attendant of the patient. The attendant of the patient was told about the problems and was assured that it can be managed with medication and counseling. The attendant was also told about the severity of the problem of each patient, how to take care of patient, how to behave with the patient and how to follow the drug plan. The doctors also started counseling program for both attendants and patients. Aproximately every patient was consulted for 30 to 45 minutes in presence of family head. In the beginning the patients were asked to come after 7 days of the first appointment. After two months of treatment patients were asked to come fortnightly. After another 2 months patients were asked to come after 4 weeks, the vital signs of the patients were recorded, detail conversation was made with the patient’s attendant. After every 2 months M. Jameel was asked to tell us how much improvement he feels in the patients. Jameel told us that not only the treatment brought betterment in the mental health of his family but also contributed well in the environment of his family life. Now his wife is actively participating in house hold affairs, his brother had started a grocery shop in the street and Arif is now doing daily paid labor job. After 9 months of treatment the recovery level recorded for patients was: Son 63%, Uncle 55 % and Mother 53%.

Conclusion

There are hundreds of such stories which have brought positive change in the lives of thousands due to the availability of telepsychiatry services in the districts of South Punjab. Research findings to the date also indicate that the use of telepsychiatry can be reliable and favorable for both patients and clinicians. Initial results suggest that these modalities are likely to improve patient outcomes. More work is needed to expand our research knowledge with regards to the ways telepsychiatry can be effectively used to augment care in patients with schizophrenia. Future studies should examine the influence of variables known to be important in facilitating patient-clinician communication. Initial progress with the use of video- and internet-based modalities has been made, although the pace has been slow. More well-controlled interventions are needed to confirm whether psychopathologic outcomes can improve in those modalities in which this has not been well examined (i.e., with videoconferencing). Future research also needs to focus on important aspects of system development. Through well-designed quality improvement initiatives, telepsychiatric systems can be improved
and refined in order to provide better healthcare for patients with schizophrenia in deprived areas.

References

[3] www.answers.com/topic/Pakistan

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Lessons Learned from National Telemedicine and eHealth Initiatives
The epidemic of Ebola virus disease is devastating in West Africa since February 2014. The national authorities have made formal announcement since March or one month later. It is the first time for West Africa to be attacked by the disease.

Epidemics have already been recorded since the discovery of the virus in the Democratic Republic of Congo (DRC), Sudan, Gabon, and Uganda. However, no one has recorded among these epidemics such cases of death in the past as the epidemic wave happened in Sierra Leone, Liberia, Guinea, Nigeria, Senegal and Mali [1].

By the spreading from Guinea to its neighbor, Sierra Leone and Liberia, and extending in Nigeria and Senegal, African communities are facing the most important epidemic never recorded with more than 22,828 cases reported and more than 9,152 death (Report of WHO, February 7th, 2015).

The WHO had announced that if drastic measures were not taken to curb virus outbreak, West African region could have faced 10,000 new cases per week [2].

In view of the nature highly contagious of the virus, the proximity of the development and intensity socioeconomic exchanges, the disease could easily spread in other African neighboring countries. This is the reason why the WHO, member states and partners have organized an emergency meeting in July to discuss the means to stop the virus transmission in West Africa. Following this meeting, the Malian ministry of Health and Public Hygiene (MSPH) has decided to strengthen prevention and response, including introduction of various digital tools.

Digital Tools Used in the Fight against EVD and Their Functioning

Since the beginning of Ebola virus in the neighboring countries, the ministry of Health through The National Agency for eHealth and Medical Informatics (ANTIM) did not fail to make efforts in order to inform and educate the population to avoid the penetration and/or outbreak of the disease in the Malian territory.

It concerns particularly:
• Web oriented tools: Official website, social networks, mailing lists;
• Telephone toolkit: Android Application, Ebolaphone, Free-phone numbers and Call-center.

These tools in their functioning are integrated. All the official information on the management the epidemic are available on the website of MSPH. These information are relayed on the official Facebook page of MSHP and others social medias since the first case of EVD declared from la Guinea; making available in this way the information for more than 10 000 Malian users.

An Android application has been developed in order to collect data of routine among Ebola and all the diseases at epidemic potential to strengthen the alert of suspected cases. This application sends collected data by the user from mobile terminal on a web platform of data visualization called Digital System for Integrated Health Information (SNISI).

Adding to all these measures, Freephone numbers have been put at the disposal of Malian public through the two mobile phone operators: Orange Mali and Sotelma/Malitel. The objective of these Freephone numbers was to provide more information to the public in giving answers to the latter’s questions and trace the alert cases of EVD. It is completed by a system of communication exclusively dedicated health professionals involved in the riposte against the EVD called Ebolaphone.

From the beginning, the MSHP has established 3 operational Freephone numbers for the great public. These Freephone numbers are: 80 00 88 88, 80 00 89 89 working on the network of Sotelma/Malitel and 80 00 77 77 for the network of Orange Mali. However, following the detection and confirmation of the first case of EVD in Mali, Freephone numbers were permanently saturated by calls. That has frustrated the public and been qualified as «non-functional» Freephone numbers.

The National Directorate has taken urgent measures for Health (DNS) and ANTIM, from Saturday October 25th, 2014, to make services available as possible.

On the date of October 31st, 2014 at the midnight the Freephone numbers 80 00 88 88 and 80 00 77 77 have been interconnected, facilitating their access for the user whatever the used phone operator. This measure has been completed by an Ebolaphone communication system. On the date of November 4th, all the sanitary cordons have been endowed with Ebolaphone terminal.

A call center of «Call Me» has been quickly established by Orange Mali to ensure in emergency Freephone services. The center has reserved a room of ten positions for this activity. About thirty teleoperators have been
trained on calls management concerning Ebola by the team of the DNS and ANTIM.

Quickly some malfunctioning appeared, as insufficiency of a number of positions, the non-call routing of the Sotelma/Malitel numbers towards the Call Me call center. This situation has increased the number of positions for call me call center from 20 to 40 through Orange Mali’s financing.

Furthermore, urgent measures have been taken on the date of December 4th, 2014 making the Voice Telecom call center with 15 positions 24/24 to operate all the Sotelma/Malitel calls on UNICEF’s financing.

To summarize the process of the treatment of Freephone calls (Fig 1), the population makes calls with either phone operator. These calls are routed towards the call center, which deals with caller’s request. This dealing is recorded in an Excel file and regularly transmitted on the diffusion list of the Ebola crisis response cell. However, when an alert case is recorded, the teleoperators call rapidly the emergency operational center via ebolaphones to provide all the necessary information for a riposte of rapid field teams. As well, the crisis response cell is informed about.

Figure 1: Management of Ebola Free phone numbers

Essential Observations

The number of visitors on the web pages of the minister has registered a significant increase. On the other hand, the analysis of Freephone number calls enables to make brief observations especially during the follow up of the second transition chain of EVD in Mali. As clarified by the figure below, we have attended an increasing development of the number of initiated calls and number treated calls. The development being quasi-
The calls treatment rate increased from 25% to 88% certainly influenced by the number of position of the call center. The improving of technical solutions for routing calls and service time from 16H (8H to 00H00) at 24h/24 [3].

Figure 2: Daily progress of Freephone number calls in November

The qualitative analysis of calls enabled to gather the calls per category according to the content of communications between the teleoperators and the population. The communication difficulties in terms of misunderstanding, difficult hearing, non-response of the speaker wherever the call be hung up were making the information unworkable. That was especially in the second week of November.

The issues on the prevention as well as those specifically on the transmission of the virus, its symptoms and issues of a general character on Ebola were more recorded. These calls are distributed between the different regions of Mali as the following: 25% from Bamako 22% from Sikasso, 17% from Segou, 15% from Kayes and 12% from Koulikoro. The age bracket 16 to 25 years old was the most represented. The average age of the women was 19, 46 years old and 22 years old for the men.

Lessons Learned

The mobile phone has shown proof as new in the management of health information further: in an epidemic context where the traceability of contact persons is of a great interest to prevent the EVD outbreak. The use of information in this context is strong where the necessity to place at the disposal of the population a reliable information by all the communication channels.
Figure 3: Distribution of calls reasons

References


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National Telemedicine System in Slovenia for Remote Interpretation of Pre-Transfusion Testing

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Background

Several activities in transfusion medicine could benefit from the application of telemedicine (TM) [1]. In the Slovenian blood transfusion service, telemedicine has been used for a centralized remote interpretation of pre-transfusion testing since 2008. The aim of the development and implementation of TM in the period 2005–2008 was to enable an expert from the central reference laboratory to give advice to the staff in any transfusion laboratory of regional hospitals where pre-transfusion tests were performed. The TM system was initially developed by the leading professional transfusion medicine institution Blood Transfusion Centre of Slovenia (BTCS) in cooperation with the Faculty of Electrical Engineering, University of Ljubljana [2]. After 2008, the reorganization of blood transfusion service started the former transfusion departments of regional hospitals gradually became dislocated transfusion centres (TCs) of the BTCS or the Maribor Centre for Transfusion Medicine (7 and 2 affiliated TCs respectively). These two blood establishments then took responsibility for the organization of the non-stop work at the affiliated TCs. Physicians from the hospitals that used to interpret routine pre-transfusion testing when transfusion medicine specialist was not available were no longer involved. Faced with the situation of the shortage of transfusion medicine doctors (TMDs) needed for the organization of continuous work (24/7) at dislocated TCs, telemedicine that has already been implemented offers a solution. Consequently, its use was extended from giving advice in the case of complicated patients to the interpretation of pre-transfusion and prenatal tests for all routine patients. Due to the increasing use in the following years, the BTCS with partners decided for a complete rewrite and upgrade of TM system, which was finally implemented in 2013 [3]. Tele-transfusion medicine was the first national TM system in Slovenia that operates routinely. Here, our experiences from the perspective of its users and patients are presented.

Organization of Blood Transfusion Service
Blood transfusion service in Slovenia is comprised of:
- Independent BTCS with 6 affiliated transfusion centres (TCs) and one hospital blood bank (BB),
- The Centre for Transfusion medicine (CTM) Maribor with 2 affiliated TCs being part of the University Clinical Centre Maribor,
- General hospital-associated CTM Celje.

Before blood transfusion is given, obligatory pre-transfusion tests are needed to confirm patient-donor compatibility. They are performed in all 12 transfusion laboratories throughout Slovenia 24/7. The tests are performed by skilled laboratory technicians using gel ID-cards. The results are interpreted and signed by a TMD. Only in three main blood establishments is a TMD constantly available (24/7) for the interpretation of pre-transfusion tests on site among other obligations. In other nine transfusion laboratories, TM service is used when a TMD is not on site.

Telemedicine for Remote Interpretation of Pre-Transfusion Testing

The TM service is organized regionally in the Ljubljana and Maribor regions (Fig. 1).

Figure 1: Pre-transfusion tests from 9 remote transfusion centres are interpreted via TM by a teleconsultant from Ljubljana (7 TCs) or Maribor (2 TCs) region

After receiving a request for blood components, a technician performs the obligatory pre-transfusion tests using ID-gel cards and creates a TM session (Fig. 2) with captured images of the ID-gel cards for each patient. The
sessions are sent to a regional teleconsultant on the other location who is responsible for several remote transfusion laboratories (7 or 2 in each region) at the same time. Since he can work from any transfusion location, all TMDs within the region can be involved in providing TM service. The consultant is informed about every arrived session by an SMS and voice alarm on mobile phone. Urgent sessions are exposed in red colour.

Figure 2: A telemedicine session includes patient data with transfusion history and previous test results, attached request form and ordered tests with captured images of gel cards

The TM system is connected with the national transfusion information system DATEC. From its database, the consultant gets information about patient data, transfusion history and previous results of immunohaematology tests for patients and donors. Additionally, a request form is attached to each session. This is how a teleconsultant gets the same information as s/he would if working on site. After a teleconsultant has interpreted and validated the results, the session is sent back to the technician. The results are issued in DATEC and with electronic signature.

Methods

In order to evaluate the significance of telemedicine, statistical data obtained from the transfusion information system DATEC and TM system were analysed. The satisfaction of the TM users (consultants and technicians) was evaluated by two surveys.
Results

The growing importance of the TM is supported by numbers. Since the beginning of 2008, the number of TM sessions has increased from 290 to 21,220 in 2014. The proportion of patients from dislocated TCs whose pre-transfusion tests are interpreted by TM gradually increased to 50% on average in 2014 (the range being from nearly 100% to 45% in different TCs). The TM system enables prompt responses: 54% of sessions are concluded within 30 minutes and 88% within one hour. Eighty per cent of the TM users (8 teleconsultants and 32 technicians) have claimed that the TM service is indispensible and 20% that it is very important for everyday practice [4].

Conclusions

Since 2008, a unique national TM system for remote interpretation of pre-transfusion and prenatal testing has been used successfully in Slovenia. Comparable experiences from other countries are limited [1]. The use of TM has a strong impact on the improved and timely transfusion service for patients, improved relationship between BTS and hospitals, improved organization and rationalization of work in TCs and on substantial cost savings. TM allows pre-transfusion tests nation-wide to be interpreted 24/7 by TMDs who are the most experienced especially in solving complicated cases. Consequently, increased patient’s safety is expected and the same quality of service for all the patients regardless of time and location is provided. Apart from that, clinicians get improved transfusion service without their involvement. The TM system has proved to be reliable and secure and has been highly appreciated by its users [4].

Acknowledgements

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References

Introduction

South Africa is implementing an innovative system of health financing, the National Health Insurance, which will change many aspects of public sector healthcare delivery. The South African eHealth Strategy which is enabling of the National Health Insurance refers to telemedicine as a way of improving access to care for rural people [1]. Attempts by the National Department of Health (NDOH) and the nine Provincial Departments of Health to implement telemedicine over the past 15 years have been of limited success or have failed[2, 3]. Before considering and planning new services it is important to review the current use of telemedicine in the public sector in South Africa, and also those implementations that have failed or ceased to function.

In 2008, as part of the development of the National eHealth Strategy the NDOH conducted an audit of telemedicine activity in the public sector. They reported 86 telemedicine sites in South Africa of which 32 were active [4]. To count telemedicine sites is not helpful as it looks only at infrastructure and videoconference and teleradiology infrastructure in particular. It does not take into account different telemedicine activities emanating from a site or informal store and forward services or tele-education activities. It also fails to appreciate that every health professional with access to a computer, smart phone or tablet PC is potentially a telemedicine ‘site’. More importantly the survey does not report actual use of the telemedicine services. A subsequent postal survey of 2,839 health facilities identified 21 facilities with telemedicine services [5]. As telemedicine is an integral part of the National eHealth strategy the aim of this study was to determine the current state of telemedicine infrastructure in the public sector by survey of the nine provincial departments of health and review of published literature.

Methods

A questionnaire addressing telemedicine infrastructure, services offered, their use, administration and management of telemedicine was sent to people identified by the NDOH as being either responsible for or leading
telemedicine in each of the nine provinces. The survey was emailed to them and they were contacted by telephone and requested to either complete the survey telephonically or complete the form in their own time if they did not have the information readily available. Repeat phone calls were made and email sent if no response had been received within three weeks. In addition, the annual reports, performance plans and strategic plans of the nine Provincial Departments of Health (DOH) were reviewed as was the installation plan for the MRC telemedicine units.

A literature review was undertaken of telemedicine in South Africa. Searches were conducted of PubMed, Scopus, Cinahl, African Journals online and African Index Medicus. The databases were searched using common keywords relating to telehealth. The search was conducted in November 2013. For PubMed, the terms (“telemedicine” OR “telehealth” OR “ehealth” OR “mhealth” OR “email” OR “electronic mail” OR “telephone” OR “mobile phone” OR “cell phone”) AND (“South Africa”) were used to search the title, abstract and keywords of articles indexed. No limitations were applied to the date of publication, the journal category in the database or the language of the documents. The abstracts of all papers found in the searches were read by both authors. Relevant papers were obtained and only those reporting telemedicine use in the public sector were included in the review.

Results

Only four completed surveys were returned, from Limpopo, the North West, Mpumalanga and KwaZulu-Natal Provinces. The persons identified in the Western Cape and Northern Cape felt that they were not telemedicine co-ordinators and were unable to direct the survey to a relevant person. No responses were obtained from the Eastern Cape, Free State and Gauteng Provinces. The results of the questionnaire were checked against annual reports and performance plans to check for oversights and additions. Problems were experienced with the Mpumalanga DOH Website. The data on telemedicine sites in South Africa extracted from the responses to the survey and review of the reports of the Provincial Departments of Health are supplemented with additional data from the literature review, which reflects telemedicine activities in public hospitals and clinics implemented by the MRC, Universities and NGOs. Included in the table are data on the number of MRC telemedicine units that have been distributed to the Provinces which have been installed in hospitals and clinics. The data are presented as sites, for comparison with the 2008 survey. (Table 1)

Table 1: Telemedicine (TM) sites by Province at hospitals, including educational sites, and clinics in South Africa in 2000, 2008 and 2013.
Abbreviation (LP = Limpopo Province, MP = Mpumalanga Province, NW = North West Province, KZN = KwaZulu-Natal, EC = Eastern Cape Province, FR = Free State Province, GP = Gauteng Province, NC = Northern Cape Province and WC = Western Cape Province, NTS = National Telemedicine System, TM = telemedicine)

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<th>NW</th>
<th>KZN</th>
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| Clinics with TM | NTS 1999-2000 | 0  | 0  | 0  | 2  | 0  | 0  | 0  | 0  |
|                 | DOH 2008 Report | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 1  |
|                 | Clinics 2014   | 1  | 0  | 16 | 0  | 53 | 0  | 0  | 1 (8) |
|                 | In use         | 1  | -  | 0  | -  | -  | -  | -  | 1 (8) |
|                 | Total 2014     | 14 | 2  | 21 | 53 | 81 | 5  | 0  | 22 |

| MRC unit allocation | 8 | 14 | 16 | 10 | 14 | 8  | 4  | 11 | 7 |

A total of 470 publications were found with reference to telemedicine South Africa from 1978 to November 2013. All articles except one were in English. After removing duplicates, 361 publications remained. All abstracts were read and 148 were not relevant and were removed. A further 43 were removed as they pertained to the use of telephones, fax, and email for gathering data for research. The remaining 170 publications were reviewed and the 44 papers reporting telemedicine activity in the public sector are reported. This does not include information from departmental reports or plans. (Table 2)

Table 2: The number of papers reporting telemedicine activity in public sector hospitals and clinics, by specialty, and mode of delivery, store and forward (S&F) or videoconference (VC) and the provinces in which this activity is reported. (LP = Limpopo Province, MP = Mpumalanga Province, NW = North West Province, KZN = KwaZulu-Natal, EC = Eastern Cape Province, FR = Free State Province, GP = Gauteng Province, NC = Northern Cape Province and WC = Western Cape Province.)

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Discussion

Apart from teleradiology, there is little evidence of widespread sustained clinical telemedicine activity in the public sector in South Africa other than in teleradiology. Overall, 131 of 433 government hospitals have or have had some form of telemedicine activity as have 79 of 3,075 clinics. There are no papers on telemedicine implemented by either National or Provincial Departments of Health Apart from two papers on the National Telemedicine System implemented in 1999 [2, 6]. Reports and plans of Provincial Departments of Health refer to telemedicine but only two, Mpumalanga Province and North West Province provide limited data on use of their services i.e. the number of CT scans and X-Ray images transmitted. The reports of the Eastern Cape Province list a number of hospitals and clinics with telemedicine equipment, but no data are provided on their use in either departmental reports or the literature [7, 8].

In several instances there is more than one paper about the same service. The eight papers on teledermatology report on three store and forward services and one videoconference based service, the six papers on teleophthalmology refer to two services, and the five telepathology papers emanate from one service. Videoconferenced education for both clinical training and continuing professional development has been well received and has been used as a starting point to involve doctors in clinical services [9].

Those making decisions about planning and implementation of telemedicine in the public sector face a problem as there is insufficient information in the literature or Provincial reports on current activity and use. These data are urgently needed.

References


Introduction

The Nenets Autonomous Okrug (NAO) is situated in the far North-East of the European part of the Russian Federation in severe climatic conditions. The territory of the region is 176.7 thousand square km, which covers more than 300 km from north to south and about 1,000 km from west to east. The population of the region is 43 thousand.

The remote distances between the settlements and the regional center, absence of ground means of communication, irregularity and high prices of air carriage prevents the provision of medical care to residents of the region. There is a shortage of medical personnel and sometimes their medical skills are too low to take prompt decisions concerning the management of the patient.

Due to these features of the Nenets Autonomous Okrug, telemedicine is a especially powerful tool for provision of medical care to local population.

The stages of Creation of Telemedicine in the NAO

The Russian-Norwegian project "Telemedicine in the North-West of Russia" became the crucial factor for the development of telemedicine in the European North. The project started in 1996 and lasted until 2002. Practical use of telemedicine in the NAO started in 2000 as follows:

- 2003 – Telemedicine is separated in an independent structural unit of the regional hospital – a telemedicine department;
• 2008 – Introduction of videoconferencing;
• 2011 – Creation of telemedicine network of NAO;
• 2012 – Design and implementation of the system of planning of telemedicine consultations in NAO;
• 2012 – Introduction of remote health monitoring of pregnant women in remote settlements;
• 2013 – Participation in the Russian-Norwegian project “Qualitative improvement of health services for indigenous people in remote areas in the Nenets Region”. The project is the transfer of knowledge and skills from the Norwegian Centre for Telemedicine (NST) to the Nenets Autonumous Okrug (NAO) [1]. The project is based on the previous experience of the NST in the project cooperation with the Northwest Russia. The main topic is organizational aspects of telemedicine. Technologies and communication will no longer be great challenges in this project because the NAO have seen about the equipment and communications channels long before the project. The following issues come to the fore: technical competence of the local staff, informational safety and judicial base, as well as interaction between the practical healthcare and the healthcare administration, the rules of their play in the shared area [2].
• 2014 – International scientific and practical conference “Arctic telemedicine” was held in Naryan-Mar, NAO [3].

Current Status

Currently, the NAO telemedicine organizationally is represented by a methodological center situated in the State Healthcare Institution of the NAO “Nenets Regional Hospital”, consultations are also provided by the State Healthcare Institution of the NAO “Central Out-patient Clinic of the Zapoliarny district” located in the Iskatelei village. The NAO telemedicine network involves 7 district hospitals, 8 out-patient clinics. “External” consultations are carried out via the Arkhangelsk regional center of telemedicine and telemedicine studio of State Healthcare Institution of Archangelsk region “P. Vyzhletsov’s Arkhangelsk Children Clinical Hospital”.

In the Nenets Regional Hospital the telemedicine consultations are an inalienable part of the diagnostics and treatment process. Currently, they arrange training of personnel and work out of skills in telemedicine consultations in the medical organizations of the region. Annually about 400 – 600 consultations and 10-15 videoconferences are conducted, which is sufficient progress of “external” telemedicine for the Nenets Regional Hospital.
Outcomes

Up to now the “internal” telemedicine remains unrealized in the NAO system of medical care organization.

The issues preventing the full use of the telemedicine potential include:

- Absence of rules and regulations in the area of telemedicine;
- Absence of tariff policy for provision of telemedicine services in the mandatory medical insurance system;
- Absence of common telemedicine information space;
- Underestimation of significance and potential of telemedicine among medical personnel of the medical organizations of the region;
- Absence of skills to work at the telemedicine equipment and lack of motivation to use telemedicine in everyday life.

The modern organizational and economic tendencies require the further development of telemedicine in the NAO such as:

- Expanding the NAO telemedicine network – linking of paramedics (feldsher) and mid-wife stations (FAPs), especially those remote from the center;
- Provision of medical services to sub-soil users via telemedicine consultations;
- Introduction of remote monitoring of children of the first year of life;
- Improvement of quality and access to medical care via preventive checks, dispensersisation, monitoring of health via remote technologies;
- Implementation of the program of medical assistance to ACS patients via remote consultation and timely thrombolytic therapy in the medical organization at a remote settlement.

The further development of telemedicine requires joint efforts of the authorities, health care organizers, specialists in telemedicine and healthcare workers.

References


Anton Karpunov is the Head of The Nenets Regional Hospital. His research interests include medical management, remote medicine, gynecology. He is currently involved in the Russian-Norwegian project “Qualitative improvement of health services for indigenous people in remote areas in the Nenets Region”.

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The Benefits of Telemedicine Application in the Middle East: Hashemite Kingdom of Jordan

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Abstract: We investigated the benefits that the adoption of telemedicine has provided to the Middle Eastern countries and the Hashemite Kingdom of Jordan in particular. In order to obtain data, we sought opinions from all perceived key stakeholders, 90 semi-structured interviews were conducted with doctors, technicians, engineers, and decision makers, and 110 questionnaires were distributed to further key stakeholders including patients to ensure that we gained opinion from people from all relevant backgrounds. In addition, visits to various hospitals and clinics were made in order to make direct observations. We found that there has been significant use of telemedicine in parts of the Middle East and there have been benefits gained. This was found to be especially the case in Jordan, where telemedicine has proven to save time and cost, bridge the distance gap, facilitate second opinion and overcome the lack of training by providing continuing education and training courses.

Introduction

Remote areas in the Middle East are suffering from a shortage of all health professionals including doctors, nurses and paramedics that is causing a deficiency in delivering healthcare to people, and resulting in sickness, disease and death. Telemedicine is seen to offer a solution in Middle Eastern countries for many healthcare problems, especially those countries that include large remote areas of sparse population. In the context of this paper we define telemedicine to be the utilization of telecommunication technology to support healthcare between geographically separated locations [1].

This paper considers the benefits that telemedicine can offer to the Middle Eastern countries. The data has been obtained by systematic literature review and validated through primary research.
Problem Overview

Telemedicine is well established in many areas of the world, connecting patients with medical specialists in separated locations, and is popularly used in remote rural areas. Developing countries consequently have less experience than developed countries in telemedicine and its application. This is attributed to many factors, but cost of equipment and connectivity is predominant [3]. Moreover, comparing to developed countries, the Middle Eastern countries are suffering from shortage of medical specialists. For example, the number of doctors is 1.5 per 1000 people in the UAE comparing to 3.7 per 1000 in Germany [4]. This shortage is particularly acute in the rural areas; a dispersed population and the long distance to the towns results in sparse health services and poor access to specialist services.

Efforts are being made to introduce telemedicine in the Middle East by various organizations [5], however many obstacles, technical and organizational, remain.

The Hashemite Kingdom of Jordan

Jordan is a country in the Middle East with a population of around 6,388,000 [6]. It has 106 hospitals, 63 being private and 43 public [6]. There are 4984 registered doctors (estimated in 2012) [6].

The private hospitals are generally in excellent condition and have high quality healthcare services. However, few of the Public hospitals run by the government (Ministry of Health) have such good services, mainly due to the lack of funding and the large number of patients.

Although Jordan is relatively wealthy, only a little is being invested in telemedicine by few private hospitals and clinics. The policy of the government in Jordan is to encourage healthcare providers to establish telemedicine projects, but to date there have been few projects, these being restricted to a small and limited range of applications in private clinics.

Methods

This research was conducted in the Hashemite Kingdom of Jordan. Visits to various hospitals and clinics were made in order to observe the benefits gained from the current telemedicine projects. Moreover, 90 interviews were conducted with key stakeholders from both urban and rural areas including doctors, technicians, engineers, decision makers and patients. In addition, 110 Questionnaires were completed by further key stakeholders including patients in order to seek opinions from a wider range of participants.

The research follows the qualitative approach [7]. Data has been collected through both questionnaires to key stakeholders to evaluate their knowledge about telemedicine and semi-structured interviews with further key
stakeholders to gain a deeper understanding of issues raised. The questions focused mainly on the benefits that telemedicine can provide to Jordan. Every interview was with consent, but all preferred to be anonymous. Interviews were analyzed using Thematic Analysis and by using NVIVO.

Benefits of Applying Telemedicine in Jordan

Thematic analysis of the interviews identified the following major themes.

A. Second opinion consultation

Although a minority of the private hospitals and clinics already use telemedicine in its simplest form, the remote hospitals are poorly equipped and have insufficient doctors, unreliable medical devices and poor knowledge about technology.

It has been anticipated that collaboration between these hospitals; consulting between each other, exchanging experiences, and improved communication; can fill the shortages that these hospitals face and provide a means to support healthcare in the entire country.

Jordan has recognised the benefits that telemedicine can offer and established a telemedicine project to provide a second opinion and exchange medical data. The project was a joint venture between the King Hussein Medical Centre and Mayo Clinic (USA) and was funded by His Majesty King Hussein. However, these efforts ceased a few months after his death in 1999 because the government could not afford the high cost of maintenance the project.

B. Bridging the gap

Telemedicine has a major role in linking remote and rural areas to urban areas, it removes the need for patients to travel and specialists can provide reliable healthcare services to the patients in these remote areas. In 2011, Jordan and CISCO launched a regional telemedicine project to link Mafrak Public Hospital and Queen Rania Hospital with Prince Hamzah Hospital in the capital Amman. The project provided a large number of consultations to patients through integrated audio and video communication [8]. This project proved successful, it provided the means for the doctors in both regional hospitals to consult with specialists in Hamzah Hospital, also reduced the cost of travel and enhanced access to healthcare facilities to people in remote areas in Jordan.

C. Cost and time saving

Telemedicine has assisted the delivery of healthcare services to patients located remotely in Jordan. This was evident in the project which was established in 1998 between few public clinics in Madaba and HeartBeat centre in the capital Amman. More than 500 calls associated with chest pain
have been received by HeartBeat call centre in three months. These calls were forwarded to the medical specialists in Amman in order to analyse the calls and give the right advice. 300 of these cases would have been referred to Nadim Hospital which is the nearest hospital to Madaba, however, these cases were minor and have been treated over the phone.

The major benefit of this project was saving 300 patients the efforts and cost of travelling from Madaba to Nadim Hospital, saved the time of the specialist at Nadim hospital, the cost of the referrals and other services that the hospital would have provided to these patients [9].

D. Training and education

Doctors and nurses in the public hospitals commented about the lack of training in IT provided by their hospital and the lack of funds allocated to training. However, it was recognised that the telemedicine projects that have been established in Jordan have offered an ideal solution to overcome the problems of travel to the capital to attend meetings or training courses [8].

It is essential that the healthcare staffs are competent in IT. The need to start education and awareness in the medical schools in universities was clearly identified in Jordan, with some doctors explaining that they had had no IT courses in their university. We found that the doctors are in general, apprehensive of using new technology as they have a lack of knowledge about it. They retain many of the ideas that they learned in medical school many years previously. “I am having difficulties using my mobile phone, how can I use computers to run telemedicine projects?” Moreover, providing information to the decision makers can help persuade them of the advantages of telemedicine and its role in improving the quality of healthcare in Jordan. The decision makers will be key to the introduction of telemedicine “We need to convince the decision makers because they are the key to the telemedicine application; if they are satisfied then they can convince the government to pay more attention to the healthcare field”. There is a great need for training and education to be provided to healthcare staff and people in general”. Educating the people is essential; they have to have more knowledge about the basics of healthcare.”

Discussion

Telemedicine has proven that it is an effective means to provide a high quality healthcare service in Jordan. Although Jordan has one of the most modern healthcare infrastructures in the Middle East [10], telemedicine has yet to be used efficiently due to various barriers. However, there have been serious efforts in Jordan to overcome these barriers. Workshops and seminars have been provided to the public and the medical specialists to raise the awareness of the benefits that can be gained from the telemedicine.
Conclusion

Developed countries are making significant efforts to encourage the adoption of telemedicine applications. The Middle East has exploited this experience and applied it in order to gain the benefits of telemedicine applications.

Despite all the barriers to the adoption of telemedicine in Jordan, various telemedicine projects have been established in the country and succeeded in improving the delivery of healthcare services in a way that is convenient to the people in need. Moreover, the adoption of telemedicine in Jordan has overcome the barriers of cost, distance and lack of medial experts [8].

There are various differences between the adoption of telemedicine in the developed countries and the Middle East due to dissimilarity of the available resources. However, it became very clear that the adoption of telemedicine and technology in the Middle East has a promising future and their application can create a new era of providing high quality healthcare services.

Reference

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The National Pseudonymisation Service of Luxembourg

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Abstract: Medical data of persons that is collected in the context of medical treatment or of clinical trials and studies is highly valuable information that must be protected against illegal access or misuse. Beside the strict enforcement of access control or the use of encrypting techniques, pseudonymisation of medical data is another useful tool to protect sensitive data. The demand for pseudonymisation services has been strong by key players in Luxembourg in the past. The Agence eSanté of Luxembourg, which is responsible for the setup of a nationwide eHealth platform, has therefore commissioned the installation of a National Pseudonymisation Service that is now up-and-running.

Introduction

The need to protect the privacy of medical data by the use of pseudonymisation techniques is strong in case of population based statistics or clinical studies and trials. In all of these cases, the person behind the data is only needed in the initial treatment situation but not for the identification or proof of research questions. Anonymisation of the data might be sufficient in some situations, but the quality of data can be significantly improved, if data of the same person can be linked, independent of collection time or collection place of the medical data or samples. In that case only pseudonymisation will help to establish this link.

For the Integrated Biobank of Luxembourg a pseudonymisation solution was already developed and was running for many years. The proof, that such a tool can be used in a real use case situation has increased the awareness of other stakeholders in Luxembourg about the need to pseudonymise their existing databases, or to foresee the use of a pseudonymisation solution already in planned infrastructures.

The Agence eSanté therefore had commissioned a study about existing and potential use cases of a National Pseudonymisation Service (NPS) that
extends the use case of the running biobank solution. On base of the outcome, a functional specification has been elaborated that is the base of new national implementation (*The study of potential use cases and the functional specification are publicly not available*). This solution not only provides a platform for a larger variety of potential use cases, it centralizes some of the costly implications of a pseudonymisation service: The management of the persons, and the solving of problematic identification decisions. As a National Pseudonymisation Service, it can benefit of the existence of a National Master Patient Register that includes the latest high-quality demographics of all persons that live and work in Luxembourg, and the identity vigilance service of the Master Patient Index in case of uncertainty.

Methods

Several research institutions in Luxembourg have or plan databases that contain medical data of patients for research purposes. A first analysis of potential scenarios of the use of a national pseudonymisation service has identified strong differences in the way data flows from the sources of the medical data to the research database. Differences are mainly related to the questions: Who has access to demographics of the patient? Who has access to the pseudonym of the patient? Who creates the pseudonym? In regard to different data protection risks of the analysed scenarios, these questions are answered in different ways.

A National Pseudonymisation Service must support all these variations of use and must not limit the use to a specific scenario [2].

A. Warrant exchanged

In the biobank scenario, samples from donors (blood, specimen, urine) are taken at a collection site, which are usually situated at hospitals. These samples are sent in special cryoboxes to the biobank. It is clear, that the collectors of samples personally need to know the donor and therefore must have access to the patients' demographics. The biobank as a storage facility must not have access to these demographics and only works with pseudonyms. These pseudonyms are needed to identify samples from different collection events and collection site as being from the same person. All pseudonyms must be protected and neither collection sites, nor researchers are allowed to get access to this information.

The separation between demographics at collection site and pseudonyms at biobank is now performed by the use of the National Pseudonymisation Service of Luxembourg. First, the collection site registers the patient at the National Pseudonymisation Service and receives a unique identifier as
result. This step is needed, because the collection sites have no access to the local identifiers of the patients in the associated hospitals. After samples have been taken and stored in a cryobox, the unique identifier of the donor, plus the unique Kit ID of the cryobox are registered at the National Pseudonymisation Service. On base of the unique identifier, the National Pseudonymisation Service creates a pseudonym that can be accessed by the use of a warrant, in this case the Kit ID. After the cryobox has reached the bio bank (sent by special parcel services), the Kit ID is then used to request the pseudonym from the National Pseudonymisation Service.

B. **Pseudonym exchanged**

In the cancer register scenario, cancer related medical data is collected at several institutions, e.g., hospitals. For some institutions, a local identifier can be used to register demographics at the National Pseudonymisation Services. For other institutions such an identifier does not exist and a local identifier needs to be requested first. On base of the local identifiers then, pseudonyms are requested by the institutions from the National Pseudonymisation Service and only pseudonymized medical data is sent to the cancer register. So the cancer register does not get in contact with the demographics of the patients, but all involved sources know the pseudonym. Storing the medical data with a 2nd level pseudonym that is created out of the received pseudonym can minimize potential disclosure risks.

C. **Local identifier of the sources exchanged**

This is a scenario for which no use case currently exists in Luxembourg. In the scenario it is foreseen, that the medical data is sent to the research database together with the local identifier of the patient that is used at the data source. The research database then is allowed to request the pseudonym from the National Pseudonymisation Service on base of this identifier. In this case, only local identifiers are exchanged and the research database does not get access to the demographics of the patients.

D. **Intermediate identifier exchanged**

This second scenario for which no use case currently exists in Luxembourg foresees, that the source requests an intermediate identifier from the National Pseudonymisation Service, than can be seen as a 1st-level pseudonym. The research database then requests its (2nd-level) pseudonym from the National Pseudonymisation Service on base of the received 1st-level pseudonym, so does not know demographics, nor local identifiers of the sources.
Results

The National Pseudonymisation Service of Luxembourg supports a variety of use cases that require pseudonymisation. It mainly acts as a translator of demographics, local identifiers and pseudonyms. Each identifier or pseudonym belongs to isolated identifier domains. Strict enforcement of permissions on base of certificates ensures that only information from identifier domains can be seen by systems for which it is registered. Permissions are only set by authorised personal of the National Pseudonymisation Service on base of validated security concepts.

Since the National Pseudonymisation Service of Luxembourg relies on the existence of the National Patient Register of Luxembourg, all identity management related problems are already solved on national level. In cases of revised decisions (e.g., update of demographics leads to a different identification of the person in the Master Patient Index), the National Pseudonymisation Service provides mechanisms to manage these decisions without leaving data of the research databases in an undefined state.

References


Dr. Uwe Roth worked several years as a scientific researcher and post-doc in research institutes in Germany and Luxembourg. At the Luxembourg Institute of Science & Technology (LIST, formerly CRP Henri Tudor) his main focus is the development of concepts of data privacy and privacy by design.

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Smart Technologies for Independent/Assisted Living, Ageing Well and Wellbeing
An Innovative Technico-Medico-Social Structure and Platform for Services to Elderly

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Abstract: The population keeps ageing and there are today more and more elderly. They have access to a lot of information and services to help them staying at home but elders turned out to be easily confused and misinformed due to this excess of information. This population needs a simplified solution, and a diminution of interlocutors to help them organising their well-ageing. We introduce here a concept of an innovative transversal structure that uses the principle of a shopping centre dedicated to the elderly and grouping in a single entry point an expanded set of services and information that can meet the needs of the elderly and disabled in all areas of their daily lives.

Context of Health Care Professionals Today

Today elderly are at the heart of public policies. European countries in particular face an increasing number of elderly especially in rural areas (25% of French population will have more than 65 years old in 2025). The French and European population has a tendency to live longer but people do not necessarily grow old healthy while retirement homes are more and more expensive. Many stakeholders have looked for solutions to enable older people to remain safely at home. But these solutions are, for most of them, somewhat specialized in the medical and social domains and lead most part of the time to a multiplication of information and services structures.

Furthermore, in the healthcare sector, this evolution has been led jointly with a lack of communication between professionals and a compartmentalisation of professions that inherently limit the proper care of elderly. In such a context elders can easily be confused and misinformed facing such an amount of choices with the risk of neglecting certain aspects of their life. The access to services and information is not intuitive enough and the needs for daily tasks assistance are not covered.

In particular, leisure, craft services, shipping services to home, social network, daily activities for well ageing, intergenerational links, communication facilities with the caregivers and families are not integrated and, more importantly, not transversally nor globally considered.
The Concept

Our concept comes in the form of an innovative transversal structure that uses the principle of a shopping centre (Figure 1). The purpose is to find all the information and services elderly and disabled people could need in all the area of their daily life, grouped in a single location.

This structure is there to enable fragile public to have an access to everything they need every day having a single interlocutor. With this innovative business model, we want to simplify procedures, reduce intermediary number and facilitate services and information access.

![Figure 1: Representations of the structure](image)

This structure has multiple objectives. First of all it aims to inform elderly, disabled and their caregivers. For this purpose, information and prevention campaigns will be available and implemented. Adviser can also answer questions and requests and help put in place actions to prevent various risks incurred by this vulnerable population.
Afterwards, this structure is intended to answer any type of emergency in everyday life. It aims to come to the rescue of the person. This can range from a hospital discharge organization to a water leak for elderly who are unable to manage the problem alone. In order to answer all kind of demands, the structure appeal to external company, partners whose services are registered and approved. Through this functioning, our structure has the capacity to guarantee services provided by partners. It also proposes a 24/7 intervention availability in order to ensure reactive and efficient response to the demand.

The main and novel structure characteristic is the “one stop shop” aspect since it has been thought as a single entry point that can answer and find immediate solution to any request. It aims to take into account the overall needs of people’s life. It not only aims to prevent or troubleshoot but it also accompanies the beneficiary over time and in the term in different aspects of his life. To do this, it provides individualized advices with the objective of creating a life project for the elderly with the elderly (house organisation, medical, outing, etc.).

We also offer the possibility to order some services for people with reduced mobility to avoid them to unnecessarily move to obtain and access what they want. Those orders concern daily life common tasks such as bread's delivery at home or a transport request. Those services can also be accessed through a web portal. This portal provides services in an online form and, in addition, gives access to all services and information provided by our structure. The portal is divided into two parts: indeed one is reserved

![Diagram](image_url)

**Figure 2: Main scheme of the structure organization**
for “the clients” (the beneficiaries) to enable them to access the services offer and the other one is intended to be used by professionals and external registered and approved companies who acts within the structure. The goal being they have access to beneficiaries’ information but also that they can exchange part of those information when necessary.

The last aspect of this structure is leisure activities, meeting and social networking. To palliate isolation of the people, it is important to maintain or even create social links and maintain relations between different generations. We then provide leisure groups organisation (board games, reading, arts, etc.), visits (museum, shows, etc.) as well as intergenerational workshops. The underlying objective is to also improve the offer of services through feedback information that will be collected at the end-users’ level.

At the top level of organisation, the structure is driven by a coordinator who oversees activities and maintains the link between approved firms and the information services (Figure 2).

Perspectives

This structure is there to enable fragile public to have an access to everything they need every day having a single interlocutor. With this innovative business model, we want to simplify procedures, reduce intermediary number and facilitate services and information access.

Through its transversal approach, this structure implicitly enables many manners to extend the offer and diversify services in order to reach a larger public. Services first dedicated to elderly and disabled people could be easily generalized to provide services to students, families and anyone who is supposed to need a service or information.

Another possible extension would be to propose, through the web portal, tele health services.

Finally, as a “one stop shop”, this structure model could be integrated into an innovation center (a structure dedicated to help detection and design of innovative ideas). The researchers and students in the center could help to define new services and new ways of bringing the services to the end-users.

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Building a Dataset of Smartphone Inertial Sensors Measurements to Study Falls and Mobility in Older People

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Introduction

It is well known that falls are an important health problem in the elderly. Fall risk increases with age and people who fall can suffer important physical and psychological consequences, which in turn imply high costs for health systems. Thus, in recent years there has been a lot of research effort in fall detection, risk assessment and prevention. Information and Communication Technologies can play an important role in this context. In particular there is an increasing interest in wearable sensors because they can record subjects’ data unobtrusively over large periods [1-5]. Smartphones are popular devices integrating inertial sensors. Thus they are good candidates to be used as monitoring devices. However, most studies are focused on controlled environments and difficult to reproduce since the original data are not made public. To sum up, a public data set with movements of older people recorder with smartphones in real situations would be a relevant contribution since it would allow many researches to test algorithms and compare them fairly.

Thus, the aim of this work is to show the design of a study to record a large dataset of elders’ everyday movements. Besides sensor data, the volunteers will also answer several questionnaires and pass several clinical tests to assess mobility, balance, etc. The dataset can be used mainly: i) to study algorithms to predict fall risk from unlabelled movement; ii) to study physical activity; and iii) to test fall detection algorithms. In this regard, although the probability of recording a fall is low, an objective estimation of false positives for a given detector can be obtained.

Questionnaires and Tests
The questionnaires and test were selected after a consensus in the group. The group included doctors, psychologists and engineers. The list and a brief description follow below.

Several questionnaires will serve us to gather general information and pathologies. Another questionnaire will be devoted to measure social support, which can influence his/her physical and emotional wellbeing. Risks at home will also be evaluated by means of a short questionnaire. Besides, a smartphone app will be developed to measure reaction time.

The rest of the tests have been previously used in the literature [4]. The Activities Balance Scale (ABC) will be used to measure fear of falling, that is, the confidence you have to keep your balance while performing some activities. The Timed Up and Go Test is one of the most important at the time of evaluating the falls risk in elderly, since he evaluates the physical condition of the person, as well as also the force of its low extremities. This test starts with the subject sitting in a chair; then, the volunteer is asked to get up and to walk 3 meters, to turn and later to return to the initial state. The goal is to measure the time that the subject takes in completing the test. The Performance Oriented Mobility Assessment (POMA) assesses the ability to maintain balance and mobility on the progress of the elderly. The assessment of mobility, especially in the balance and gait, is very important since they are directly related to the activities performed in daily life and with the falls precedent. Balance assessment is completed with a Romberg’s test. Finally, the Katz Index will be used to measure how dependent or independent a person is during his/her activities of daily living.

Description of the Smartphone Application

The application for Android mobile smartphones gets the information from the accelerometer and GPS (Global Positioning System) sensors. The user has to carry a mobile phone in the pocket. He/she does not need to have previous knowledge about smartphone use. Once the phone is switched on, the application starts to run in the background and continues running even when the screen is off.

The accelerometer stays running all the time, while the GPS is activated every 5 m. The information is saved in two files. The first file includes accelerometer information, the three axes (x, y and z) and the time between that record and the previous one. In the GPS file we store the date at which the file is updated, the number of satellites that are caught in that moment, and all the information from them (PRN pseudo-random number for the satellite, if the satellite was used by the GPS engine, the signal to noise ratio for the satellite, the azimuth of the satellite in degrees and the elevation of
the satellite in degrees). At the same time, we store the latitude, longitude and altitude.

Storage of all the information collected by the accelerometer would require a large amount of memory, which we estimate around 100 MB per day. When the application has collected a large number of data, it sends them by email. If we save all the information, the data transmission would be very expensive. Therefore it was decided not to save data when the phone is inactive following a state machine design.

Thus, the application can be in one of four States; see Fig. 1, (Active, Inactive, Waiting and Copying). The application is in the “inactive” state until the acceleration reaches some high-low thresholds. Then it goes to active. If the acceleration goes inside a band, the state goes to “waiting”, in which it still saves data. If there is no more activity in about 10 s, then the state goes again to inactive, while if some acceleration value goes outside the band, it comes back to active. In the inactive state, the size of the file is checked and, if greater than 10MB, the file is sent by email in the state copying.

![Application states diagram]

Conclusions

We have presented the design of a study to record elder’s mobility data in the large using smartphones. We plan to carry out the measurements in the next months.

Acknowledgments

We acknowledge the “Gobierno de Aragón”, the “Fondo Social Europeo” and the “Fundación Impulso” (project “ImpulsAPP Elderly”), for their support. V.R. acknowledges a grant from “CONACYT - Gobierno del Estado de Durango, México”. Smartphones will be provided by means of a contract with Vodafone.
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Definitions, Implementation, Coordination and Evaluation of the Implemented Information Technology and Communication on Maintaining Independence at Home

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Abstract: Almost every study concerning patients with loss of autonomy at home is in the medical field. The research areas are based on the hospital model. Health professionals have little information concerning habits and lifestyle at home, cultural and emotional experience of migrant populations or social data. This research will describe the relative role and the patient place as citizen. Recognizing weakened persons as main actors, they could express their opinions and suggest solutions and innovations throughout their health course. In this way, the solutions could be customized. As well as changing perspectives on their path between the intra and extra hospital.

The Context

The health course perceived by the patient

Almost every study concerning patients with loss of autonomy at home is in the medical field. Those persons are perceived as ill subjects [1]. The research areas are based on the hospital model. Health professionals have little information concerning habits and lifestyles at home, cultural and emotional experience of migrant populations or social data [2].

The adaptation of the housing and the implementation of solutions are mostly made after an accident or an incident at home. The people are rarely involved in decision-making on technology.

The questions are: how does the daily professional approach includes the information, the advice on public health or home prevention? How is the information transmitted between the main actors? “For the health professional: to present a road map to the patient and to explain the different possibilities and after to accompany him with his choice” [3].

Other authors take the patient in a global health eco-system: environment, socio cultural, biological, social, etc.

Other regard as citizen
Publications related to the use of new technology in areas such as telecommunication, tele-medicine or tele-vigilance show that they are rarely used and often ignored [4]. Furthermore, the reasons were rarely described. Let's stress the fact that there are little research offices that include the weakened person in the research of new technologies. This research focuses on the participation for citizen/patient in the use of technology.

The relatives
What is the place of the relatives about the acceptance of the technology? They need information and contact with the health professionals. Who gives the information about technology? Longer lives and the high cost of nursing homes now lead seniors to remain at home. The habitats are often not suitable for age-related diseases and environmental change denial is common.

Today, it is assumed that eight out of ten slightly dependent people choose to stay at home. However only 36% of homes are adapted to the daily life of people with reduced mobility and on average only 12% of houses are equipped with home automation. Development and access to new technologies bring many systems to be designed but are often specific to a single need and sometimes not compatible with each other, leading to difficulties of understanding, handling and acceptance. Moreover, these solutions are often costly for people with little income. In terms of home management, changes are then made in order to provide them with the necessary assistance and security.

The Framework

The technology? My opinion as patient, as citizen, as relative
Given the large number of organisations and professionals in this field, this research focuses on the overall description of a framework available in several modules:
- The health course perceived by the patient,
- The relations between the citizens/relatives and the health professionals;
- The place of the coordination,
- The description of the various sources of information and their inter-relations.

Recognizing weakened persons as main actors, they could express their opinions and suggest solutions and innovations throughout their health course. In this way the solutions could be relevantly customized.

Goals and Suggested Approach
How would these solutions be perceived?
What would be the impact on the acceptance and the appropriation? What would be the most relevant models?

**Conclusion**

This study aims to focus on the status of the concerned people: recognize them as full citizens, acting in the society, in the cultural and health domains; as well as changing perspective on their path between the intra and extra hospital.

**References**

Eclip6: A Personalized Information Channel Companion for Daily Life and Home Support

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Abstract: As the technology keeps evolving, more and more persons have difficulty to get relevant, useful and non-intrusive information where and when they need it. With the evolution of connected homes, information has never been so much present in our daily lives. Information flows are heterogeneous, both in terms of data rate and type of information and there in lies the difficulty. This article introduces our concept of information channel, which offers home support and a facilitation for daily life to the users.

Information in Everyday Life

Today, new technologies make it possible to implement new ways of working, entertain, communicate, learn and be informed of everything. The elderly are now often overwhelmed by these new technologies that they find complex to understand and sometimes difficult to appropriate. Yet, many of the applications of these powerful tools could be of obvious benefit in their everyday life. One of the main barriers to good acceptance of digital tools by the elderly is the speed of development of these tools, their multiplication and multiplicity. Thus, the information exchanged during a day, even classic, is growing. The amount of information initially made to bring knowledge in all areas of daily life, at every moment, and regardless of the place, may ultimately prove to be a source of confusion, lack of relevance, even cognitive overload. In addition, homes have become comfortable, contoured to the personalities of each and modernized by home automation systems to control installations. With the current development of connected houses and communicating objects, information has never been so many, and that can lead to difficulties in using and analyze them. Through these modern houses, information is everywhere, creating the constraint for the user to move to get each new piece of information (calls, ringtones, alarms, etc.).

Eclip6: The Concept
The Eclip6 concept is based on the availability for each user of a dedicated and personalized information channel whom the user is both actor and beneficiary. Eclip6 is a companion for everyday life profiling information to the user’s needs. It provides a comfortable life and a simplification of daily information. As described in the example in figure 1, Eclip6 is comparable to a smart tool that can provide an organized management of daily information.

Figure 1: Example of a situation managed by the Eclip6 information tool

Thanks to its simple appearance and adapted features, the Eclip6 channel will meet the needs of the user, through four axes shown in figure 2. It will allow the user to select and prioritize relevant information in his living environment. The information will change and adapt with the activity rhythm of the day of the user, automatically and discreetly. With a profile selected by the user, the channel will accompany him in his movements within his habitat and during the day on preventing him with relevant information (multimedia, communications, home automation, recreation, etc.) and events (habitat dangers and alerts, fire, medication reminder, danger, etc.) that the system will prioritize according to the chosen profile, the time of the day and the place in the house.
Having the choice of our information is essential in a world where new technologies are taking control of our data. With this objective, Eclip6 brings to the user control on his daily activities and life. By customizing his channel, the user has the option to select the useful information taking into account his age, his hobbies, his social life, his home, his health by giving them a priority level.

A Customizable Tool

As shown in figure 3, the system adjusts the flow of information, by filtering into the four categories (from dark blue to orange) according to their degree of importance or urgency.

Figure 2: The four axes of Eclip6

Figure 3: Information prioritization scheme
In order to make Eclip6 accessible to as many people, the colors of the degree of importance were chosen to enable people with visual disabilities to distinguish the contrast of the presented data.

Eclip6 is also a general tool for processing information flows that organizes the daily life of the user, taking into account his habits, his living and selected best times to deliver the information. Therefore, it is able to meet a variety of lifestyles, with varied interests. Figure 4 shows this principle at a given time of the day for various user profiles.

![Figure 4: Various age profiles enabled by Eclip6 channel](image)

In a habitat with multiple information terminals (TV, computer, tablet, smartphone, etc.), the system will be able to disseminate information to the right place at the right time depending on the person's lifestyle, becoming as a kind of reminder.

**Perspectives**

In the near future, it is likely that pico-projectors could be used to multiply in ubiquitous and inexpensive way information delivery and display in multiple and selected locations in the house. These small, low-power devices will be non-intrusive and easy to integrate into the users’ environments.

Robots can also serve as a communicating interface as a modern butler delivering the channel information. Customization, playful and social aspects of the interface can then be integrated into the concept.
Abstract: Age, accident and illness may, at any time, force all of us to face a situation of disability or loss of autonomy. Fortunately, we are now in a unique position because our time invites to technological solutions that push the boundaries of the possible. What if, despite the physical limitations of a heavy physical disability, we could maintain our home? What if we could still get around the inconvenience and the taboo of being dependent of an individual to satisfy our inner needs? What if, trapped in a wheelchair, we could still visit, and instantly all the places of our planet? Thanks to technological advances in the fields of robotics, many things can be made possible. Humanoid robotics has a huge range of possibilities. It may also vehicles many phantasms such as that of the companion robot replacing the human relations.

The Robot’s Impact on the Humanity

Ignorance grows with knowledge; the more you know, the more you know that you do not know. Indeed, a baby is ignorant of his ignorance and the more he knows the more he can estimate his ignorance.

This is an applicable scheme which explains a lot of technology's fears. We will try to understand the roots of the fantasies around the robots. Karel Čapek, a Czech writer [1], created a new word: "robot" from the Czech word "robota" meaning labour. The word automaton already existed; Čapek intended to embody the fears of his era. It was in the beginning of the 20th century, the industrial revolution had just happened and new fears of the modernity (misunderstanding of technology, creating masses of workers, grouped into unions) needed to be embodied. So, Karel Čapek turned the automaton’s lack of consciousness into robotic rebel consciousness. The automatons rebelled and it led to the extinction of the human kind.

Few years later the American writer Isaac Asimov democratized the "robot" word and imagined the famous rules of robotics. The robots were then designed to protect the humanity where, again, the robotic artificial intelligence (IA) is a threat for humans.

Having considered this mechanical fantasy, our work has been to think about the relevance areas of humanoid robots uses in an autonomy earning
prospects. The uncanny valley is a Masahiro Mori’s concept, published in 1970 [2]; it is the observation of the aesthetic acceptance level of robots by humans, represented in figure 1 below. The scientific theory is that the more human it is, the stranger it is felt. The robot is easily accepted if it is out of the bottom of the valley. If the humanoid robots are clearly identified as machines, they are not annoying to humans. However, if aspects of their morphology are too close to human appearance without being perfect copy, the feeling of aversion will be very important. The basic tool of our project is NAO [3]. Like Romeo and Pepper, it fits to a very good place on the graph of the valley, which is very important for the application that we are implementing. There will be no rejection of these robots and even positive reactions from the users.

Figure 1: The Uncanny Valley, a Masahiro’s concept

To increase the feeling of acceptance and agree with our principles of ethics, we use the humanoid robot just like a remote control with many functions, to cope with the management of the house, to keep sexual autonomy and to explore many perspectives with the avatar. The aim is not to minimize the action of the human but the action of the robot, allow executing the action even if it has physical or other difficulties and keeping in mind that the humanoid robot is neither a child nor a friend or a companion. It is just a machine. As a result, we thus recommend on the one hand the limited and targeted development of robotics’ artificial intelligence
in a human-type purpose, and on the other hand the prospects have to move towards the utility and functional aspect of robots without seeking to project a particular affect.

A New Kind of Butler

The aim of the butler is not to replace the human but to help him. The robot is there to protect and not to harm. This is why Nao acts only if it is asked except for a warning or a notification. The butler Nao supervises the different applications of the house thanks to its centralizing system. In a first time, he can advise about a dysfunction. In a second time, he can take control on each application. That makes it possible to save energy, improve comfort and a ensure safety of the house and the people. Nao can for example switch off the lights or gas, detect presence and intrusion, detect fire start or water leak, and also identify fall situations of the person.

A Sex Device for the Respect of Sexual Autonomy

Many disabled and older people are facing sexual abstinence, because of physical dysfunction or lack of social relationships. The sustained abstinence can have many adverse consequences for the person psychologically and socially. It must not be forgotten that sexuality plays an important role in the quality of life, especially if it is weakened by a physical disorder or disability. The sex surrogate is prohibited in France and in several countries; it forces people to seek help for someone close, like a family member, friend, or in other cases a prostitute. This can cause many ethical concerns particularly in the case of the intervention of a family member where the relationship is perceived by both parties as an incestuous relationship (which seems justified). But the major problem is that the dignity and respect of the person is clearly violated. The feeling of failure worsens and there is no sexual autonomy because the person is completely dependent on another, which is even more disturbing in intimate acts. Being able to move, carry objects, to be available 24h / 24, have a voice recognition not feel any emotions or opinions and even for some, able to handle a person make humanoid robot a relevant tool for sexual assistance. The robot can be used in place of a third party as an intermediary or assistant and not as a partner. Advanced technology intersects today in many areas; the market for the sexual object is not an exception. New technologies can offer and improve the quality of life of a dependent person from a sexual point of view. New sex toy robots have appeared recently and demonstrate a high degree of realism in the satisfaction of pleasure with movements close to the natural human gesture. They allow a mixed gender satisfaction (male or female), but also for a couple integrating timing
functions and transcription of movements performed by the partner. The use of sexual object is relatively common among disabled even though the problem remains the same: someone else will have to make or install the object, with the problem of the breach of modesty so that embarrassing situations can emerge. The humanoid robot enters the scene to clear the way and install the device.

Avatar, a Projection of the Body

Avatar is a word from India, used to call the projection of gods in a human or a creature. Now, it has become a common word used to call virtual graphical representations of users on a computer platform. The idea is to turn the robot into a new kind of avatar in the real life. The user is projected into the body of the humanoid robot, so he can control the robot as his own body. If one can see through the robot’s webcams, listen through its microphones, talk with its speakers and move with its mechanical structure, the robot then can be a wonderful device for a lot of applications. In a first case, if the robot is in the family's home, the disabled/old/isolated person can visit them, talk to them, play with them through the robot in distance. It can be used in the other way by the family to visit the disabled/old/isolated person. It can also be used like a new helpline device to give a better look on the assisted person. Finally, it can be used by everybody to virtually travel over the world securely. To provide a better travel immersion, it could be associated with the virtual reality headset which allows a 3D view to the user.

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Generic Evaluation Guidelines for Digital Technologies for People Living With Dementia

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Abstract: The numbers of people living with dementia globally is set to grow significantly and digital technology will be used to help support and care for them. Evaluating innovative technology for this population has to be done correctly to achieve its widespread adoption in health and social care services. An evaluation guideline is being developed with the aim that through wide consultation and collaboration it will evolve into an internationally recognised guideline.

Introduction

As the number of people living with dementia worldwide is predicted to increase to 75.6 million by 2030 [1], the need for affordable solutions to maintain independent living is growing. It is inevitable that people living with dementia will be supported in part by digital health and social care technologies and services [2-3]. Any such technologies where use by people with dementia is intended should be designed specifically for them [2, 4].

Previous work has shown that there are shortcomings in the current state-of-the-art and argued that a special approach is required to innovating technology for use by people living with dementia (i.e. including their carers). This was presented in an innovation framework that, while reflecting the paradigms of user centred design and iterative evolution of solutions, was novel for explicit appropriate consideration of the dyad – the person with dementia and their carer – as users [4].

In new work the step of evaluating any completed design in a rigorous way has been investigated through considering the content of the corresponding research protocol. Many evaluation protocols for assistive devices in dementia care are published, but only for reporting method and self-consistency for individual projects [3-5]. In order to generate international coherence there is a need for the development of generic guidelines that can be applied to nonspecific devices.

Approach

The format of the proposed guidelines is a table divided by headings that follow an assumed (but flexible) chronological order of protocol
preparation. Each section contains information to which the researcher can refer both during the design and the reporting of the evaluation. Particular focus is given to where the involvement of people living with dementia necessitates a specific approach. Also the interdependencies between sections in the guidelines are discussed. A brief summary of the different sections included in the guidelines is presented below in Table I.

Table 1 Outline of guideline sections

<table>
<thead>
<tr>
<th>Section</th>
<th>Elements to cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>• Description of problem/need, cause, possible solutions etc.</td>
</tr>
<tr>
<td></td>
<td>• Literature review (including state-of-the-art)</td>
</tr>
<tr>
<td></td>
<td>• Summary of prior consultation</td>
</tr>
<tr>
<td></td>
<td>• Rationale for planned research</td>
</tr>
<tr>
<td>Consultation</td>
<td>• Consider needs of population in designing a consultation forum</td>
</tr>
<tr>
<td></td>
<td>• Involvement of relatives, carers, where applicable</td>
</tr>
<tr>
<td></td>
<td>• Involvement of professionals, where applicable</td>
</tr>
<tr>
<td>Funding</td>
<td>• Who is funding the project?</td>
</tr>
<tr>
<td></td>
<td>• Resources available for the evaluation</td>
</tr>
<tr>
<td></td>
<td>• Intellectual Property (IP) management</td>
</tr>
<tr>
<td>Participants</td>
<td>• Recruitment process, with consideration for adapting methods and communication to suit the needs of the target population</td>
</tr>
<tr>
<td></td>
<td>• Use of brief neuropsychological assessments to support inclusion/exclusion</td>
</tr>
<tr>
<td></td>
<td>• People living with dementia as individuals or with their carer/relative</td>
</tr>
<tr>
<td>Duration</td>
<td>• Sufficient length for ‘regular use’ to be established</td>
</tr>
<tr>
<td></td>
<td>• Consider practicalities of long-term evaluation with the target population</td>
</tr>
<tr>
<td>Environment</td>
<td>• ‘Natural’ environment, e.g. home, hospital etc. or ‘simulated’ environment e.g. laboratory</td>
</tr>
<tr>
<td></td>
<td>• Considerations of implementation of device within the chosen environment</td>
</tr>
<tr>
<td>Outcome measures</td>
<td>• Different outcomes for short-term/long-term evaluations</td>
</tr>
<tr>
<td></td>
<td>• Outcome measures selected may need to be specific for the target population, taking cognitive impairment into consideration</td>
</tr>
<tr>
<td>Ethics and consent</td>
<td>• Details of consent forms and information provided to participants, with suitable communication for population</td>
</tr>
<tr>
<td></td>
<td>• Process of obtaining informed consent and capacity assessments with consideration for how often these should be repeated</td>
</tr>
<tr>
<td>Method</td>
<td>• Selection of baseline assessment</td>
</tr>
<tr>
<td></td>
<td>• Training required to use the device</td>
</tr>
<tr>
<td></td>
<td>• Data collection and analysis methods</td>
</tr>
</tbody>
</table>

Considerations

As in all prior stages of the project, people living with dementia including their relatives or carers should be consulted when designing the evaluation to ensure that the participant experience is as appropriate as possible [4]. It should not be assumed that a diagnosis of dementia prevents active involvement in consultation [6], and an appropriate forum should be provided in order to enable full participation of everybody involved [7]. The
recruitment process should be designed to take into account the varying abilities of the target population and does not exclude people through the use of unnecessarily complex materials or methods. Consideration should be given for physical and sensory impairment [8], dementia type, cognitive functioning, any comorbidities and/or concurrent interventions [9]. General communication principles and approaches for working with people with varying levels of cognitive impairment should be adopted by front line research team members, for which prior training might be required [10].

The process of obtaining informed consent and evidencing capacity should be described when conducting research with people with dementia and their relatives or carers [5], and if working with the same participants on multiple occasions, it might be necessary to repeat these assessments. It is possible that the involvement of people living with dementia in assistive technology research could cause relatives and carers increased stress [5], and preparation should be arranged to minimise this risk. Indeed a priori, in general forecasting possible potential adverse consequences and devising ways to mitigate and/or minimise their impact on participants is sensible.

Effective evaluation of an assistive device requires ‘regular use’ of the device to be established [11]. This will vary depending on the device, but where long-term evaluation is required there may be practical issues to consider given the progressive nature of dementia [12]. The outcome measures selected will need to be appropriate for use with people living with dementia, and alternatives should be sought where possible if a chosen measure reduces the potential for participants to provide data due to impaired cognition.

Due to the intentionally generic approach in constructing these guidelines, references to dementia and the technological devices are deliberately vague so as not to exclude a particular sub-population of people living with dementia or use of a specific device.

The authors propose that an evidenced based approach be evolved through international collaboration and be published as a guideline. Its value, particularly for those inexperienced, is to helping researchers to have a well founded evaluation.

Acknowledgment

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References


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Phil Joddrell is a PhD student at the Centre for Assistive Technology and Connected Healthcare in SchHARR at The University of Sheffield. His research interests are focused on improving the quality of life for people living with dementia using digital technologies, with a recent focus on the use of touchscreen devices in dementia care.
Home Automation and Self-Sufficiency

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Introduction

Recently the research and development of home automation and ambient assisted living systems have offered many technological solutions. At the same time there are running discussions about ethical and legal issues connected with application of these technologies. However, the question of self-sufficiency and the right moment of introduction of the technology in home environment has not yet been satisfactorily investigated. There can be two extreme views. The first one is too technocratic: make the house/flat as smart as possible, introduce automation everywhere. The second one we can call minimalistic: introduce technology only in cases when the human function or ability needs obvious support or replacement. Recently several applications have been developed that help to assess self-sufficiency of a person and recommend type of aid that can support the person’s activities. In the paper we discuss basic features of self-sufficiency, aims of activation, and approaches to home automation in relation to self-sufficiency.

Home Automation and User Acceptance

Certain level of home automation has been introduced in almost all newly constructed houses. It can ease control of many devices. However, it can also represent a burden if the user interface is not intuitive enough and if even a minor system problem requires professional action. Then the user may hesitate to accept such technology even if he/she understands it. We have to consider that the users might be very different, from those willing to have technology everywhere in the home environment to people refusing to use digital technology. In particular, elderly people are not in any sense homogenous population; they have different capacities, biographies, attitudes to the adoption of innovations, and life experiences.

The issue might be the introduction of new technology at a time when it is judged that it is needed into the homes of older people who have never learned any ICT skills. They might not be interested in receiving instructions over the Internet, connecting with professionals for advice or ordering services into the home. What is usually more important for them is personal contact. Loneliness in older age, especially amongst those most confined to their homes for reasons of health and frailty, is becoming a huge
problem. With introduction of these new systems we also have to ask where the border is when we should start supporting the deteriorating cognitive or physical abilities of individuals. It is necessary to distinguish between passive and active support. In particular the systems and tools determined for elderly users should have adaptive and learning features so that they can be adjusted to personal needs and motivate the user to certain activity.

There have been developed many research projects and applications that are primarily focused on technological issues and functionality. However, little attention was paid to user acceptance and active involvement of users in the development and successively regular use. Namely, it is known from health and social care perspectives that people should not be only passive recipients of services but they should be motivated to active interaction. Passive acceptance means that the person is waiting for the service to be done, e.g. bringing ready-made food. Active interaction would mean that the person participates in preparation of the meal. Of course, if he/she has the necessary abilities to perform such activity. The question is how to develop and introduce an acceptable system that could replace a human career and motivate the user to perform certain activity. Definitely these tools and devices should be at least to a certain degree personalized. The level of support will depend on degree of self-sufficiency.

Self-Sufficiency and Activation

Self-sufficiency is defined as the state of not requiring any aid, support, or interaction, for survival; it is therefore a type of personal or collective autonomy. With respect to ageing, we understand self-sufficiency as ability to perform daily activities without anyone’s else assistance, to care for one’s own health, to manage basic household activities.

Psychosocial activation has enormous significance in life of persons with various handicaps or diseases. There exists a wide range of ways how to activate people. In literature, there are described possibilities that can be used by careers – humans. Nevertheless many of them can be transformed in the human – machine interaction. The main goals are to retrain skills (e.g. fine motoric movements after an injury), at seniors training of cognitive functions, memory, or sensory abilities.

Let us focus on aims of activation of both physical and mental abilities that play an important role especially at ageing population. We want to keep or improve existing skills – for example walking after an injury, improve fine motoric in such a way that the person is able to perform standard activities in the household, to cook, etc. At elderly people the key issue will be keeping memory, thinking, attention, thus cognitive functions. Activities fill free time, serve as prevention of hospitalism, boredom, mood
worsening. With time demands the activities prevent unsuitable behavior forms, e.g. superfluous and excessive stay in bed, aimless wandering along corridors (in case of senior homes), prevents displeasure, irritable behavior. Activation has positive influence on emotional state of the person, increases self-confidence, one’s own dignity, satisfies higher needs, need to assert oneself. After gaining or re-gaining certain skills and abilities activation increases the possibility of self-sufficiency and decreases dependence on helping persons. Activation supports regular regime – some activities must be performed in the morning (e.g. food shopping, cooking), in the afternoon the activities can be more for fun (e.g. walking outside, visiting friends). Regularity helps feeling responsibility.

Designed activities must satisfy certain requirements. The chosen activity must correspond to the state of the given individual. For example at persons with physical handicap after an injury there will dominate activities focused on training movements; at seniors with memory disorders there will be activities focused on support of cognitive functions. Of course, walking outside should be included always. The range of offered activities must be varied and individual activities must be interchanged. Activation must be profitable for the person and must be regular. Activation derives from the abilities of the person and goals that are defined. Thus the activity corresponds to the age of the given individual, his/her handicap or disease, current motoric and mental abilities. Various activities and training must be performed in a known environment for the person. Activities and training must not be boring for the person, must not initiate either physical or psychical suffering, or feeling of humiliation. Activities must support mental, physical and sensory abilities.

Home Automation and Activation

From the description of activation methods we can start our consideration how to combine home automation features with interactive control so that users are motivated and addressed by the devices. The home can be equipped with various sensors that follow the inhabitant activities; for example, whether the inhabitant gets up from the bed at approximately the same time or whether he/she stays in bed during the daytime. Then the care centre can be informed and start communication with the inhabitant and check his/her state. The home system can remind the user to take the medicaments, start a cognitive game on TV for training mental abilities, etc. If part of the installation is any wearable technology we have to keep in mind that it must have acceptable design and must not stigmatize the user. It must be unobtrusive and easily controllable.
Conclusion

This paper presents briefly several aspects of home automation, self-sufficiency and activation of elderly and disabled people. We tried to point out the importance of self-sufficiency and activation of elderly people. We mentioned the issue of interaction of home automation systems with the user and possibility to develop motivating solutions that could be adjusted to individual needs. Motivation plays an important role: the extent to which older people actively decide to purchase and use ICT equipment represents a very different set of attitudes from the common situation where others have forced or manipulated them into getting it up to those who like to have new gadgets and technologies.

Acknowledgment

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Innovative Home Automation-Based Usage of Light Bulbs and Modern Lighting Equipment for Natural Assistance to Elderly At Home

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Abstract: Today, places available in retirement homes are less numerous and actions are recommended to enable older people to remain at home. In this context the technologies are available to give these people support and security. However, the proposed solutions are numerous, often specific to a single need and sometimes not compatible with each other. In contrast, light, accessible and affordable for all, is known to have soothing and reassuring benefits. For example, light guide is used in hospitals for patients who sometimes get up at night and therefore need assistance in these movements. This article introduces our concept of connected bulbs that offers security and well-being.

Context of Aging Population

Longer lives and the high cost of nursing homes now lead seniors to remain at home. The habitats are often not suitable for age-related diseases and environmental change denial is common. Today, it is assumed that eight out of ten slightly dependent people choose to stay at home. However only 36% of homes are adapted to the daily life of people with reduced mobility and on average only 12% of houses are equipped with home automation. Development and access to new technologies bring many systems to be designed but are often specific to a single need and sometimes not compatible with each other, leading to difficulties of understanding, handling and acceptance. Moreover, these solutions are often costly for people with little income. In terms of home management, changes are then made in order to provide them with the necessary assistance and security.

Concept

The proposed system is based on the concept of light as a wellness tool. It is an all-in-one system which includes various interconnected devices (lamps, control and sensor terminals). The bulbs can be used in a traditional way (associated with their command switch) or become a signalling or
ambiance device by changing its colour or blinking: bulbs thus become so much more than just light bulbs. The main features provided by the complete system are: alerts (as bright flashes or colour change of the light bulbs) in case of identified hazards, reminders (reminding to take medication or close a water or gas faucet) and light ambiances (depending on the day's activities). The definition of the features and uses of light is made playfully using a simple universal and unique interface.

A smartphone or a touch pad can then provide a simple and affordable application to drive the whole system. This application is in the form of a house map where each terminal device is represented as a colour chart for each connected bulbs installed in the house (Figure 1).

![Figure 1: Example of interface design](image)

The originality of the system is that the ranges of alert functionalities can be augmented by controlling the security and home automation organs that are connected in the smart-home environment. For example, detectors (smoke, gas, presence) and comfort devices can be controlled, interconnected and customized to allow the system to evolve and be usable by all. The sensors are connected together and with the bulbs through a wireless protocol like Zigbee and can define relevant usage scenarios.

Examples of Scenarios
We give here in figure 2 an example of intrusion scenario in a house with equipment previously installed and connected to the system. In the application, a new scenario named “intrusion” is first created. Then, the terminal devices are identified and selected to build the scenario. In our case, it concerns five light bulbs and 2 presence sensors. Once the scenario is created, preferences settings are set. It is then possible to define the behaviour of the bulbs when the intrusion alarm is detected by the presence sensors. A menu then allows adjusting the colour, intensity and blinking frequency with which the bulbs will light up and flash.

![Image of scenario configuration procedure](image)

Figure 2: Example of a scenario configuration procedure

One of the highlights of our system is its interconnection capabilities (Figure 3). For the example, we show here the ZigBee technology protocol which enables through its mesh configuration, to connect the devices one with each other, and thereby to create functional zones within the system.

It is possible to add or remove part of the equipment connected at will, depending on the needs and configuration of the house. This technology offers a complete system scalability, and easier customization.

In the example, the presence sensor is monitored by the system though the scenario profiles in the application to activate a specific light process when an intrusion is detected.
Perspectives

The system has been first though in response to population aging issues and a desire to better adapt housing for people with reduced autonomy. However, it is quite possible to consider it for other target population. Children and their families are subject to similar requirements both in terms of security, ambiance design and well-being. Nursing homes and hospitals have already took steps in this direction such as installing light paths in the patient room and even in the corridors for people who get up and walk during the night.

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Mobile Android Application to Help with Mindfulness Practice

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Introduction

Mindfulness is a secular and scientific psychological technique based on meditation techniques from Eastern traditions. From a psychological point of view, the concept of “mindfulness” can be stated as an awareness that emerges by the way of paying attention intentionally and nonjudgmentally in the present moment phenomena, to the unfolding of the moment-by-moment experience [1]. Several meta-analyses of publications have demonstrated its efficacy in many illnesses and in psychiatry, as well as its utility in healthy people, in order to increase their well-being and quality of life. Finally, it has been proved that its practice changes brain anatomy and physiology and reduces the vegetative system activity [2-4]. So, the interest in mindfulness has extended in several fields like health, teaching and business.

A previous review of the literature concluded that, while a wide selection of mindfulness-based mobile applications (MBMAs) is available in the online market, there is still a lack of scientific evidence to support the use and effectiveness of those apps. Authors found no randomized clinical trials evaluating the impact of these applications on mindfulness training or health indicators. They concluded that the potential for mobile mindfulness applications remains largely unexplored [5].

In order to overcome this lack an application for mobile devices to support users and professionals in the practice of mindfulness has been developed.

The Mobile Application

Following the previous conclusions of the state of the art [5], the interface of the app should be easy to use, according to different guides to design
mobile software. The app should present functionalities for naive meditators and long-term meditators or, at least, both profiles (users and professionals). It is necessary to develop apps in languages other than English to make them friendlier to non-English-speaker users. Therefore a smartphone app has been developed by an interdisciplinary team in Spanish and Portuguese languages to help users and professionals during the practice of mindfulness. The Android application is structured in three main sections.

The first section, named ‘What is Mindfulness?’, gives a short definition of the concept, so users can put the app into context.

The second section, ‘My Virtual Coach’, offers a guided plan of training structured into ten sessions and intended to be carried out throughout 8 to 10 weeks (similarly to the usual 8-week Mindfulness-Based Stress Reduction workshops). The application does not allow accessing a session without having consulted the preceding sessions first; however, users can conduct them at the pace they want.

Prior to the first session, a sub-section named ‘Before we begin’ hosts useful information for novice practitioners as tips and advice, frequently asked questions, and multimedia about postures.

Each session consists of explanatory texts and videos addressing the most common mindfulness formal practices (i.e. body-scan) or giving convenient recommendations for bringing informal practices to daily life.

The third main section, ‘My Practices’, leads to a set of tools that can be used at any time and help the user in the purpose of keeping a regular practice:

‘Non-guided practice’ tool is just a configurable timer in steps of 5 minutes, which triggers the sound of a bell indicating the end of the practice.

Through ‘Guided practice’ users can watch again the explanatory videos of the different formal practices contained in the app, so they can follow the oral instructions of each practice.

‘My diary’ is a personal space which gives the possibility of keeping a record of aspects like depth of concentration, discomfort, satisfaction, etc. after performing practices.

‘My mindfulness test’ lets users fill in and get the result of the Mindful Attention Awareness Scale (MAAS) questionnaire, which has the longest empirical track record as a valid measure of trait of mindfulness.

‘My statistics’ keeps track of the number and duration of performed non-guided practices, and compares the results of the first MAAS test the user filled in and the last one, hence they may be aware of their progress.
‘My virtual groups’ has links to Facebook pages and Twitter profiles of mindfulness-related groups, helping the user stay in touch with mindfulness instructors or other practitioners.

Eventually, ‘My alarms and reminders’ lets the user set a periodic Android notification (with optional bell sound or vibration) which shows text quotations or everyday tips for the user to spend a few seconds thinking about the present moment. The active time slot and repetition interval are configurable.

Figure 1: Several screen shots of the mobile app

Preliminary Results and Future Lines of Work

The app has been tested during seven months in controlled groups of naive practitioners. A specific test based about quality, usability and user satisfaction has been developed as a tool to evaluate the app. Preliminary results is promising.

As future lines of work the utility for professionals, the impact in a long-term practice and the usefulness for helping people in rural area, where usually there are no groups or networks to practice, will be evaluated.

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Principles to Underpin the Use of Cameras and Other Surveillance Technologies in Care Homes

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Abstract: This paper considers the use of surveillance technologies in care homes and the way in which they can help to identify abuse and protect residents. An ethical way forward is signalled for the use of such technologies and for the way that the gathering of visual or audio information can be legitimised.

An important intention of the paper is to de-fuse any heightened rhetoric associated with cameras and related concerns about personal privacy. A number of principles are put forward by which, with appropriate controls, it becomes more readily possible to consider the use of surveillance technologies and to achieve an appropriate balance between privacy and people’s safety and autonomy. Part of the key to this is in the way that information is gathered and stored and the way that related procedures are agreed around access to the same. The principles to underpin the use of cameras and other surveillance technologies in care homes and the context within which they have been developed is further discussed elsewhere [1].

Introduction

On 9th September 2010 the European Parliament agreed a resolution that called, amongst other things, for a ‘Green Paper to be produced by the Commission on elder abuse and safeguarding older people in the community and in all care settings’. The position is one in which awareness of the problem of elder abuse is increasing but there is, as yet, no fully agreed definition; are only limited data regarding its prevalence; and there are concerns regarding its under-reporting [2].

The phenomenon of elder abuse and the challenges it poses is discussed elsewhere [3-4]. In such work, however, there is little or no consideration of the way in which surveillance technologies could play a part in both identifying and helping to prevent such abuse. And yet, different kinds of assistive technologies such as telecare and telehealth are increasingly commonplace in care homes and have a role that is recognised as including surveillance (albeit sometimes termed as ‘monitoring’). More recent technological developments mean, furthermore, that there are increasing
opportunities for these (whether by use of cameras, audio-recording or movement monitoring technologies) to be used in care homes as both a deterrent and an ‘independent witness’ to any abuse. For the kinds of technologies concerned, justification for their use may, it is considered, be growing stronger. This is, in large part, because of increasing awareness of the occurrence of abuse in care homes – some of which is borne witness to through the use by family members of miniaturised cameras. A number of exposés, by such means, have been recently publicised - the consequences of which include, in England, the issuing of specific guidance on the use of cameras to care home providers and to the family members of care home residents [5-6].

The Ethics of Surveillance

Surveillance, whether or not is described as such, can be regarded as a crucial part of care. That surveillance can be for good or ill depending on the way in which information gathered is used. And following from this, in view of the vulnerability of care home residents, a higher level of surveillance can be justified.

There is, however, a crucial ethical issue that relates to people’s privacy. This recognises that much of the abuse that takes place is hidden and may relate to very personal activities or relationships. For care homes the question arises, therefore, as to whether surveillance technologies could or should be used at some or any level in people’s private rooms, bedrooms or bathrooms. Linked with this is the nature of the technologies that are used and the way in which information derived from them is handled.

For the purposes of this overview our attention focuses on the potential of cameras for surveillance. But the usage of audio recording and activity/movement monitoring must also be recognised – with similar issues pertaining and the potential for lesser invasion of people’s privacy.

With regard to key ethical requirements the balance that needs to be struck is between on the one hand respecting people’s privacy and autonomy; and, on the other hand, affording their protection. The matter of consent provides an ‘overlay’ by which any approach can be considered.

With this in mind, a prelude to the setting out of principles is to note that, in considering the potential use of cameras (i) there is no necessity, barring exceptional circumstances, for any person to view images or to listen to linked audio recordings that may be gathered; and (ii) that some degree of privacy may now be afforded through ability of the technologies to pixellate or blur images or to render people as skeletal or silhouettes [7]. The issue becomes, therefore, one that should arguably be less concerned with cameras per se and more concerned with how information derived from
them is treated. Linked with this is what has been noted above as the overlying matter of consent.

Seven Principles

Seven principles by which the use of surveillance technologies in care homes can be positively considered are set out below. It should be noted that they relate only to overt surveillance - with covert surveillance arguably only appropriate when required by a regulatory or legal body. Adoption of the principles will enable the use of surveillance in different or all parts of care homes. Further work on this set of principles is, however, necessary to consider the detail of any protocols and to ensure that legal and rights issues are satisfied.

Principle 1: Any reasonable level of surveillance (including cameras) is appropriate for common or public areas in care homes.

Clarity and openness on this matter is necessary in promotional literature, contracts, care plans, etc.

Principle 2: Care homes should be able to provide or should be willing to permit or facilitate, the use of surveillance technologies (including cameras) within a resident’s room or other private areas.

Consent (sometimes involving family members or others where the resident has limited capacity) is required. Very careful consideration requires to be given to the way in which images, audio or video-footage are treated.

Principle 3: The location of surveillance technologies should be carefully considered. They should be visible or otherwise clearly known to be present.

Some concessions could be made to decor but the principle still applies. Levels or types of lighting should be such that the technologies are able to fulfil their primary purpose.

Principle 4: Staff should be fully aware of their responsibilities in relation to surveillance technologies.

This helps to ensure that effective use of surveillance technologies is not compromised. Staff should also be made aware that their conduct is able to be monitored through such technologies but that this may also provide a record of good care practice.

Principle 5: Access to data, images, audio or video footage should be restricted only to authorised persons or agencies in particular, defined circumstances.

The need for clear safeguards around this (including audit trails regarding when any access took place, by whom and at what level of ‘visibility’) are obvious. Special provision might be made for
access on routine matters where falls or thefts may have occurred. And there may be scope for authorised agencies to be the custodians of such information.

Principle 6: Ownership of data, images, audio or video footage.
Data, images, audio or video footage should be treated as if owned by the resident but held and used for his/her benefit (though not able to be accessed or acquired by the resident or appropriate others – except in specific circumstances).

Principle 7: Minimising intrusion
Requiring that special consent (via a regulatory agency) is necessary for using any surveillance technologies that have the potential to intrude excessively on an individual’s privacy.

Conclusion

This paper offers principles by which the use of surveillance technologies (notably cameras) can be used, with ethical justification, in care homes. The benefits in terms of identifying abuse or protecting residents from it have been signalled.

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Malcolm Fisk is Senior Research fellow at Coventry University and led the European Commission funded TeleSCoPE project that developed the European (now International) Code of Practice for Telehealth Services that is being taken forward by the Telehealth Quality Group. He is a member of ANEC: The European Consumer Voice on Standardisation; the BSI (British Standards Institution) Consumer Panel; the Quality Services Advisory Committee of the National Institute for Clinical Excellence (UK) and an Advisor to the Welsh Government in respect of tackling poverty among older people.
Promoting Innovation and Efficiency of Solutions for the Elderly through Intergenerational Workshops and Experimentation

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Abstract: Today, on the one hand modern technologies are available for all but the elderly and isolated people often do not know about it, and on the other hand that the designers of the solutions have not bothered to assess the real needs of these people. Beside that, students who work on these issues are not integrated into the market and in direct relations with elderly. We have chosen to fill these gaps by putting in relationships these different generations and these different actors to create a group of intergenerational collaboration, called Inter'Actions, defining the real needs of users and that endures in time.

Context of Technologies for Elderly

The department of Creuse today prefigures how large areas of Europe will stand within the next 20 years in terms of elderly population ratio. Its rural population is at now one of the oldest in Europe with a low density.

Today, we are in a unique position because our time invites to technological solutions that push the boundaries of the possible, in particular for people with disabilities and loss of autonomy.

Seniors who are no longer in business represent a significant population of potential users of home automation. Today's home automation allows arranging the house for comfort, safety and ecological, economic and sustainable housing. With connected technologies, recent years have seen the introduction of online services making the smart home to serve its occupants. This is of course relevant for elderly, disabled or frail people.

Yet, while modern technologies are available to all, elderly to whom are intended most solutions, do not often know neither the existence nor the features and even less the benefits they could draw to regain and maintain their independence at home. Often, solutions designers have not bothered to evaluate, to end users, the real needs and the "transaction" is unilateral as ineffective.

Recognizing this potential for economic development and underlying societal benefits, this rural area has long been very innovative in terms of
habitat technology deployment in the homes of elderly and jointly, in terms of academic degrees on technologies for people with loss of autonomy through the university partnership. But again, there are no real relations between students, manufacturers / installers and end-users.

Concept of Intergenerational Process

Our concept based on intergenerational workshops aims to build detection, testing, validation and implementation solutions scheme through a new citizen council recognized as public utility.

Through academic degrees, many students are working in the home automation industry - autonomy within the framework of the silver economy. At the same time, solutions manufacturers offer many products and equipment. However, learners and solutions providers on the market do not clearly know the needs and feelings of end-users who are simply not put into the loop of thinking and validation of offered products.

Thus, the action is based on the establishment of a permanent working group who will cogitate innovatively on the needs, practices, solutions and their implementation. The group who wants to be an ethical instance (a recognized Approval Committee) consists of learners in the "silver economy" sector and potential elderly users of the results of cogitations. Through this participatory and citizen work, the aim is to attract manufacturers and installers craftsmen so that they are more familiar with the levers of market technologies of today and can propose projects with a collaborative thinking approach.

"Brainstorm" Workshops

The basic operation of the process is based on information and brainstorming meetings in the presence of the actors. The primary objective is to better understand the needs and usage limits for establishing relevant specifications relatively to the users and that help manufacturers and installers to better communicate the benefits of their solutions.

The conduct of meetings that is meant to be friendly is presented in Figure 1. Three types of meetings can cover all stages of the detection of innovation to the adequacy of solutions with the needs through validation ethics, their testing and validation.
The first level allows setting up the detection process. It is then to present the context of a general theme and to identify more specific directions that may be given to projects that emerge.

At the second level on a specific topic, it is to discuss the related needs, desired uses, limitations, and products and solutions that would be appropriate and accepted by end-users.

The third level will evaluate a particular solution or product available on the market and establish its proper implementation on field for end-users in terms of usage, ethics and efficiency to meet the needs.

First Feedbacks from the Elderly of the Group

In Phase 1 of this process, the first meetings were given the task of thinking about the future functioning of the group that will soon be integrated into future Grand Gueret innovation center. The simple collaborative communication today suggests important future benefits in terms of redefining the solutions and their deployment. Figure 2 shows an example of a workshop held in December 2014.
Figure 2: Example of workshop for actors

Initial feedback has been very positive from our seniors and suggests their interest to actively participate in the process. The added value of each through the role he can play seems to be the key to the success of the process. The model will be fully operational in September 2015.

Acknowledgment

We wish to thank the seniors who participated in the implementation of the operating cogitation model without whom this tool would never have succeeded. We also thank the urban community of Grand Guéret for their assistance and support.

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Semantic Intelligence and Sentiment Analysis

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Introduction

In nowadays the domain of health data is composed by different dimensions with an emphasis in Electronic Health Records and also in Genomic, Public Health and Social Data among others. The enormous quantity of data provided from different sensors and communication languages forms what we call the Big Data of Health and Wellness. However, the unstructured data does not necessary conducts to information. The usage of Smart Technologies to promote information and knowledge is a very important issue for independent living and wellbeing.

According with [1], intelligent data analysis applied to big data, presents the following challenges:

a) Increase of sensor data volume (terabytes to exabytes);

b) Heterogeneity: multiple data formats and standards, mix of structured and unstructured;

c) Need to quickly acquire and process intelligence information;

d) Agility is required to be able to incorporate new data sources;

e) Support to data exploitation: each piece of data represents some part of a situation, intelligence data contain entities that must be understood and correlated.

This paper presents a methodology validated by a case study to extract information from patients’ discharge notes.

Multi-Agent Platforms

The gathering and analysis of data is a complex task that has high processing requirements. The usage of parallel computing and different specialized agents are an important contribution to achieve this complex goal. The concept of Intelligent Agent (IA) is not new. According to [2], An agent is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its design objectives. So the IA can have different behaviors corresponding to their internal models. A type of IAs have the functionality of following rules reacting to stimulus from external sensors or others IAs while other
types can predict states and take actions. It is possible to create a Multi-Agent System (MAS) with different types of IAs communicating and sharing tasks.

There is a normalization organization called The Foundation of Intelligent Physical Agents (FIPA, http://www.fipa.org/) that established a set of standards and specifications to promote the interoperation of heterogeneous agents and the services. One of the best known platforms is Java Agent Development (JADE) platform. Some case studies have been developed and implemented with JADE on many different areas.

A good example of AIs application is the MAS to service restoration planning [3]. The IAs were programmed to develop autonomously collaborative work and sharing information among them to achieve a collective goal.

Other implementations use AIs as contribution to tactical management and knowledge construction above other AIs layers. An example of this application is the MAS for reasoning of Key Performance Indicators (KPI) [4]. The IAs can be used to gather text from physical sensors including voice recognition systems, social networks, mails or other text sources and send the unstructured text to others IAs specialized in semantic intelligence. It is possible to develop a mesh network of IAs with different competences that can analyze the expressions and even detect sentiments or opinions. The IAs com belongs to different domains and can have mobility through the network. They can also share ontologies of concepts and trained neural networks.

Data Normalization and Ontologies

The data normalization is an important issue to the semantic analysis. Examples of this lack of normalization are formats of dates, values, units of measure and acronyms. When the data is text, a special transformation must be done to normalize synonymous, gender and verb tenses.

A special algorithm called stemming was created by Porter [5] and there are versions for many well known languages.

Ontology describes a set of normalized concepts with structured relationships. There are many ontologies to archive knowledge of science domains. The ontologies can be stored in databases and can be written with an XML language called OWL [6]. The major advantage of the ontologies is their flexibility and scalability to accommodate new concepts and rules.

The ontologies can be populated with single terms and multi-terms also called expressions. The reasoning of the populated ontologies produces sentences with knowledge meaning. A set of reasoning chucks of
information can be linked to other ontologies with a higher level that can describe other information like sentiments or opinions.

The biggest challenge is how to develop the ontologies and how to populate them. The definition of the ontologies is made by panels of experts that use normalized data to identify the domain concepts and the association rules. The research is an interactive process based on secondary data and supported by data mining tools. It is desirable that the defined ontologies are sharable with as many actors as possible and a version control system guarantees the necessary alignment.

Data Annotation and Ontologies Population

There are two different approaches to annotate data from unstructured sources of free text in natural language. The first approach uses statistic algorithms to identify the most significant terms and with a correlation analysis establishes the groups of most significance that are called expressions. This type of data analysis is currently called vectorization.

The second approach uses grammar rules to identify the expressions and this method also relate each expression with a special concept. This second algorithm can also cross the expressions with a thesaurus of idiomatic expressions. However the grammar rules must be written by experts and this challenge is an effort overhead.

None of these approaches have sufficient accuracy and precision and a specific method using neural networks and artificial intelligence was created to overcome this barrier.

The semantic intelligence systems have the following three main objectives:

- Identify the concepts expressed in the text;
- Select parts of the text that have a similar sense and can be related opinions or sentiments;
- Extract the relations among expressions.

To identify the concepts expressed in the text, some different approaches can be taken. One possibility is to use statistics analysis to identify the most significant terms and create a relationship with the defined ontologies [7]. Another possibility is to annotate the relevant expressions with an annotation tool. The Sheffield University has developed a semantic system called Gate [8]. The Gate framework uses a grammar language to extract the terms and to relate them with the concepts [9]. A system to analyze patients’ discharge notes was developed using the mentioned methods and technologies.
The above figure shows the first level of concepts selected to the ontology. Doctors argue that the normalized taxonomies are not accurate enough to describe the patients’ history and discharge conditions. So most of the text is written in natural language and the information can be extracted to construct knowledge about healthcare services and be integrated in the workflows.

References

Smart Insole for Measuring Actimetry of Frail People

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Introduction

Prevention of dependence represents a major healthcare issue. Frailty is a syndrome determining a higher vulnerability to stressors. It is responsible for an increased risk of major negative health-related events, including disability [1-2]. Fried et al. [3] criteria are the most commonly used by the medical community to identify frail subjects: slow gait speed, less muscle strength, exhaustion, sedentariness, and involuntary weight loss. In order to encourage sedentary people to practice walking, we propose to develop an economically viable technical device facilitating the follow-up of frail elderly people. In a previous paper [4], we have presented the electronic design of a smart shoe insole to quantify the human movement without constraint of positioning. This device embeds some sensors and a wireless communication. The smart insole allows measuring the gait speed and its variability, the weight variation and daily activity with minimum invasiveness. It performs measurements continuously and automatically during the walking periods, both indoor and outdoor. This wireless insole transmits information to a local database which can be consulted from a secure Internet connection in real time. This paper focuses on the algorithms that evaluate the stride length. It presents several methods for measuring the gait dynamic parameters and gives preliminary results.

Material and Software Device

Application requirements

The smart insole was thought to be intrusiveless for the user and well accepted by him. This device is designed and used in a medical context. It is a disability prevention tool intended for:

- The subject itself: The tool must be able to inform the subject and to motivate him to maintain physical activity, and to collect medical data via online questionnaires, etc.;
• The hospital geriatric physician: he sets the goals of the subject, interprets results and follows its evolution (e.g. decrease of activity);
• Relatives: They can act as relays to help the subject to maintain activity.

The system's service life may vary according to the purpose intended. The use of the tool can be limited to a few months in the case of short time accompaniments of a frail subject to become a robust subject. For other purposes, monitoring can be done over several years until the entry into institution and beyond in some cases. The system has to be operational at least 3 months. Fig 1. shows the global architecture of the system.

*Hardware integration*

The technological solution is an integrated system in a shoe insole (one system per pair). He must be able to make accurate and reproducible measurements of required physiological parameters. The components of the system were selected both on the basis of medical, technological integration and functional specifications:

- A 3-axis accelerometer sensor for dynamic analysis of the process, the measurement of the distance and walking speed;
- A force/pressure sensor for the measurement of the variation in weight;
- A microcontroller for the data pre-processing with the calculation of the average of the physiological parameters by running period in a day;
- Electronic preprocessed data storage (flash memory) associated with a real-time clock for time stamping of the registration periods;

![Figure 1: Global architecture of the system](image1)

![Figure 2: Description of the instrumented insole](image2)
A low-power radio modem, based on Zigbee technology, to transmit the preprocessed data and time-stamped to a central collection device.

An autonomous power supply system based on a 3V battery.

Fig. 2 shows the description of the different functions implemented in the device. The dimensions are 3.2cm*2.2cm*3.5mm and a total weight of 5 g (including the battery).

Software integration

To detect steps, we have implemented the method proposed by Jiménez et al. [5]. In this publication, the error on the number of detected stride is 0.1% for normal operation. The accelerometer acquisition rate was set at 100 Hz. All calculations are made onboard. The algorithm for detecting the stride is composed of the following steps:

1. Compute the magnitude of the acceleration, \( a_i \), for every sample \( i \):
   \[
   a_i = \sqrt{a_{xi}^2 + a_{yi}^2 + a_{zi}^2}
   \]
   where \( x_i, y_i, z_i \), are samples acceleration (g) of x, y, z axis.

2. Compute the local mean acceleration value, computed by this expression:
   \[
   \overline{a_j} = \frac{1}{2w+1} \sum_{q=i-w}^{i+w} a_q
   \]
   where \( w \) defines the size of an averaging window (\( w=15 \) samples).

3. Compute the local acceleration variance, to highlight the foot activity and to remove gravity:
   \[
   \sigma_{ai}^2 = \frac{1}{2w+1} \sum_{j=i-w}^{i+w} (a_j - \overline{a_j})^2
   \]

4. Stride detection with two thresholds on the local acceleration variance:
   - The first threshold is fixed to 0.2 g in order to detect the rising edge;
   - The second threshold is fixed to 0.1 g in order to detect the falling edge.

5. After stride detection, we use it to compute the local cadence expressed in steps per second (one stride is equivalent to two steps) with a sliding windows on the last three strides (six steps):
   \[
   C = \frac{6}{t_j - t_{j-3}}
   \]
   where \( C \) denotes cadence and the expression "\( t_j - t_{j-3} \)" denotes the elapsed time at which the last three strides are detected.

Fig. 3 illustrates the steps of the stride detection.
We have implemented the method described in [6]. The length of the stride $step_n$ is determined by the equation:

$$step_n = \alpha C_n + \beta RMS_n + \gamma Mean_n$$

(5)

where:
- $\alpha$, $\beta$, $\gamma$ are coefficients to be determined by calibration;
- $C_n$ is walking stride rate n determined by equation (4);
- $RMS_n = \sqrt{(v_n)}$ is the square root of the variance of the acceleration of the stride n detected at time k calculated using equation (3) with N samples;
- $Mean_n = \frac{a_{k-N,k}}{N + 1}$ is the average acceleration of the stride n detected at time k and computed with N samples.

Results

**Performance test of the gait speed measurement**

Three volunteers have conducted tests during three step instructions (slow, medium and fast). Instrumented sole was calibrated for each volunteer to fit stride gait speed. The distance error obtained on 400 meters for each volunteer is shown in Tab. 1.

<table>
<thead>
<tr>
<th>Volunteer 1</th>
<th>Volunteer 2</th>
<th>Volunteer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Slow speed</strong></td>
<td>3.9 %</td>
<td>4.2 %</td>
</tr>
<tr>
<td><strong>Medium speed</strong></td>
<td>2.6 %</td>
<td>2.5 %</td>
</tr>
<tr>
<td><strong>Fast speed</strong></td>
<td>3.2 %</td>
<td>3.2 %</td>
</tr>
</tbody>
</table>

Furthermore, the insole has been worn for three months by the volunteers, and the actual energy autonomy is 67 days for a battery change during the 3 months follow-up.

**Performance test of weight measurement**
The objective of this characterization step is to verify that the system is able to see a change in weight of 1 kg. The tests were performed on treadmill, at 3 walking speeds, with a loaded backpack from 0 to 10 kg using calibrated weight of 1 kg. For these tests, the device delivers the output voltage of the weighing system to 100 Hz. A Matlab program was used to analyze the raw data. The results are presented in Fig. 4.

We can consider that the speed affects the pressures measured at the heel. Given these results, it seems possible to observe variations up to 1 kg by placing the sensor in the heel under conditions set by averaging the maximum of 10 successive steps.

User-interface design
Fig. 5 shows a period of activity recorded for one of our volunteers during a time of presence in the office. For this, several treatments have been applied to the data set to calculate the daily rate indicators and reliably walking pace. These treatments are:

- Calculation of average daily from all readings during the day, beyond 15 steps and beyond 25 steps;
- Calculation of daily averages from the three longest walk of the day.

Following these treatments, it appears that the inclusion of the three longest periods of operation, during each day allows obtaining reliable indicators of the daily rate and stable rhythm.

Conclusion
We have shown that the shoe insole designed and tested was a good monitoring tool to follow some indicators
related to frailty of old people. Now the work is focused on updating the device with a Bluetooth low energy communication and a battery with an induction charging. The solution of the assessment tests are underway in natural environments at home with frail and robust subjects.

Acknowledgment

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References


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Eric Campo is a Professor at the Toulouse University. He conducts research in LAAS-CNRS on wireless multisensory systems mainly for smart home and human health monitoring applications. He is responsible for the smart home platform at the Blagnac institute.

Damien Brulin is an Associate Professor at LAAS-CNRS and technology institute of Blagnac. He obtained his PhD degree in 2010 in automatic and data treatment and he is currently working on smart integrated system for people monitoring.

Antoine Piau (MD) is practitioner in a geriatric Acute Care Ward from the Gérontopôle at the Toulouse University Hospital. His research field is clinical evaluation of technological support for aging, technologies for disability prevention and frailty management.
Abstract: Objective: To give an overview of telemedicine projects in the last decade in a rural German federal state with low population density and discuss the current state of translation into regular services in the health care system. Background: Mecklenburg-Vorpommern is a federal state in the North-East of Germany. Most parts of the state are categorized as rural area. With a mean population density of 69 inhabitants per sq km it is the state with the lowest population density in Germany. With an area of 23,193 square km it roughly spans 80% of the size of Belgium but has only 1/8 in respect to the population. With a mean age of 45 years and 22,1 % of the population older than 65 (in 2014) this state has the oldest population in Germany. Telemedicine holds a great potential to overcome this structural challenge in providing expert knowledge independent of time and location and securing health care delivery for the population in the rural area. The objective of this paper is to give an overview of telemedicine projects developed in this region and discuss the current state of implementation in day to day health care delivery. Methods: Projects have been compiled by searching the internet, the German Telemedicine Portal, the eHealth@home map of the Institute for Work and Technology in Gelsenkirchen (IAT) and by personal contacts of the author.

Results: More than 20 unique projects have been identified ranging from a small study involving telemedical methodologies to several EU-Projects one of them led by a partner in Mecklenburg-Vorpommern. One project, a teleradiology network, managed to run on an economic basis after the funding period. The majority of projects have not been translated into a regular service in the health care delivery system.

Conclusion: Despite successful implementation of various telemedicine projects and the associated knowledge growth about telemedicine in the region, only few projects survived the end of the funding period and serve in health care delivery on a regular basis. The main reasons seem to be a lack of financing models, resistance or missing awareness on the side of important stakeholders and the lack of reimbursement models from the federal level.
Introduction

Telemedicine holds a great potential for healthcare delivery in the rural area and underserved regions. This has been proved by several hundred projects around the globe. However, even in countries with a long history and a comparative high adoption rate of telemedical services, like e.g. Norway, there is still room for improvement. Zanaboni et al. concluded in their study about the adoption of routine telemedicine in Norway: “Routine telemedicine in Norway has been widely adopted, probably for geographical reasons, as in other settings. However, the level of use of telemedicine in Norway is rather low, and it has significant potential for further development as an alternative to face-to-face outpatient visits” [1]. Moffatt and Eley identified the following barriers to the up-take of telemedicine in Australia: funding; time; infrastructure; equipment; skills; and preference for the traditional approach [2]. These are just two examples showing that there are considerable challenges in translating pilot projects into routine healthcare delivery.

In Mecklenburg-Vorpommern, a rural state in the North-Eastern part of Germany, telemedicine has been identified as an important measure to overcome the structural challenges of a rural and sparsely populated area. A second challenge in this state is the lack of general practitioners and specialists in remote areas. Telemedicine has been included as a priority area in the “Masterplan for health economy 2020” [3] and has been developed for more than a decade in a number of model projects supported by the regional government, the federal government and the EU. Table I gives an overview of the projects and studies that have been carried out in Mecklenburg-Vorpommern in the last decade.

The objective of this contribution is to give an overview of the different models and solutions developed in the region and discuss the state of adoption in routine health care delivery.

Methods

The projects listed in this paper have been compiled by searching the Internet, the German Telemedicine Portal [4], the eHealth@home map of telemedicine and eHealth projects of the Institute for Work and Technology in Gelsenkirchen (IAT) [5] and by personal contacts of the author. The study is limited by the fact that only publicly available and published projects and studies are included.
<table>
<thead>
<tr>
<th>#</th>
<th>Project title</th>
<th>Link</th>
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<td>Fall Detection</td>
</tr>
</tbody>
</table>
Results

Using the method described above 24 unique projects or use-cases have been identified. In some cases it is not easy to clearly distinguish the borders of a project, i.e. some projects have developed sub-projects or different use-cases. There might also be cases, especially studies in the academic context where telemedicine is used which are hard to identify. There is also an overlap with projects using assistive technology in the domain of Ambient Assisted Living.

This paragraph gives a small overview of the different projects. Due to space limitations only some projects can be mentioned as representatives of a special use-case. More information can be found in the German Telemedicine Portal and the IAT eHealth map as well as on the respective homepages of the projects or published articles. The numbers in parenthesis indicate the index in the table.

The Telerad-MV project (1) is one of the few projects that has been translated in a routine service after the end of the funding period. The project was funded by the Ministry of Social Affairs MV and was implemented by the Institute for Medical Informatics of the University of Applied Sciences Stralsund. Services are paid by the participating clinics.

The Teleradiology Network Pomerania is an Interreg: A project between the German federal states Mecklenburg-Vorpommern, Brandenburg and Polish Voivodeship Western Pommerania. There were 4 funding phases between 2001 and 2013. The start of the project was in Radiology. In the course of the project several other domains like teleophthalmology, teleotolaryngology, teleoncology, televideoconferencing and more where added in several subprojects (2-9).

The Institute for Community Medicine (ICM) of the University of Greifswald initiated and developed several Telemedicine projects. The AGnES project (16) gave rise to a new model of care delivery in the German health care system. It implemented a kind of community nurse that works in delegation of a general practitioner for doing home visits. Other projects developed in the ICM covered the domain of telecardiology ans telepsychiatrie (18).

LiveCity (19) is an FP7 EU Project. The project partners in Greifswald and Dublin test a high-definition real-time video connection between an emergency car and the clinic. The video equipment is tested in the simulation laboratories of the Faculty of Medicine of the University of Greifswald.
Discussion

When analyzing the projects it is evident that most of the projects where developed in an academic context. 15 projects were initiated in the University of Greifswald, 2 projects in the University of Rostock and 1 project has been developed at the University of Applied Sciences Stralsund. The remaining projects have been developed by other stakeholders like research institutes or SMEs. As can be seen from the above study, there is a broad spectrum of use cases, expert knowledge and proved models of telemedical services available in the region under investigation. However, there is a very low translation rate from project status into routine application in health care delivery. An exception is the Telerad-MV project which has been transformed into a regular service paid by the participating clinics. The reasons for this are manifold and some of these barriers cannot be solved on a regional level. One of the main barriers is the missing reimbursement models from the federal level. Furthermore, there is a knowledge gap between the “telemedical experts” which are mainly working in an academic setting, and the healthcare professionals working in the field. Finally, there is a lack of business models that integrate all actors in a telemedical ecosystem where all stakeholders gain.

References


Thomas Karopka, project manager of BioCon Valley GmbH, has a background in biomedical informatics. He is a member of ISfTeH and co-chair of the Collaborative Care Team in Open Source (CCTOS) WG of ISfTeH. He is also chair of the International Medical Informatics Open Source WG (IMIA OS WG) as well as chair of the Libre/Free Open Source Software Working Group of the European Federation for Medical Informatics (EFMI LIF OSS WG).
The Innovation Centre of Grand Guéret: A Community Tool to Boost the Sharing of Ideas and Pioneering Ventures

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Abstract: The French department of Creuse is European champion of aging population. Young people do not stay because they do not have conditions allowing them to hope for an interesting future. While the land is the source of yet innovative actions in the area of Silver Economy, including in terms of university courses, companies close and the territory does not ensure the implementation of new structures. The idea is then to unite the forces through a structure for the detection and the emergence of innovative ideas and projects. The structure adopts collaborative tools that will help ensure the participation of all potential actors to create the jobs of tomorrow.

Innovation at the Heart of a Rural and Ageing Area

Today, the Creuse department is the reference territory in Europe for aging population. The over 60 want to stay as long as possible at home for financial reasons and well-being, but only 6% of French homes are suitable for home support.

In Creuse, actions take benefit of housing technologies for people with loss of autonomy and innovative academic courses on the silver economy have emerged. However, even with these efforts, there is still a lack of communication between individuals and professionals, and on this commercial market still not well known, local economic stakeholders are neither aware nor mobilized.

Yet, the Grand Gueret, in the heart of Creuse, has built potential powerful tools such as its Domotics Resource Center (DRC), but imperfectly exploited. The university campus, whatever modest, provides degrees on the «autonomy of people» context and welcomes more and more students who are mobilizing around technology and social projects.

However, these students, coming from across the whole French territory, leave with knowledge and ideas once their training is complete.
Innovill’age: The Concept

The basic concept is to bring people together, multiplying the potential actors, whoever they are, in a "third place" environment in which interaction, knowledge sharing and collective cogitation will do come from the new projects to be detected, validated, implemented, evaluated and put into service for the benefit of all and with a gain of all.

The structure is based on a regional center for innovation and technology transfer but strongly out for its very transversal theme that is the "silver economy" not making the structure a specialized co-design site but rather an open space, a kind of citizen ideas factory, where the opening is cultivated by the diversity of stakeholders and project themes.

On site, volunteers are many and just waiting to get benefit from key actions, including the territories, users, manufacturers of home automation, researchers, students, health professionals and the various trainers. All are able to move forward in a co-design process to the benefit of everyone and that will be the essence of a structured steering committee.

Converging Ideas by Bringing People Together

Our structure is developed around the idea of the third place. The third place is a place located in a moment of each day between home and work (or place of activity/business/job), whose goal is to cross people to share ideas and mutually provide knowledge and ideas.

This is a particularly relevant concept for the theme of the silver economy that requires knowledge and varied skills ranging from medicine to technology through the usual experience of each, customs, usages, social, societal and ethical aspects. In fact, the concept itself helps in setting up a breeding ground for the emergence of solutions that directly impact the daily lives of people for their own benefit.

To get the maximum benefit from the concept, we have integrated to our structure several third-place tools to catalyze creative process and guarantee the emergence of ideas.

Tools To Germinate the Creative Potential

A first tool consists of an intergenerational working group. With the aim of being seen as a local associative authority, this group works on the detection, implementation and evaluation of projects and innovative ideas, from producer to consumer by providing advice and recommendations to guide the actuation or not of projects. Work meetings are held in the presence of learners and end-users dealing with mobility, comfort, safety and autonomy of people in general.
A second tool dedicated to experimentation is a FabLab, a place of interaction and co-design, real manufacturing laboratory open to all, making scope players and tools, and enabling to go to the prototyping of projects. In this Fablab will be made available standard tools (3D printer, laser cutter, machine tools), but also virtual simulation tools for pre-prototyping.

The enthusiasm to innovate and create often goes through the use and knowledge of the existing by being able to test solutions. The innovation center integrates a consulting and information platform on technologies and their uses backed by a showroom.

In this technical space, technological solutions from prototypes and commercial partner solutions are put in demonstrations, allowing visitors and actors from the innovation center to handle, assess, and understand them in order to issue an opinion on their uses and new recommendations.

This improves the dissemination of knowledge about the actions related to the silver-economy and promotes the partners of the center and the actions of the latter to put them available for everyone.

An Identified 24/7 One-Stop Shop

With the aim of facilitating access to information for all and offer services dedicated to daily lives of people, the innovation center also offers a “services to people” structure widely extended compared to what exists commonly. The global service is presented as a one-stop shop open 24h / 24 and 7/7 which principle is to assist and guide the public towards information and guaranteed services structures and respond quickly and effectively to their needs. The proposed service areas range from medical, social, through local shops, leisure, relational tools and social networks, troubleshooting, and delivery.

A Fertile Ground for Applied Scientific Research

To make this dynamic even more effective, we have also integrated in the innovation center, human potential resources in the field of scientific research applied to the silver economy. PhD students from the University of Limoges will perform, with the benefit of the partners they cross, their research work in contact with persons to whom the solutions they are thinking are dedicated, but also to the benefit of students on this theme.

This link allows cogitation to develop deeper emerging ideas but also to improve and integrate existing products and concepts, thus putting them to the benefit of all for convergent added value.

The goal here is to make available to all stakeholders and in each third-place human resources and intelligence to integrate in a systematized way reliable collected data and scientific expertise for example through
feasibility and design studies, or technical achievements that could promote significant progress for concrete and feasible projects on field for end-users. The final objective is to establish a living-lab rich of its actors to always increase over the relevance of the proposed solutions and make reference solutions that are transferable and exportable.

**Information and Communication**

The information and exchange remaining at the base of the functioning of the structure, the innovation center will coordinate training (citizen, business and education) as well as seminars, public thematic lectures and regional innovation conferences.

As part of the installation of the “home automation” cluster of Greater Guéret, the proposed structure will represent the backbone of the networking and culture of innovation processes. Thanks to the rand Guéret, the home automation center "Odyssey 2023", the University of Limoges and local and regional partner companies, the network of potential stakeholders who can find in their respective fields and at their scale a real added value is already established and consistent.

The proposed dynamic should quickly benefit to the attractiveness of the area, attracting new actors and investors who want to build on this innovation opportunity, and stabilize in the territory companies that will rise up directly from the innovative university courses.

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Abstract: To face the problems of elderly and disabled people in a rural environment, the district of Guéret (department of Creuse, France) has set up the “Home automation and Health Pole”. A new international master degree has also just started and this has been possible thanks to a collaborative process between universities, local and national industrial partners, health organizations and institutional authorities. The collaboration is operating at financial levels, but, more importantly by involving all the actors in the “life” of the degree close to the students and needs of the market.

A Rural Initiative in the Silver Economy Context

The department of Creuse today prefigures how large areas of Europe will stand within the next 20 years. The rural population of the department of Creuse is one of the oldest in Europe. To take benefit of this demographic reality and to promote economic development through new jobs linked to the aging of the population, Urban Community of Grand Guéret (UCGG) Guéret (now 22 towns for 31 000 inhabitants) decided in 1997 to create the “Home automation and Health Pole”. The aim was to drive a coherent action plan in terms of comfort, safety, autonomy and communication for the elderly and disabled people. In conjunction with this, the University of Limoges proposes since 1998 a BSc dedicated to “Home automation for elderly and disabled people” which objective would be to train "architects" of socio-economic solutions for home support; a largely transverse theme since it encompasses technological skills, sociological, medical, socio-economic and medico-social. ICT, communication techniques and networks technology together with home automation management constitute the backbone of this initiative.

From the start, it had to answer and fit the following objectives:
- Improvement of the living conditions of elderly people, in respect for their socio-economic environment, following ethical rules;
- Help for the development of home automation companies and associated services for health and assistance domains;
- Participation of the university and the education system in specific training and research programs.

A Region Involved in the Silver Economy Context

The Limousin region has, for years, been involved into the Silver economy context. The reasons are many:
- The demographic situation with an increasing part of elderly had to be taken into account for a near future.
- The region is small so that all possible stakeholders and potential are easily identified.
- The regional institutions are strongly involved themselves in the domain through national networks such as Sen@aer, and european networks such as Leader+.
- In the field of habitat technologies and domotics, some indispensable assets can be put into action to help the process such as the Legrand group, a world leader in electrical and digital building infrastructures, having facilities in over 80 countries and marketing its products towards 180 countries.
- Since 1990, Autonom’lab (a living-lab belonging from the Enoll European network [3]) has started in the same domain.
- Through the BSc degree, the actors have shown a need to extend and collaborate with international partners. In this frame, more than 80% of the students make their internship abroad, thus networking with more than 15 partner universities.

A University Rooted to Its Environment with International Partners

For decades, the University of Limoges has close relations with institutional and industrial partners, to ensure the academic degrees it offers are in line with the expectations of the job market and society needs. In the wake of the BSc, that helped to establish the Auton'Hom-e master program, a unique degree in Europe dealing with the needs of the Silver economy.

To complete the project, the University has jointly worked with many local, national and international partners, in particular with the Legrand group based in Limousin.

In 2009, Legrand joined the consortium of regional actors to work on securing access in institutions for persons with Alzheimer's disease. In addition to its active participation in the academic process especially
through its "Innovation team" that pushes the project initiatives and ideas, Legrand organizes each year in partnership with the University and also at the national level a "Campus Legrand" Challenge which objective is to stimulate innovative initiatives in the use of equipment of modern living for people with loss of autonomy.

The company is now like UCGG, a member of the Master Development Board; a partnership that can scale the academic content and methodologies related to professional issues. Both partners are actively involved with a dozen others to logistical and financial operations of the master and both are natural and indispensable allies for the University. Figure 1 shows the French partners involved in the process.

Figure 1: French partners of the Auton’Hom-e international master degree

These partners are local institutions (UCGG, General Council of Creuse department, region council), mutual insurance organizations (Mutualité française limousine, MGEN), manufacturers, equipment vendors, promotors and installers (Legrand, Rexel, Promotelec, chamber of craft trades - CNISAM), private foundations (CéMaVie), energy supplier (EDF), broadband network providers (Axione Limousin – Bouygues Telecom group) and the Health Regional Agency (ARS).

With the support of its partners, the Auton’Hom-e master today provides a double master's degree with the University of Sherbrooke in Quebec within a consortium of 15 universities in 12 countries.

Figure 2 shows the partner universities involved in the academic process or welcoming students for internships.
The BSc and the Auton’hom-e master degree has also joined the “Larrey Federation”, a group driven by the top ranked Mines-Telecom engineering schools. This federation regroups the e-health degrees delivered in France. The University of Limoges has integrated the group in 2014 as an associated partner. The objective is to federate the training offer in France in the fields of e-health and technologies for health to make a convergence between engineers and medical actors.

The Auton’hom-e master degree is also a training tool within the thematic chair “Preventing the breakdown of autonomy of people” in the frame of the partnership foundation of the University of Limoges.

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VoIP Platform: A Solution to Advance Communication Practices in Health Sectors

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Introduction and Research Background

The traditional telephony calls are made over the Public Switched Telephone Network (PSTN). Both PSTN networks and Private Branch eXchange (PBX) systems using the same technology, are expensive, both in the buying of hardware used for switching, and in requesting maintenance and programming for the proprietary hardware [1]. In recent years, however telephony utilizing Internet Protocol (IP) networks has become popular, coming under the general label of VoIP. In addition, the past years have seen an increase in streaming and downloading of multimedia content over the Internet [3]. Nevertheless, limited capacity and transmission properties of the general Internet have restricted both the scope of sound and video quality. According to [2], the domain of video annotation, indexing and retrieval has attracted a large body of research in the past. “There is an undesirable behaviour that elderly patients leave hospital early because of medical expenses yet they still need additional care at their home premises to recover from their illness”. As the number of persons suffering from cognitive disabilities in Europe increases because of the increasing number of elderly people and pathologies associated with aging such as Alzheimer disease or depression, there is a social and economical pressure for staying at home as long as possible [2]. It is believed that treating a patient at home is less expensive than treating them in hospitals [4]. In this context, there is a need for technological tools that will support and help to deploy the integrated care for elderly and chronic patients. The review of research questions gave us an understanding of the research problem as a whole and it also gave us a clear reflection of knowing which VoIP tools should be implemented and integrated in order to achieve the research objectives. Some of the research questions that the researchers looked include. Does the problem of codec’s compression and decompression result from softphone...
clients, and which tools must be implemented to address such? Can the IP camera accept orders from PBX server in a form of audio and videos using Real Time Streaming Protocol (RTSP), if possible are there any delays?

Robot Companion Use Case Scenario: Morning Session

As reflected in Figure 1, is a typically example of elderly patient interacting with robot machine. Jasmine comes from the supermarket and she has been shopping for her breakfast. As she approaches the door, Robby that’s her Companionable robot greets her: “Hello Jasmine, welcome back, shall I keep your keys?” Jasmine is happy to put them into Robby’s box as she can be sure that they are safe and Robby will always remember where they are. For this elderly patient, it has become a bit more difficult for the last couple of years now, as she has been diagnosed with Mild Cognitive Impairment (MCI). That was when her daughter, Melanie, who lives in a nearby city, decided to invest into the Companionable robot, that will help Jasmine to remember medical appointments and date, as well as giving her company and supporting social inclusion using the built-in videoconferencing. After Jasmine has removed her coat, she is going to the kitchen to prepare her breakfast (scrambled eggs, bacon and toast). While having a breakfast, she always reads the morning newspaper but now she cannot find her glasses. She calls Robby (robot companion) “come here to the kitchen”. Robby appears and waits near the entrance of the kitchen. Jasmine asks Robby foe her glasses: “Can you bring me my glasses”. Robby moves towards Jasmine so that she can take out glasses and moves back to the entrance of the kitchen. After few seconds he asks whether Jasmine still needs her. Since Jasmine only wants to read newspaper, Robby retreats to his resting station to recharge its batteries.

During the conference call, Melanie takes control of the robot to drive around the kitchen to see whether everything is alright. Jasmine does not mind this as her daughter has always been very caring about her needs and daily activities. After the video call has finished, Robby reminds Jasmine of the upcoming appointment with her therapist, Dr. Harper, which is about to start in 3 minutes. Jasmine asks Robby to connect to Dr. Harper. Later the same day, Jasmine is watching TV, but gets a bit bored as her favourite
show is not starting until 12 noon. To entertain herself she wants to do some cognitive training and asks Robby to start the programme. The display shows the selection menu from which Jasmine is selecting the game. Just before the game started, Robby is asking Jasmine whether she has taken her medicine. Again due to her condition she has to take medicine regularly but often forgets it and that’s why she appreciates the gentle reminders from Robby Robot Companionable. As usual she goes out for lunch to meet up with some friends. When leaving the house, Robby follows her to the door and ask Jasmine whether she would need her glasses, keys and mobile phone. Jasmine takes them out of Robby’s box and says “Good bye, see you later”. Then Robby retreats to his resting station to await the return of Jasmine.

VoIP Architecture and Communication Services

As reflected in Figure 2, VoIP architecture with SIP clients and SIP servers, whereby a call in a form of video and audio (orders), can be assigned/ dialled and accepted and this will provide a means for choosing delivery channels such as UDP, TCP and RTP mechanisms. According to [4], this VoIP platform is composed of three parts thus: a master server, a smart home and a remote client [6]. A remote client system is a personal machine with VoIP client or a Smartphone and the Internet is the main communication media for this platform. Asterisk PBX from DIGIUM Company was utilised for the first version of the infrastructure and it is a standard configuration for classical communication module hence it supported both voice and video transmissions. The patient network will use private IP addresses and it will be necessary to have a local PBX to manage local communications and to act as a gateway to make or receive a call from public and private domains. When a call is initiated, a SIP request is sent to the PBX then it will transmit it to another SIP client and when this signalling communication is done, a direct one is established using RTP. In addition, Asterisk SIP servers can handle voice (ulaw, alaw, gsm, ilbc, speex, g726, adpcm, lpc10, g723) and video (h261, h263, h263+) and the aim here is to come up with well
balanced setup between compression delay and ‘video quality’. According to \[1\], increasing compression rate indeed increases the delay due to the buffer use and higher processing load per time unit. Again with this infrastructure it is possible to transmit alarms using SIP MESSAGE method.

Research Methods and Tools Used

An experimental scientific research approach with VoIP supporting tools were conducted and applied in order to support elderly patients in daily activities. In addition, the discussions on the proposed Open-Source VoIP solution (SIP servers and SIP clients) were addressed to outline future developments that might be needed. Evaluation and validation of the developed VoIP service was conducted only from the lab environment by following further tests and reviews. In recent years, the advances in information and communication technology (ICT) have enabled the development of systems and applications aimed at supporting rehabilitation therapy and therefore contributing to the enrichment of patient’s life quality \[6\]. According to \[3\], ICT technologies have expanded their applications to manage and plan e-Health services and the quality of health care has significantly improved.

This paper is focused on implementing a VoIP platform for elderly patients and we propose an adoption of UCD (User-Centered Design) methodology for the design and development of VoIP platform in order to support elderly patients in their daily activities.

According to \[7\], a UCD is defined as a design process and evaluation that pays attention to the intended user, focusing on what they will do with the product where they will use it and what features they consider essential. We have utilised the following development tools and resources in pursuing the aims of the research thus Ubuntu (Linux client machine), Debian client machine & Windows XP (for cross compilation), Ekiga documentation

![Figure 3: User-Centered Design Methodology](image-url)
website, Asterisk & Kamailio documentation website, Glade interface
designer and programming languages (C, C++ and HTML). In particular, a
UCD was used by designers to address the needs of the patients and
specialists about questions related to experiences with mental models of
illness such as Alzheimer disease. As reflected in Figure 3, gives an
overview of the UCD methodology and this method is composed of four
phases: analyse, design, implementation and evaluation [7]. The main
challenge of this method is the customization of activities according to the
user’s needs. Besides, this approach can be achieved only when the users
are actively involved during the
design and evaluation of VoIP
platform.

Research Outcomes

The minimal set of modules
needed for various Asterisk and
Kamailio functions was
determined based on the
minimum requirements that
were identified. Using these
requirements makes it possible
to develop tests for the target
functionalities of these two PBX systems (DeStar Asterisks and Kamailio).
As reflected in Figure 4, is the Ekiga SIP Client Account running in
Windows XP and is registered to marmont.esiee.fr registrar sever. The tests
were conducted at ESIEE Paris lab environment and each system was
installed on both in Linux and Windows platform. Since the experiment was
persistent on the functionality of the servers, then the clients used for the
test procedures needed to satisfy certain requirements for instance, the
clients must be able to support
a softphone that can use SIP to
communicate with a SIP server
using both audio and video
codec support

After the installation process
and configuration of DeStar
Asterisk and Kamailio PBX
systems, Figure 5 reflects a SIP
windows setting for client
agent 1 and Kamailio
soult.esiee.fr acting as a SIP

Figure 4: Ekiga SIP Client
Registering in marmont.esiee, for
SIP

Figure 5 Asterisk SIP settings with
agent1& Kamailio SIP Server
Registrar Server and it is possible to issue SIP calls.

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Wearable Devices in Personal Health Monitoring: Positioning Difference between OTT’s and Telecom Operators

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Introduction

Today, wearable devices are progressing to become more suitable for personal health monitoring while, in parallel, cloud computing enables digital healthcare platforms to connect mobile as well as home sensors applications.

Obviously, wearable devices are new entrant in the healthcare market and become gradually a greater threat to traditional suppliers of consumer healthcare such as Omron, Braun, Philips, etc. While established suppliers provide blood pressure monitors, temperature monitors and pedometers, new actors like Apple, Samsung, Google, Sony, Nike, Orange, etc., position themselves as new leading players in the market of IoT (Internet of Things) and wearable objects for personal health such as smartwatches, smartbands, cameras and patches..

The digital transformation observed in the healthcare domain is not an exception since a similar Schumpeterian transformation is also observed in other domains like the home automation, smart cities, transportation, and energy… to such an extent that Gartner [1] forecast that the average family home could contain 500 smart devices by 2022.

In the IoT, according to IDATE [2], 80 billion objects will be connected in the world within 2020. Thus, according to IDC prediction [3], the global IoT market could hit $7 trillion by 2020 and the part of wearable devices market could be around $12 billion.

To analyse the entry of wearable devices in personal health monitoring and its consequences for the user, the service providers and the telecom operators, we used the following methodology: (1) First, to analyse the situation of this evolving personal health market, we build the value chain of the main actors, using a 4-blocks value chain representation. (2) Then, to analyse the business models, we used A. Osterwalder canvas method [4].
In this paper we don’t analyse the services rendered in terms of health but in terms of data management.

**Analysis of the evolving landscape of personal health**

Today, the ecosystem of existing health and wellness devices in mobility and home equipment looks like in the Fig. 1.

Historically, within 2010-2012, wearable devices were the reserved area of start-ups like Withings, Netatmo, Fitbit, etc. Recently, new players entered the market like manufacturers of electronic devices and terminals (Apple, Samsung, Sony…), Internet giants (Google, Microsoft, Amazon…), manufacturers of consumer goods (Philips, Nike, Decathlon…), operators (DT, Orange,…) and also health partners (insurance, etc.).

Therefore, the landscape is today very fragmented and, even if diversity could bring massive choice, we observe a large dispersion in the standards of communication (NFC, Bluetooth, Zigbee, Wi-Fi, TV, Cellular…) and dispersion in the services’ offer.

Moreover, in addition to this interoperability problem, we observe also a lack of privacy and this will become a major concern since a recent HP study [5] revealed that 70% of IoT devices are vulnerable to attack, detecting about 25 security vulnerabilities per device.

![Figure 1: Connected objects and equipment's in mobility and at home](image-url)
Analysis of value chain and business models (BM)

As represented in the value chain of Fig. 2, the major players such as OTT’s (over-the-top) and Telecom operators propose a cloud-based platform to collect, store and analyse sport, wellness and healthcare.

As generally, OTT’s plan to control the core of the value chain by imposing their standards and selected devices to partners and developers such as Apple with its HealthKit using your iPhone as a platform [6], Google with its Google Fit [7] and Samsung with its SAMI [8] cloud platforms.

On their part, Telecom operators propose cloud-based platform as a hub open to their partners, and also alliances of different partners gathering wearable devices providers, insurances, clinics, manufacturers of electronic devices or consumer goods, etc…

Although the positioning of OTT’s and Telecom operators seems to be the same in the value chain, there are some differences in their business models:

- The BM of OTT’s varies from a conventional one shot model or a distribution model (namely sale through partner’s distribution channel) to an associated services model (for example coaching Apps);
- The BM of Telecom operators varies from a traditional M2M cloud platform model offered to partners (in B2B mode) to a B2C model with ‘plug & play’ kits and classic subscription (with a box for home services).
Value proposition for the users

If the difference in the upper business models is not significant for users, they will be more and more concerned by the other differences in interoperability management and in data privacy.

Regarding interoperability, it is an intrinsic job of Telecom operators to cover the whole spectrum of standards of communication (NFC, Bluetooth, Zigbee, Wi-Fi, TV, Cellular…) and could propose well tested selected devices adapted to the equipment of each user, whereas OTT’s will probably continue to impose Apps adapted to their Operating System (OS) and the standards chosen through their partnerships.

The question of interoperability will increase in the near future, when users will notice that they have (i) some mobile wearable devices on one side, (ii) home automation equipment on the other side and (iii) sometimes wireless health equipment at home. Therefore, they will probably ask for some unification and interoperability of all these equipment.

The more significant difference will come from data privacy. OTT’s will probably remain in systematic data monetisation related to their generic advertising BM, whereas privacy policy is generic for Telecom operators and data monetisation will concern aggregated and anonymized data whilst ensuring customer's privacy [9].

The question of data privacy will increase with the overlap between the two areas of mobile wearable devices and traditional healthcare equipment with devices like blood pressure monitors, temperature monitors, diabetes and some remote patient monitoring.

Obviously, if owners of wellness or sport connected devices had little interest in protecting their privacy, it is not the same for patients with chronic conditions and remote monitoring equipment who feel more concerned by protecting their privacy and by a secure hosting of their health data.

Let us bet that the role of health professionals unwilling to prescribe gadgets and the health care systems whose role is to legislate and standardize, will be predominant.

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Telenursing
eHealth Potential in Bringing Health and Social Care Closer to the Community

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In the way of changing Europe’s health systems, eHealth is bringing great potential in supporting professionals, patients, citizens and families to modernise healthcare systems [1]. Europe is facing a rapidly ageing population accompanied by an increase of people living with long-term conditions, non-communicable diseases (NCD), chronic diseases and multimorbidity [2]. This is matched with decreasing resources to manage the delivery of patient-centric care. Cuts have been made in the health and social care sector since 2008 and policy-makers saw this as an opportunity to push for changes [3]. But the question remains: “what is the impact on patient outcomes?”

EFN believes that it is socially and economically unsustainable to maintain the traditional vision of healthcare delivery, focused on a medical and curative approach. Therefore it is necessary to focus on preventive care, helping citizens to have the best chance of remaining free from disease and at the same time improve the caring, making it more personalised driven. Healthcare reform should be about shifting the focus toward delivering person-centred care within sustainable integrated healthcare systems where multidisciplinary teams work in the common endeavor to empower patients in an operational system of continuity of care [4].

As healthcare needs more local and global integration, education, communication and continuity of care are becoming key enablers for success deployment of e-health services. Technology has understood that in order to establish integrated systems and bringing care closer to the citizens and their community, it is necessary to design ‘fit for practice’ continuity of care solutions in ICT. Those solutions must embrace the use of ‘big data’, focusing on deployment and scaling-up concrete actions, next to empowerment of the users, with a specific attention on interdisciplinarity, and skills mix among health professionals.

Data is the resource of the 21st century. The use of big data in the health and social care system needs to have beneficial effects for the fieldworkers. In order to free up time of the nurses, and other health professionals, to focus more on direct patient care, fieldwork contacts, face to face and online, data collection need to be integrated upon the ‘ecosystem’ of health and social care. It can help to fulfil important objectives of continuity of
care when merging the health and social care sectors to guarantee an increased access to health and social care services. The complexity of the health and social care ecosystem, which demands that more data are gathered and retrieved, requires electronic mechanisms that can preserve patient confidentiality while still meeting diverse requirements. This implies the adoption of electronic data governance systems sharing multiple entities simultaneously. The health and social care ecosystem need more and better coordination so frontline and patients benefit directly from it, 24h on 24h, 7 days/week, 365 days a year.

By using ICT solutions that are ‘fit for practice’ and supporting the implementation of re-organizational pathways that have proven to be effective in increasing the accessibility and coordination of health and social services, an optimal coordination and integration within different sectors is possible. Scaling-up practices that are an innovative integration of prevention within the health and social care systems will cater for real needs in a more effective and efficient way to coordinate care. Optimal care coordination will deliver patient outcomes better fitting planned and projected clinical pathways. And when complications emerge, deviation will need to adjust these planned pathways based on massive stores of data to refine pathways, not only diagnoses (DRGs), in order to set the best course for the continuity of care and personalised care. All providers of care need to be able to see the care system from the patients’ and citizens’ perspective if they are to empower patients within an increasingly complex health and social care system.

In this context, eHealth services constitute an effective vehicle for managing empowerment and fostering education and training to boost user’s engagement in clinical pathways and as such strengthening the empowerment of patients and citizens through adequate and remote support from health professionals. Designing strategies where patient empowerment is at the center of health and social care will contribute to provide high quality, safe and effective services. In the process of up-scaling integrated care further, individuals and groups should be able to express their needs, present their concerns, decide jointly strategies for involvement in decision-making and take political, social, and cultural actions to meet their needs [5]. Empowerment goes way beyond self-care. This will transform the process into a collective action empowering patients and citizens in designing and developing health and social services according to their needs.

Building on the concepts of ‘big data’, clinical pathways, empowerment and upscaling coordinated care, inter-professional collaboration becomes an EU imperative for up-scaling integrated care. The best outcomes for
patients are achieved when professionals work and are educated together [6]. Inter-professional collaboration starts at the early years of training where inter-professional education can set the foundations for future collaborative practice [7]. A large European project investigating quality in healthcare reaffirmed this position when they concluded that the key to progress on quality and safety is a shared understanding across professions [8]. In the context of the Patients’ Rights in Cross-border Healthcare Directive 2011/24/EU, providing the rules for facilitating access to safe and high-quality cross-border healthcare and calling on Member states to enhance cooperation between healthcare providers and institutions at all levels, safe, high-quality and efficient care can only be achieved when inter-professional collaboration is a criteria for up-scaling innovation. Inter-professional education is the key to achieve a coordinated and integrated health and social care system.

Finally, a health workforce that is able to undertake its professional duties in a coordinated way will needs to be skilled-up for the deployment of health and social care services. Without the right eSkills, technologies will not be fully integrated into existing healthcare pathways. Therefore, the eSkills of the health and social care professionals need to be enhanced and effectively integrated into their education and training at both undergraduate and postgraduate level as well as through Continuous Professional Development (CPD) [9].

To conclude, as multi-morbidity is the blind spot of health science, and coordination across services is the Achilles’ heel of healthcare, the value added approach of continuity of care should embrace the complexity of the ecosystem of health and social care data and algorithms of pathways. Continuity of care implies health professionals studying and training together with the ultimate aim to empower patients and citizens.

Notes: The European Federation of Nurses Associations (EFN) was established in 1971 and is the independent voice of the profession. The EFN consists of National Nurses Associations from 34 EU Member States, working for the benefit of 6 million nurses throughout the European Union and Europe. The mission of EFN is to strengthen the status and practice of the profession of nursing for the benefit of citizens’ health and the interests of nurses in the EU & Europe.

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Invisibility of nursing in health care has been pointed out in many publications. Standardisation and interoperability are required to improve the effectiveness of care and helping health professionals to avoid errors, ensuring continuation of continuity of care, and better utilizing resources—especially the use of time [1-3]. According to Regulation on the National Interoperability Framework and Operational Programme Digital Poland 2014 – 2020 [4-5], the minimum requirements for public records and exchange of information in electronic form and minimum requirements for information and communication systems nurses could play the crucial role in developing exchange information for the health policy.

Data gathering is crucial for clinical decision making, which is complex and requires knowledge, reliable data and supportive environment [6-7]. In USA from 90’s and Europe from 2005 nurses association started developing strategies which could help nurses’ leaders to understand the vision, and achieve accurate information for care management.

The ability to share nursing data across organizations and electronic health records is a key component of improving care coordination and quality outcomes, and aims to transform health care systems to provide higher quality, safer, more affordable, accessible, and patient-centered care [8].

In Poland some classification have been implemented and disseminated till now, e.g. ICD (International Statistical Classification of Diseases and Related Health Problems) and ICF (International Classification of Functioning, Disability and Health (ICF)). Nurses, from early 90’s are working to establish ICNP in polish law. This is the key to implement EHR in Poland.

ICNP is recommended by the nurses’ organisation, and nurses speak with one voice. In Poland, in 2009 the statement was adopted by Polish Nurses Association (PNA) delegates, in 2011 the Main Council of Nurses and Midwives adopted statement about ICNP implementation, and in 2012 Minister of Health supported activities of PNA [9-12]. ICNP is also
recommended by international organisations like the European Federation of Nurses Associations (EFN).


Technology and information systems are necessary foundations for achieving these goals and provide an opportunity to use „big data” from multiple settings to improve outcomes [14]. The International Classification for Nursing Practice (ICNP®) provides a formal terminology for nursing practice and a framework into which existing vocabularies and classifications can be cross-mapped in order to enable comparison of nursing data.

Nursing leaders at Polish Nurses Association (PNA) chartered a collaborative effort to [15]:

1) Develop a common nursing information model for a nursing sensitive quality indicator;
2) Document the process; and
3) Demonstrate an interoperability plan for data sharing between large integrated health delivery networks in Poland.

Many activities had been done till now e.g.: conferences, information disseminations, workshops and publications. This huge engagement of leaders, prepare nurses to provide the nursing process by using International Classification and IT tools.

In the National Centre for Information Systems in Healthcare (CSIOZ) in 2010 [16] the e-health Council in Nursing was established, responsible for nursing recommendations and ICNP implementation in Poland. Implementation ICNP® into EHR is a key for a clinical decision making in nursing and central part of professional nursing. Nurses could gather patient data, evaluate the date and make judgement that results in the planning and provision of patient care. The recommendation of CSIOZ „Approaches to Classification of medical records in the category Directions computerization eHealth Poland for 2011-2015” recommends use of ICNP into EHR.

In 2012 International Council of Nurses (ICN), Ministry of Health and Polish Nurses Association issued a joint press release „Interoperability of Health Care Data Advanced by the International Classification for Nursing Practice (ICNP)” [11]. The Polish Ministry of Health supports the Polish
Nurses’ Association’s efforts to establish and implement ICNP.

From 2010 ICN-Accredited Centre for ICNP® Research & Development at The Medical University of Łódź (ACR&D) is responsible for cooperation and consultation with hospitals, business partners, schools and independent practices [15]. ACR&D in cooperation with the Department of Nurses and Midwives, conducted an analysis of the implementation of the ICNP to teaching in nursing schools. Every year the Centre regular assesses nurses’ opinion concerning the merits of the implementation of the classification of nursing practice. From 2010 to 2015 in Poland were organised 55 workshops with 1590 participants and 24 conferences with almost 4000 participants, who had received information about current status of ICNP implementation in Poland.

The importance of standardised languages in nursing has been discussed in the literature for nearly 40 years [16-17]. Knowledge work help nurses to make decisions in care of patients [18]. Studies show that standardised nursing diagnoses and interventions in computer systems versus paper care systems affected patient outcomes e.g.: pressure ulcers, perception of pain, nutritional status, bowel functions, mobility, independence in activities of daily living [19].

Huge efforts have been done during last 10 years. But nurses still must to lobby on the political level, to achieve the main goal - fully implementation of Classification into the law and to EHR. In Poland the main obstacles which not support implementation of electronic documentation into nurses’ daily practice and not help with visibility of nursing in the health system are: the big nurses’ shortage, lack of friendly ICT tools, lack of IT skills and low salaries.

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The Importance of Diagnostic Reasoning in Telephone Triage by Registered Nurses

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Background

The telephone has long been used by patients to communicate with the members of their healthcare team. Transition into the information age, changes in societal expectations, limited healthcare resources, and emphasis on patient involvement, has made the telephone the primary access point for the delivery of care for many ambulatory care patients.

This paper will explore the risks of the telephone triage and shortcomings in current practice. Furthermore, the reader will be encouraged to abandon conventional wisdom regarding clinical decision making by RNs practicing in the highly complex and ambiguous telephone triage setting.

The Problem

Telephone triage is performed in virtually every setting in which a patient can access a nurse by telephone [1]. Patients call nurses to seek advice on day to day problem solving when they’re unsure which action to take. These calls range in nature from seeking recommendations about home care to decision making about potentially life-threatening medical conditions. And even in situations in which the patient has a known diagnosis (e.g., a recent known surgical procedure), the problem presented may be an unexpected complication of the surgery or unrelated to the surgery at all.

Due to the extreme difficulty associated with assessing patients who the nurse generally can’t see or touch, this type of nursing may well be the most complex and high risk form of nursing practiced today [1]. Yet, specific training in the practice of telephone triage is sorely lacking. Further, when it does exist, organizational policies and procedures regarding the use of decision support tools often result in overly rigid procedures that do not emphasize the importance of the nurse decision-making process. Both the lack of formal training and the over-reliance on decision support tools limit use of clinical judgment by the telephone triage nurse.

Telephone Triage
Telephone triage is defined as “An interactive process between the nurse and client that occurs over the telephone and involves identifying the nature and urgency of client health care needs and determining the appropriate disposition” [2]. Close examination of that definition raises a question regarding the word ‘nature’. This concept is not in other definitions of nursing, probably because in almost every setting in which nursing care is provided, patients have at least a working diagnosis conferred by a licensed provider, and thus the “nature” of the patient’s problem is generally known.

In true telephone triage, although the patient might have a well-developed problem list, any previous diagnoses might or might not provide insight into the nature of today’s problem. Upon what, then, does the telephone triage nurse base the patient’s plan care, especially as it pertains to referral to the right place at the right time for the right level of care?

Clearly, the nurse must identify the patient’s concern(s), collect meaningful data, and help the patient develop a plan of care that will effectively meet their needs. Patient education is often necessary, as is assistance with problem solving when resources are limited. But how does the nurse determine the patient’s physiological problem? On the basis of what diagnosis does the nurse develop the patient’s plan of care?

To answer this question, the telephone triage nurse must use clinical diagnostic reasoning. Diagnostic reasoning is most needed when knowledge is limited, when something unexpected crops up, and when multiple possible diagnoses or interventions need to be considered [3]. These are precisely the circumstances for many if not most telephone triage calls. The use of diagnostic reasoning involves an analytic process in which alternatives are generated and these alternatives are systematically weighed against clinical data and the feasibility of desired outcomes [3].

To illustrate, imagine a patient calls with a complaint of chest pain. Regardless of previous diagnoses or ancillary studies, the question of a life-threatening cause of that chest pain must be addressed. Specifically, the possibility of a myocardial infarction, pulmonary embolus, or similar life-threatening cause of chest pain must be assessed. Eventually support, collaboration, education, and problem solving might be needed. But before identifying desired outcomes and a plan of care, the nurse must draw conclusions regarding whether the patient might be experiencing a potentially life-threatening event. Therefore, diagnostic reasoning is necessary.

Telephone Triage Settings and Program Design

*Formal Settings with Formal Program Design*
In many formalized programs, telephone triage nurses utilize well developed (often electronic) decision support tools. These tools employ an algorithmic approach which leads the nurse through a set of symptom-based questions designed to assess the probability that the problem is or is not a life-threatening emergency. The nurse then bases the plan of care on the guidance provided by the decision support tool. In order to assure patient safety, these decision support tools often cast a wide net in order to be sure that no life-threatening problems are overlooked. After high acuity problems have been ruled out with a high degree of certainty, the decision support tools often base the recommended disposition on criteria that are less sensitive. In other words, it is not necessary to determine the nature of the patient’s chest pain once the high risk symptoms have been ruled out. In such cases, the disposition will generally lead to home treatment or referral for further (non-emergent) evaluation of the patient’s symptoms.

Clearly, determination of the nature and urgency of the patient’s problem and the associated appropriate disposition can require an extremely complex process. However, as described in many formalized call centers, this process is based primarily on decision support tools which are developed to supplement (and sometimes supplant) the nurse’s decision making. These tools endeavor to mitigate the role of the nurse in decision making regarding the nature of the patient’s problem. In other words, some call center nurses are discouraged from using independent nursing judgment.

**Informal Settings with Little or No Formal Program Design**

Although formal call centers do exist, it is certain that the great majority of telephone triage is occurring in informal settings such as doctors’ offices and clinics, same day surgery centers, and specialty areas such as interventional radiology and labor and delivery. The role of telephone triage in home health and hospice is also significant in that patients are being cared for at home by family or unlicensed care-givers.

The use of formal decision support tools is limited or non-existent in these areas. Often there is role confusion, and telephone triage, which is often the most complex and high risk nursing care delivered in these areas, is performed by un- or under-licensed personnel or RNs without formal training in telephone triage. Unlike in the formal telephone triage setting where high-level clinical judgment is discouraged, in these informal settings, the need for high-order clinical judgment and decision making is often underestimated or overlooked. Instead, messages are often taken by unlicensed personnel and consequently acted upon by under-informed professional nurses. Or when RNs interact directly with patients over the telephone, they often collect insufficient data and commit significant practice errors such as accepting patient self-diagnosis, jumping to a
conclusion, and not erring on the side of caution, basically failing to consider unexpected and potentially high-risk causes of the problem.

The Elephant in the Room OR the Truth We Choose to Ignore

So to sum it up, telephone triage, and the inherent diagnostic reasoning process, is often sub-optimal across settings. In some formal telephone triage settings, the system provided does not encourage nurses to utilize clinical judgment. In many informal settings where patients are routinely triaged over the phone, the nurses fail to recognize the need for clinical judgment, and furthermore, they’re often multitasked and thus distracted from the primary problem at hand (the patient on the phone). Putting it bluntly, call center nurses are often discouraged from thinking and nurses in doctors’ offices don’t realize that they need to be thinking.

The Solution

In general, telephone triage has been shown to be an effective modality for the delivery of high quality, efficient, and safe care that yields a high degree of patient and provider satisfaction [4]. However, bad outcomes and resulting litigation continue to surface, often involving nurses who simply failed to recognize the need for in-depth clinical judgment that involves diagnostic reasoning. While nurses are observed to use diagnostic reasoning in a number of settings [3], this process is not formally taught in basic nursing education. Additionally, regulatory bodies do not acknowledge diagnostic reasoning as being within the scope of practice of basic RNs.

None-the-less, basic nursing education includes exposure to a wide variety of clinical diagnoses and through experience, nurses learn to recognize and participate in the management of a vast array of specific conditions and disease processes. In fact, many of the decision support tools reference differential diagnoses directly or indirectly in order to inform the nurse and enhance the decision making process.

In the absence of even a tentative diagnosis supplied by a provider licensed to diagnose, it becomes obvious that a primary role of the telephone triage nurse is to utilize clinical judgment, often in the form of diagnostic reasoning, in order to establish a meaningful clinical impression upon which to base decision making. However, as emphasized above, there is a conspicuous lack of this type of independent decision making on the part of telephone triage nurses in many venues.

In order to address these frequent deficiencies that jeopardize patient safety, the nursing profession, supported by professional organizations such as the (AAACN) and the International Council of Nurses (ICN), and with the involvement of the appropriate regulatory agencies, must take another
look at the decision making abilities and imperatives for nurses practicing in the highly ambiguous setting of telephone triage. Or to play the devil’s advocate, is telephone triage rightfully within the exclusive domain of advance practice nursing? And if not (that is to say, if it is recognized as being within the scope of practice for basic registered nurses), how do we explain, justify, and support that sophisticated level of practice simultaneously assuring patient safety?

Although telephone triage has not been identified as being at the level of advanced practice, this high-risk, complex practice does indeed require advanced clinical reasoning skills. Comparing, Ruling Out, and Determining (the nature of the problem) have been identified as key elements of the Telephone Nursing Process [5]. It is time that we examine this practice through unshaded lenses, expanding on existing research to further clarify the importance of clinical diagnostic reasoning and nurse decision-making in the highly sophisticated practice of telephone triage, and improving education and training accordingly.

References


Carol Rutenberg, MNSc, RN-BC, C-TNP is a nationally recognized speaker and author in the field of telephone triage and lead-authored the 2102 The Art & Science of Telephone Triage: How to practice nursing over the phone, with M. Elizabeth Greenberg. Carol is President of Telephone Triage Consulting, Inc., and is a consultant specializing in program design and implementation, and risk management. Her practice is committed to promoting Telephone Triage as professional nursing and providing optimum care over the telephone.

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The WATCH Program: Women with Arthritis
Taking Control of their Health

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Introduction

Arthritis is one of the most common long-term chronic health conditions worldwide causing considerable disabilities for individuals and significant costs for health care systems [1]. A cycle of co-morbidities that includes inactivity, chronic pain, and sleep disruption can potentially create significant additional risks for cardiovascular disease, diabetes, mood disorders, impaired cognition and increased oncogenicity [2]. Once an individual becomes inactive, this triggers the cycle and establishes what Pedersen refers to as a “diseasome of inactivity” with inflammation at its core [3]:

INACTIVITY → visceral fat → diabetes → decreased HDL cholesterol → heart disease → VTE → increased oncogenicity → impaired cognition → mood disorders

CHRONIC PAIN → mood disorders → impaired cognition → more inactivity

SLEEP DISRUPTION → enhanced pain perception → hypertension → obesity → diabetes → impaired cognition → mood disorders → fatigue → more inactivity.

In addition to creating a domino effect of increasing risk for additional chronic diseases, these three conditions alone create a “cycle of comorbidities” [2]:

Inactivity → Chronic Pain → Sleep Disruption → Inactivity

Although it’s well known that exercise can improve function in this population and prevent co-morbidities, exercise programs for those affected are limited especially in rural areas. Women in these areas consistently report lower rates of physical activity than their male and urban counterparts [4]. Common reasons women have identified for not exercising include lack of time, concerns about exercising outdoors, weather and not having a family member or friend to exercise with [5]. More recent qualitative research indicates that patterns of exercise for women are much more complex. It incorporates the need for establishing an exercise routine that also provides positive feelings which fuel intrinsic motivating factors to
continue to exercise [6]. This is further enhanced by social support and a feeling of competence over time that appears to overcome potential or actual barriers [6, 7].

A Telehealth Intervention

With an understanding of the issues noted above, and moving beyond brick and mortar, the WATCH program offers Internet-based, live streaming videos that can be viewed in the comfort of one’s home, delivered by a certified gerontology nurse practitioner (GNP). This 30-minute program incorporates stretching, strength, balance and mindfulness. The target population for this intervention was women between the ages of 40 and 65 who had been given a diagnosis of arthritis by their health care provider but were not yet disabled or using any assistive devices.

Over two-thirds of people with arthritis are younger than 65, with a prevalence higher among women than men in every age group [8]. By targeting this specific population, interest can be maintained with topics and content that appeal to women, delivered orally by the nurse practitioner during the daily broadcast. This intervention was meant to be fun and engaging! Exercise routines often are viewed as boring and tedious. The word “exercise” was deliberately avoided to minimize the negative association many women have with this activity. While participants were performing gentle range of motion and stretching, the GNP would provide interesting, current information related to arthritis wellness, interspersed with appropriate humor. This strategy, combined with brief mindfulness activities that were incorporated into the program, was planned to increase the positive feelings experienced by participants and mitigate competing interests that could present as barriers to continued participation. Social engagement was encouraged through a video blog on the program website.

If participants were unable to attend live, they had access to the daily webcast, accessible for a 24-hour period. A HIPPA secure VIDYO platform supplied by Virtual Care Works (VCW) was incorporated into the plan for ease of use and high security features [9].

Methods: Study Design and Data Collection

A traditional Phase 1 clinical research model was employed using mixed methods. Quantitative measures of health outcomes, pre- and post-intervention, included data related to pain, sleep, and quality of life. The primary instrument was the PROMIS 57 Profile v.2.0 [10]. Domains covered include emotional distress (anxiety/depression), fatigue, pain interference and intensity, physical function, sleep disturbances and ability to participate in social roles and activities.
Using Assessment Center, a free online data collection tool, a study specific website was created for capturing participant data securely via the web. It was developed and is managed by a team of outcomes researchers and software development experts at Northwestern University’s Department of Medical Social Sciences [11]. Participants could complete the informed consent form, demographic data and the pre and post questionnaires using this secure website.

This three-month pilot would also provide qualitative data regarding population interest, engagement, and accessibility. Virtual focus groups were planned to capture these data as well as field notes documented throughout the intervention.

Study Terminated - Lessons Learned

Unfortunately, this study had to be terminated early in its’ launch. The first issue involved difficulty in the recruitment of participants. Further investigation into this issue presents some promising solutions. The second issue involved risks for litigation and was a bit more problematic.

Problem 1

Attempts at recruitment using traditional brick and mortar methods did not work. Many women who were interested in participating were concerned about their ability to access and use the Assessment Center as well as the virtual platform. Although they were offered guidance and support, many felt it required too much time and energy to make a commitment for what they perceived as a challenging learning curve.

Potential resolution

Recruitment might have been more successful if a mixed approach was used combining both traditional methods as well as social networking [12]. Women who are already online and have some comfort level using the Internet might find the virtual platform less concerning. Targeted ads, based on gender, age and location, placed on Facebook, where middle-aged women have a significant presence would be a recruitment strategy worth exploring and evaluating. This strategy has been successfully used for survey research [13] but only rarely for intervention studies [14].

Problem 2

Potential legal ramifications related to this intervention were not fully appreciated. In the US, a licensed health care provider can be held responsible for injuries incurred as a result of a specific intervention. The Data and Safety Monitoring Plan (DSMP) required of clinical research in the US and certainly a consideration, even where it is not required, is difficult to implement when participants reside and are participating in
cyberspace. Although the proposed intervention was low risk, the DSMP would address any adverse or unexpected events that might place a participant at risk for injury. The initial plan was to simply advise the participant to consult with their primary care provider. Clauses were included within the informed consent that released the researcher from any liability in case of an adverse event. However, legal counsel connected with the company conducting this research felt that the risk was still too high and given the litigation climate in the US, a decision was made to terminate the study. There is very little in the literature that addresses this particular concern, specifically in regards to clinical interventions conducted in cyberspace.

**Potential resolution**

Collaborating with local health care providers and/or health systems is one possibility to help mitigate the risk in conducting this Internet based intervention. It creates a broader umbrella of resources and protections if an adverse event should occur. Since the company that designed this pilot study is not directly associated with an academic or health care system, even this was especially challenging. It’s is located in the Midwest section of the US where there are very few health care providers who are not employed by a larger health system making it difficult to collaborate with individual providers. Another option is to seek collaborations outside of the US where health care systems might be more open to innovative telehealth solutions.

**Conclusion**

The framework supporting this research is well founded in the literature and a telehealth intervention is a creative and viable option to explore in promoting positive health outcomes for those experiencing arthritis. The problems that emerged prompting the termination of this research are not insurmountable. Moving forward, collaborations will be sought in areas where some of the potential legal risks might be less concerning. Unique and often newly developed laws are being crafted for telehealth ventures within various countries. Institutional review boards in the US are also gradually considering issues related to Internet based research and hopefully will be providing more specific guidance. The issue of recruitment is relatively easy to resolve, although evaluation of social media strategies still need further evaluation. Pushing through these obstacles will pave the way to innovative telehealth interventions that have the potential of significantly improving health outcomes and improving the quality of life for those experiencing arthritis.
References


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Winner of the 2014 ISfTeH Student Videoconference Session
Use of Teleradiology in Distance Education in Brazil, Latin America

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Introduction

Brazil is a country of continental dimensions, with a wide range of health services that meet the population through public and private services. Teleradiology becomes increasingly an extremely important tool for improving the care for our population.

Brazilian Telemedicine University Network (RUTE) is a program supported by the Science, Technology and Innovation Ministry (MCTI). It is executed by the Brazilian National Research and Education Network [Internet2 - Brazil] which provides bandwidth connection (10 Gbps) for university hospitals may connect among themselves and with other national and international research educational centers (Fig. 1).

National Education and Research Network (RNP) currently connects over 400 institutions Education and Research, connecting all Brazilian regional academic networks. RNP operating since 1991, today presenting a 280% increase in aggregate capacity, 15 states connect up to 10 Gbps, 9 up to 3 Gbps, Amazonas since Oct 2012 with 1Gbps, Amapa and Roraima yet less than 1Gbps; 320 institutions connected minimal 1 Gbps, 27.500 research groups connected and 3.5 million users [1-4].

Learning Objectives

Demonstrate a Brazilian experience in the use of teleradiology for distance learning, research and improvement of health care services through Telemedicine University Network (RUTE), through the creation of a Special Interest Groups (SIG) in Radiology.
Methods and Results

Telemedicine University Network RUTE establishment of the organizational and technological infrastructure: national coordination, advisory committee made up of telemedicine experts of the country's best teaching and research institutions and interest groups on specific health areas (SIGs). Until now, Brazilian Teleradiology SIGs include: Pediatric Radiology, Neuroradiology, Thoracic Radiology, Abdominal Radiology and Medical Residency/Specialization in Radiology (Figs 2-6).

Monthly, virtual meetings including discussion on difficult cases for second opinion, classes to update and to refresh and seminars are performed. The access is free with previous invitation through a specific mailing. Every meeting is recorded in order to be reused by the groups.

Figure 1: National Education and Research Network (RNP): Global and regional integration

Figure 2: SIG pediatric radiology
The connection for SIG's among the university hospitals is made through video conference demanding high speeds as well as specific equipment while web conference, connecting the universities with remote municipalities, uses just a computer with internet. To associate the two technologies the Telehealth Center of UERJ (State University of Rio de Janeiro) included an endpoint linked to a work station with a web server that transmits the videoconference's audio and video to remote points. The combination of both technologies was made through the capture of the audio using a sound board, and also of the video using a capture card, after what they are sent to a work station and distributed to the points connected to the web conference. The remote access to the web conference was made through a browser Web, that will demand only a browser and add in whose installation is going to be required at the first access to a virtual room of the web conference. In SIGs, videoconferences linking university hospitals in several Brazilian states (Rio de Janeiro, Sao Paulo, Parana and others), and also private institutions that are residents in Medical Radiology, are held.

Figure 3: SIG neuroradiology: videoconference Brazil-France

Figure 4: SIG thoracic radiology
monthly at no extra costs to the participating institutions. SIGs in Teleradiology are now creating international networks of collaboration and integration for interactive education and facilitating multicenter research.

Conclusions

The Radiological SIGs represents a major advance for improving the comprehensive training of the radiologists and promotes the integration with the Brazilian and international medical entities

References


Figure 5: SIG abdominal radiology

Figure 6: SIG radiology and medical residency/specialization in radiology