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The International eHealth, Telemedicine and Health ICT Forum for Educational, Networking and Business

Editors
Malina Jordanova, Frank Lievens

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Preface

Dear Readers,

Med-e-Tel 2009 brought together participants from over 55 countries, networking among themselves and with representatives of international organizations, companies and project teams.

We are proud to present the Electronic Proceedings of Med-e-Tel 2009 edition.

Papers provided in these Proceedings were compiled for and presented at the Med-e-Tel 2009 (The International eHealth, Telemedicine and Health ICT Forum for Educational, Networking and Business, www.medetel.eu). The event was held at Luxexpo, Luxembourg, Grand Duchy of Luxembourg April 1-3, 2009.

At the very beginning, it is necessary to underline that:

- The sessions are listed in the order of their scheduling in the Preliminary Program on March 3th, 2009;
- Papers within the sessions are arranged in an alphabetical order of their titles. Exception is only session 9 "Citizens Services for Borderless Healthcare in the European Union: Practical Solutions", presented by TEN4Health project. This session begins with an overview paper, followed by abstracts of presentations in alphabetic order;
- Last minute changes in the program, especially re-scheduling of presentations as a result of speakers' requests, are not depicted in the organization of the Proceedings;
- Only papers that were submitted on time and were prepared according to the rules are included in the Proceedings;
- Despite the fact that papers from so many countries are included in the Proceedings, the collection does not represent an overview of eHealth /telemedicine achievements worldwide.

The Proceedings is a collective experience of colleagues from different continents and different cultures. It is an eclectic collection of essays.

The aim of Proceedings publication is to permit those who are planning to introduce eHealth / telemedicine applications in their regions or countries to rely on experiences of others in order to avoid mistakes and to reduce potential problems. We hope that anyone involved in ehealth / telemedicine will find these Proceedings extremely interesting.

With the publication of this Electronic Proceedings as well as with the second book in the series "Global Telemedicine and eHealth Updates: Knowledge Resources", Med-e-Tel strengthens its position as a widely

recognized International Educational, Networking and Business Forum for eHealth, Telemedicine and Health ICT.

We also hope you will enjoy your reading.

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Content

Session 1

Opening Session

A European Commission Policy Initiative on Telemedicine

G. Comyn
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Head of Unit H1: ICT for Health
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Why is the Commission now supporting large scale deployment of telemedicine? Is telemedicine a part of the solution to the main challenges facing our healthcare systems? The answer to these questions will be attempted in the light of the current Commission initiatives such as the Communication on telemedicine, recent results of number of integrated projects and current studies. An action plan to ensure deployment of telemedicine services for the benefits of EU patients will be presented.

Keywords: European Commission, policy, telemedicine, large scale deployment

About the Author

Gérard Comyn is currently Acting Director of the directorate 'ICT addressing societal challenges' and head of the “ICT for Health” Unit. Before joining the “ICT for Health” unit he was head of the IST research strategy unit in DG INFSO, European Commission. Before joining the Commission he used to be Managing Director of ECRC (European Computer Industry Research Centre, 1989-1994), an international industry-led research centre in Munich, owned by Bull, ICL and Siemens; Professor in the University of Lille between 1972 and 1989; Director of the Computing centre at the University of Cumana, Venezuela in 1971 and 1970; researcher at the University of Lille and at the IBM research centre of Neuilly, France, in 1969 and 1970.

Implementing eHealth in Developing Countries: Principles and Strategies

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The potential benefits of eHealth applications in the provision of healthcare services are well known in developing countries; bringing them into fruition, however, is a complex exercise requiring the definition of a national eHealth strategy that brings together different stakeholders. The presentation will overview the process of developing such eHealth strategies, emphasizing key principles that policymakers should follow, so that the selection of activities, technologies and applications for eHealth respond to national and international health priorities in the most efficient manner.

The role of ITU in supporting developing countries defining eHealth strategies will be also presented. Current ITU activities in the area of eHealth will also be presented, specifically on m-health.

About the Author

Mr. Marco Obiso Programme Manager, Strategy and Policy Unit, International Telecommunication Union (ITU), graduated in Computer Science from the University of Rome. He went on to complete further studies at the IBM Networking Laboratories in Rome. Mr. Obiso joined Unisys Corporation as Technology Consultant developing solutions and implementing system integration projects. He subsequently worked for Ernst & Young consulting, coordinating IT strategy projects. 2000 Mr. Obiso moved to Geneva to start work at the ITU as associate expert, in the area of Network Engineering. Within the Information Systems Department he participated in several areas including: network infrastructure, system integration and application cooperation.

Standard "Operating" Procedures in eHealth: Individualized Care or Health Mass Production?

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According to WHO's report from 08/2008 – "inequities are killing people on a grand scale". The WHO reports, how much expectancy of life differs between the so called "developed" and the developing world. It is WHO's opinion, that a "toxic combination of bad policies, economics and politics is responsible", which leads to social injustice and health inequity. In most cases, the unequal health situation follows the "social gradient". On the other hand: wealth alone does not have to determine the health of a nation's population, as a number of low-income countries have achieved levels of good health. In these countries, Political, social and economic forces have worked together to reach a health care system, where universal coverage, equity of distribution and especially "affordable" healthcare are possible. WHO thinks, that a key in mastering the healthcare problems of today is the "Implementation of Personal Health", meaning suitable health solutions, fitted to all layers of society.

In this environment, the costly gap between individualized care and "health mass production" is an important issue. Can standard operating procedures in eHealth help mitigating this gap?

In fact, the work in medicine everywhere on the world can be (and often is) mere stress & chaos, which favors errors and is costly. The only way out of this chaos is order and organization. Algorithms / standard operating procedures, evidence based medicine, medical guidelines and specialization can be instruments to bring order into the chaos, as they save time, money and of course – patients.

Today's medicine certainly tends to be a "medical assembly line", which is not per se negative, as specialization brings expertise, efficiency & top quality medicine. On the other side, individualized care is more important than ever to encounter frustration on both sides (patients & doctors). So, how do we cut the Gordian knot? The car industry has solved this problem already: it nowadays offers "individual assembly line mass production", which combines industrial methods with the possibility of individual adaptation. That is the way medicine can go. eHealth certainly is the enabling tool for the drafted development and it will save medicine on its way towards the future.

The International Society for Telemedicine and eHealth (ISfTeH, www.isfteh.net) is a strong partner, working aside WHO to promote these thoughts.

Keywords: eHealth, StOPs, SOP, Individualized Care

About the Authors

Professor Dr. med. Michael Nerlich was born in Landshut, Germany in 1953. He received his approbation in medicine in 1978 from Munich University, where he earned his medical doctor degree in 1979. He finished his surgical training at Hannover Medical School in 1985, specialised in trauma surgery and got his Ph.D. degree in 1988. He spent research fellowships at the University of California, Davis, USA and at the Inselspital in Berne, Switzerland.

He was elected full professor of trauma surgery at the Medical Faculty of the University of Regensburg and became head of the Department of Trauma at the University of Regensburg Academic Medical Center Surgery in 1992. He received several awards in trauma surgery and emergency medicine and is honorary member of several national trauma societies. He additionally serves currently as chair of the Regensburg Emergency Services Center at the University (RESCU).

He has been principal investigator in many European and national research programmes, especially in the field of telematics in healthcare. He has published over 160 research articles and book chapters and edited several books. His interest in telemedicine made him a founding member of the German Health Telematics Association; he is board member of the European Society of Telemedicine. At present he serves as president of the International Society for Telemedicine and eHealth (ISfTeH).

Telenursing and Global Health

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Abstract: **The International Council of Nurses (ICN) aims to advance nursing and influence health globally. ICN, with 133 member countries, represents millions of nurses worldwide. The standards, guidelines and policies for nursing promulgated by ICN are widely accepted and used by the global nursing community. ICN is keenly aware of threats to the health of populations on a global scale and the importance of nurses in meeting the needs of all people. ICN strongly supports leveraging information and communication technologies (ICT) in delivery systems to address the challenges of 21st century healthcare. The increased visibility, activism, and capability of telenursing will be of mutual benefit to ICN programmes and areas of emphasis. Telenursing has great potential for ICT synergistic collaboration with the International Classification for Nursing Practice (ICNP®), an ICN programme since 1989. ICNP® represents the nursing domain and is a unified nursing language system for use globally. Nurses are well-prepared to give comprehensive care and can, using telenursing principles and strategies, support the health needs of people who may have barriers to care. The telenursing community has addressed provider competence; ICN published international competencies for telenursing in 2007. A growing body of research is contributing to the validation of telenursing effectiveness through the identification of data-based outcomes for care recipients.**

Introduction

The International Council of Nurses (ICN) is fully cognizant of the need to leverage information, communication and technology (ICT) in healthcare globally. Nurses, through their capacity for collaborative, interdisciplinary relationships with healthcare providers, researchers, educators, ICT experts, and client populations, have an essential role in the successful application of ICT to population health locally, nationally and globally.

International Council of Nurses

ICN, organized in 1899, is a federation of 133 national nurses associations and represents millions of nurses worldwide. ICN works to

ensure quality nursing care for all, sound health policies globally, the advancement of nursing knowledge, and the presence worldwide of a respected nursing profession and a competent and satisfied nursing workforce. The standards, guidelines and policies for nursing practice, education, management, research and socio-economic welfare promulgated by ICN are widely accepted, credible, and actively used by the global nursing community. The ICN Code for Nurses is the foundation for ethical nursing practice throughout the world.

ICN advances nursing, nurses and health through its policies, partnerships, advocacy, leadership development, networks, congresses, and special projects. Twelve ICN Networks advance knowledge and practice in specialties or settings with common goals and issues. The International Centre for Human Resources in Nursing addresses issues including nurse migration and positive practice environments. ICN leader development programmes with worldwide application focus on educating nurses to have the confidence and expertise to lead, manage, and collaborate in healthcare policy and practice. These programmes include Global Nursing Leadership Institute, Leadership for Change, and Leadership in Negotiation.

ICN and Telenursing

ICN focuses on nursing in relation to the health of populations worldwide. The imbalance between healthcare availability and the growing numbers of elderly people, many with one or several chronic illnesses, will continue to strain nursing resources. The prevalence of infectious diseases among all age groups further strains resources. Basic needs for survival and health, such as clean water and nutritious food, continue to be a challenge in many parts of the world. Nurses look to ICN for education and support in establishing safe and sufficiently resourced practice environments.

The ICN Telenursing Network, approved in 2008 and launched in 2009, and ICN programmes will mutually benefit one another. The three ICN pillars, nursing regulation, socio-economic welfare, and professional practice, all have great potential for synergism with the tenets of telenursing and eHealth. With nursing regulation, for example, concepts representing nurse education for telenursing as well as the delivery of care via telenursing could be integrated with ICN's regulation terminology to broaden that database, extend its applicability, and ensure that concepts relevant to the domain are used consistently and accurately. With socio-economic welfare, telenursing can extend the reach of nurses in areas of scarce resources, or it can more thoroughly evaluate and intervene in settings where people are being put at risk due to occupational exposures and unsafe conditions.

With the professional practice pillar, telenursing can strengthen the nursing role in the global fight against multidrug-resistant tuberculosis by increasing technical support for the ICN-Lilly collaboration which involves training and education of thousands of nurses in high burden countries. Telenursing could also add to the strategies identified by ICN as critical to the prevention, testing, care, and surveillance of HIV/AIDS among at risk populations.

Telenursing is an exemplary use case for the International Classification for Nursing Practice (ICNP®). ICNP®, an ICN programme since 1989, is a unified nursing language system with state of the science maintenance and development software tools. ICNP® represents nursing diagnoses and interventions, and patient outcomes. Valid data is greatly needed about interventions and outcomes in care delivery systems. The use of technology with telenursing lays the groundwork for using a machine-based terminology for documentation (ICNP®), data storage capability, and data retrieval protocols for decision-making, research, and policy development. Telenursing, focused on the patient, family and community, together with its eHealth collaborators for system and provider resource level data, can provide a model for the care documentation and data aggregation needed for a full picture of healthcare delivery capabilities worldwide.

Telenursing and Global Health

Telenursing uses ICT to support nursing practice with clients at all levels, located in environments from local to global. ICT development provides increasingly sophisticated modalities for telenursing such as video game education systems; live, interactive voice and video patient education; downloadable data devices; remote monitoring systems; and wireless data transmission. Modality capacity and variety will surely continue to grow. Of course, the client's cultural sensitivity must be considered with the use of telenursing strategies on a global scale [1]. Cultural sensitivity includes the client's knowledge, comfort, and topic sensitivity as well as the healthcare delivery environment in terms of safety and privacy.

While the use of technology changes the care delivery medium, and may necessitate new competencies, the nursing process and scope of practice are not different in telenursing [2]. With the nursing process, nurses assess clients, develop nursing diagnoses, plan and carry out interventions, and evaluate patient outcomes. The nurse's interventions would be in relation to the nursing diagnoses as well as in support of the medical plan of care. The patient's outcomes would be in relation to the nurse's interventions and the medical plan of care.

Nursing places strong emphasis on health promotion and disease prevention, an area often neglected but one in which telenursing can make a great contribution. Patients, families and communities can be educated and counseled using telenursing processes and strategies. Local nurse educators can acquire new knowledge and skills for their important role when they are able to participate in train-the-trainer sessions with topic experts. Multi-modality technology and content theoretically could strengthen education programs and improve outcomes. This is an area for continued research.

Challenges to eHealth are found with the increased application of electronic data systems and methodologies to the healthcare environment in the 21st century. Telenursing, with its variable, perhaps invisible, practice boundaries and the potential for great nurse autonomy, can benefit from the application of competencies that accompany the licensing body's nursing scope of practice.

International competencies for telenursing [3] were published by ICN after a systematic review, analysis, and data-based assessment of the domain of telenursing. The telenursing competencies addressed the categories of professional, ethical and legal practice; care provision and management; and professional development. Recommendations for use of the competencies were targeted toward individual telenurses, health care organizations using telenursing, associations and policy organizations, nursing education institutions, and vendor/technology suppliers.

A body of research-based knowledge is developing in support of the effectiveness of telenursing. Research reports have addressed, for example, rheumatology telephone clinics [4], experiences with video-telehealth in rural/remote communities [5], different levels of nurses taking calls about childhood complaints [6], and telehealth strategies for home care of people with infections [7]. A brief review article examines evidence of several studies for patient outcomes with telenursing strategies [8].

Telenursing and eHealth will make a strong contribution to healthcare access in the coming years. More research is needed to provide substantial evidence for increased access, cost savings, and improved quality of care. ICN, telenurses, and all those determined to improve healthcare globally are challenged to leverage ICT toward the goal of health for all.

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About the Author

Claudia Bartz, PhD, RN, FAAN has worked in all aspects of nursing during her career, to include clinical practice, administration, education and research. She retired from the U.S. Army Nurse Corps in 1999. Since 2005, she has been on the professional staff of the International Council of Nurses, Geneva, Switzerland. In this capacity, she serves as Coordinator for the International Classification for Nursing Practice (ICNP®), which is a unified nursing terminology system for use worldwide. Dr Bartz now also serves as ICN staff for the new ICN Telenursing Network, which will be formally launched at the ICN Congress in Durban, South Africa in June 2009.

The Rockefeller Foundation eHealth Initiative for the Global South: Harnessing Information and Communication Technologies (ICTs) to Improve Health Systems Performance

Yunkap Kwankam
Executive Director, International Society for Telemedicine & eHealth

Over the past year, the Rockefeller Foundation has explored how to catalyze systems-strengthening activities that create broader access to affordable, high-quality health services in developing countries through its Transforming Health Systems (THS) Initiative which includes: 1) strengthening health system stewardship capacity 2) harnessing the private sector in health and supporting innovative financing strategies and 3) harnessing information and communication technologies (ICTs) to improve health systems performance, otherwise known as eHealth. Further complementing this work was a month-long Bellagio conference series focused on eHealth in the global south held July and August of 2008 which brought together key global experts and leaders to discuss how to raise the visibility of eHealth in the developing world. The Making the eHealth Connection: Global Partnerships, Local Solutions conference focused on eight specific areas including issues surrounding interoperability, access to health information, eHealth capacity building and national eHealth policies.

The presentation outlines the RF's strategy for implementing the outcomes of the Bellagio meeting.

About the Author

Prof. S. Yunkap Kwankam, MD is CEO of Global eHealth Consultants, a Swiss consulting firm based in Geneva. He is also Executive Director of the International Society for Telemedicine and eHealth (ISfTeH). From 2004 until August 2008 he was the eHealth Coordinator at the World Health Organization Headquarters in Geneva, where he was responsible for overall coordination of eHealth work across the Organization. In this role, he oversaw a number of WHO programs on the use of ICT in health.

He holds the B.S., M.S. and Ph.D. in electrical engineering, and was elected to the following American honor associations; Eta Kappa Nu

(Electrical Engineering), Tau Beta Pi (Engineering) and Sigma Xi (Research). Before joining WHO in 2001, he was Professor and Director, Center for Health Technology, University of Yaounde I. He has also been Chairman, Technology Commission of the National Epidemiology Board of Cameroon; member, Board of Directors, SatelLife; IT consultant to the US National Library of Medicine, and consultant to UNIDO on information systems.

Reflections on a Decade of eHealth
The Second Stage in Healthcare Transformation

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Abstract: This article provides some background from the early days before there were any convenient labels for this segment; looks at where we are today with eHealth (successes and failures, gaps in understanding, the value business case, strategic acceptance and lessons learnt); takes a view forward for the next decade looking at the evolution of eHealth, its importance, the critical success factors, and a brief view of the world of eHealth at the end of the decade.

This paper is inspired by the 10th anniversary of EHTEL (European Health Telematics Association) an organisation that has been active in eHealth from the beginning, providing a unique forum for all eHealth stakeholders across the European Union (and beyond). eHealth is the current label used to describe interaction between healthcare and information technology. We can already identify three clear stages of eHealth evolution as discovery, acceptance and deployment – and also postulate a fourth stage when labels become redundant and IT is accepted as an integral part of the care process.

The first stage of discovery (1989-1999) was heralded by the European Commission's recognition that their Research and Technology Development (RTD) programme should also tackle issues within vertical sectors despite the difficulties involved in interpreting the governing rules predicated purely on a research and technology base. This led to the AIM programme specifically designed for health. The major achievement was to enable and support a new community across the EU of people committed to working together, exchanging ideas, information and experience.

These were the days of "magic solutions", "silver bullets" and "paradigm shifts" with a somewhat impractical commitment to the imposition of wide ranging standards. Like many similar new communities, it spent huge amounts of time and money talking to itself, with little direct connection to healthcare professionals and the real world of clinical practice.

There have been some important signposts along the way. With the AIM programme - a turning point for what we now call eHealth – which ran

between 1988 and 1994 under the direction of Niels Rossing, Health Informatics had come to be viewed as Health Telematics. Project scope and the eHealth community expanded dramatically as ideas about applications of information technology to healthcare began to develop across care settings and health communities up to a global level. By the end of 1999 it was clear that to bring together technology and healthcare, the academic and technology emphasis would have to be rethought with some way of building bridges and securing active collaboration between the various stakeholders.

The second stage of acceptance (1999-2009) began with recognition by the eHealth community that there would need to be vision and structure, stakeholder involvement, some high level encouragement and a lot of hard work on the ground. Once again the European Commission took the initiative to support a number of activities to tackle these transformation factors. One of these was the establishment of the European Health Telematics Association (EHTEL) to provide a forum for all key stakeholders. The drive for this came partly from SMEs looking for ways to get connected to EC programmes, and other stakeholders. The challenges were evident –no main stream credibility eHealth within the technology sector or indeed within healthcare itself; no voice for innovation; no business case; few among the major players who were aware or listening.

In contrast, opportunities were opening up. The health IT community was gaining momentum and credibility. New technologies were maturing which had relevance to healthcare and there were a lot of small companies actively working with innovative local health groups and clinicians. The growing pressures of demography, medical advances and patient empowerment were in sharp contrast with finite resources available to address a growing demand from citizens and patients for more health attention. During this decade, some forward progress was achieved centred around consolidation of various IT ‘labels’ into the term ‘eHealth’. Again, it was the European Commission that took the initiative, holding the first high level conference on eHealth in 2003. This provided official endorsement for eHealth - since then, the label has stuck. In February 2009, the seventh of these conferences has taken place in Prague. The key next step was to increase the understanding of the importance and value of eHealth. Today, there are few dissenters among the stakeholders.

The European Commission’s continuing support for eHealth will be crucial, but we have learnt that the Commission cannot do all of this on its own. Its key responsibilities and priorities are declared, but eHealth is not just a top down affair. There are some components to be dealt with at European level but these are rather restricted without a European market for healthcare or for eHealth. In this second stage, much attention has been paid

to issues of healthcare transformation and to the role of eHealth. The results have been disappointing, particularly where centralist strategies have tried to impose 'one size fits all' solutions. Issues of scale and complexity in healthcare are still little understood in relation to eHealth, although this was highlighted early on in the decade [1]. Even now, it seems evident that working with population groups above 5 million involves a major shift in complexity still beyond the practical application of today's IT technology in a healthcare environment. Experience with the UK National Programme for IT serves to underline this issue and now risks causing a serious 'disconnect' with the supply side of IT industry, both large and small. The National Care Record Service, as originally envisaged, is now regarded as impractical and non-viable. Experience with medical records in France, the demise of GIP-DMP, and the smart card programme in Germany all endorse these difficulties.

What about healthcare users – how do they view eHealth? The simple answer is that they do not yet see it as an immediate priority. The prevailing perspective is rather limited and varies significantly depending on different user categories. Many users are clinical professionals across a range of specialties and functions from paramedics and nurses to hospital consultants. In their own private lives, most will be IT users at some level. Yet, at work, corporate IT capabilities often don't extend to supporting and enabling them to do their jobs. There is also some frustration among clinicians and patients, centred on the view that medicine is a personal relationship between clinician and patient, which should be kept that way.

The work EHTEL has done with patients groups leading up to the publication of the Patient's Charter [2] highlights very real concerns about quality, access, convenience, and confidentiality as well as the sustainability of present prevailing models of care. Choice and empowerment sound good, but are they any practical help when you are seriously ill or coping with chronic disease? However looking ahead for users, the prognosis is good: they will be better informed, and more notice will be taken of their individual preferences. They are likely to be given more responsibility for their own health, but there is still a large gap in understanding between them and other stakeholders to be addressed.

Much of what we have learnt in the past decade is not new, but rather a more pragmatic reflection of the difference between popular perception and prevailing reality. New business models are now required where citizens are given both choice and responsibility; where this is encouraged and informed; where clinical professionals are supported and informed to be more effective, to work as part of broader care teams looking towards more

personal and personalised care; where regions, national governments and politicians are confident enough to apply the principles of subsidiarity.

We have learnt that eHealth is no longer dependent only on EC RTD, and that support must now come from different funding programmes and initiatives. The Lead Market Initiative (LMI) and the recent ICT Policy Support Programme are both examples that are moving the focus towards local deployment [3]. There are many good initiatives just started, with projects such as Calliope (Call for Interoperability in eHealth), epSOS (Smart Open Services for European Patients) and Common well notable leaders. The focus is now on interoperability, telemedicine, personal health systems. But the real potential for connecting to care episodes, consultations, patients and citizens is still far from fulfilled.

We have learnt that, despite considerable investment, industry does not yet have the capability to apply itself to health as it has done to most other industries; there is no effective global market and still no common solutions. But we have seen some progress here too, with Microsoft, Google and Intel taking major initiatives. We have seen the rise of Open Source as an alternative model for reducing the constraints of technology 'lock in'. Perhaps most importantly we have now seen the beginnings of convergence between IT, telecoms, medical equipment and medical devices.

What we have still not seen is any truly scalable collaboration model to overcome the silos and protective interests in healthcare. We have also not seen any clear and unequivocal business case for eHealth; clear explanations of what eHealth can do, for whom; how to go about using it; how to present results and lessons learnt to a wider audience, so that people in local communities can understand how they can implement ideas and proposals to deliver better, effective, personal care with better value. Existing cost savings models are too simplistic for eHealth [4] but we will still need to spend time and effort finding answers, which are honest, and clear but also effective in a practical local care environment.

The third stage of deployment (2009 – 2019) will be a challenging one for healthcare. Cost will as ever be the prime one – how will Europe and its Member States cope with the rising cost of healthcare. The US prognosis is not encouraging with costs projected to go on rising towards 20% of GDP.

Demographic patterns across Europe clearly show an ageing population with more and more people in the age groups associated with higher proportional costs. Widespread increases in the incidence of chronic disease are a testament to our growing ability to avoid premature death – but also an economic challenge that demands changes in delivery management. New drugs, new procedures, new equipment is emerging to help, but unit costs are rising rapidly and health infrastructures struggle to cope.

Beyond this, there are new opportunities and challenges – the concept of personalised medicine, the use of stem cell technology, genomics and many others will develop and provide new ways of protecting and preventing disease. It is a faint hope indeed that the healthcare sector will become less complex, or that there will be simple answers. While much can be done by organisations like WHO and at European / national level, the hard reality of healthcare will increasingly be at personal and community levels.

Prior to the current financial crisis, the European context for IT was already moving in the right direction, with increased interest from major players and SMEs alike, with movements to bring IT along side medical equipment on the supply side. However, recently it looks as if Europe (traditionally strong in the healthcare technology field) may be beginning to lose its competitive edge. Traditional IT suppliers (many of them now operating as services suppliers) have had a mixed time recently in the UK and elsewhere, while small specialist suppliers have been decimated in some markets. This financial crisis will hopefully help to focus minds but healthcare does not offer straightforward options to replace declining financial services revenues. Health is a difficult market to engage with, often not knowing what it wants or what is likely to be realistic. There is no effective hierarchy of decision making, and still considerable suspicion and mistrust between healthcare and the IT industry.

Given these contexts and the current economic crisis, where are we now with eHealth? We know there are no simple answers or panaceas, no single immutable way forward. eHealth is just one enabler for healthcare transformation. We are close to having the technology we need, interoperability of information and the systems that share it, but not yet the transformational change mentality and the flexibility of approach needed.

We are still only at the threshold of the third stage, where healthcare is facing huge challenges from all sides. eHealth is accepted as an idea but not yet as a practical, valuable and essential support tool for facing many of these challenges. Now we have a global financial crisis which for eHealth, underlines the challenge of investing now to keep our heads above water.

The direction of travel is towards information-based care, built on evidence and collaboration; more informed self-management and responsibility for both patient and citizen. The role of technology will increasingly be to provide and support this information from the lowest level up, deriving management, public health and research information at the point of care as an integral part of the care process. We will progress by learning the lessons of the last two decades, putting them into practice wherever they are effective, by understanding the complexity of the healthcare process following good practice by decomposing this complexity

into manageable components. We have to work harder to bring stakeholders together looking for synergies and common purpose including and involving industry learning where best to invest, with whom in successful partnerships.

Our aspirations for 2019 should include a much more common community care model (irrespective of funding sources), where information is an automatic by-product of the care process, eHealth becomes an integral part of care, and where IT and medical technology converge at the level of usefulness and value. Innovation has to be encouraged, rewarded and deployed, reducing not just 'time to market' for products and services but also 'time to generate value' in successful user deployments. We recognise this as "one of the grand challenges facing mankind" as described by the US National Academy of Engineering [4] but we are confident that Europe will rise to this important challenge.

Acknowledgements

Many thanks to the EHTEL Management Team and to the Board of Directors, for their dedication, and to contribute for this historical landmark.

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eHealth in Switzerland, thereafter assisted the Swiss Government in developing the National eHealth Strategy. Current activities: eHealth and Telehealth, Health Management, Organizational and Strategy Development, eGovernance.

Secured Handling of Personal Health Information in Proposal of .HEALTH (dot Health)

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Introduction

ICANN (Internet Corporation for Assigned Names and Numbers), the organisation responsible for the world wide governance of domain names and ip-addresses, launched a proposal for **new gTLD's** (generic Top Level Domains) during the previous meeting in Cairo (Nov. 2008). Today this marketplace is mostly occupied by the .com, .net, .biz, .info (gTLD's) and many others like .be, .lu, nl, .de the so named ccTLD's (country code Top Level Domains). They all apply different registration policies, whereas the definition of the attribution of a domain name to an individual or a company or organisation is decided by the appropriate registry (licence holder of the TLD). A secured and certified attribution for specific markets such as the medical world, are not in place.

The arrival of this new window for Top Level Domain applications is a very welcome solution for the medical world. A perfect occasion for the medical work to start working on a proposal for a secured and stabilised platform of communication within the medical world. As we all know many national and international e-Health projects are struggling to be successful, basically due to lack of confidence of participating communication channels (not trustworthy, no certification).

At EU level, the introduction of e-Health services is facilitating access to healthcare, whatever the geographical location, thanks to innovative tele-medicine and personal health systems. e-Health is also breaking down barriers, enabling health service providers (public authorities, hospitals) from different Member States to work more closely together. If a particular treatment can be provided to a patient more effectively in another country, e-Health systems make it simpler to organise and carry out treatment abroad. Suppliers of e-Health tools – such as databases for patient records, mobile monitors which transmit data automatically, or handling systems for patient call centres – also benefit from the development of a European market in the sector, which has enabled them to build a strong base from which they can tackle the global market.

The increasing presence of cyber crime, we all have at least received once spam mail for medical products such as Viagra and others, popular identity theft, phishing attacks, and many more, are reasons enough to go for a

global platform being able to secure and to certify access to and from medical entities without any doubt of identity of acquiring individual or organisation.

With this perspective in view, **ISfTeH** and **Internet Society Belgium** gathered together in a constructive meeting which resulted in the creation of the project "**dot health (.health)**". Ambitious, but not out of perspective of what is considered being critical for human kind and the medical support of the human healthy. Both organisations decided to go for a consortium structure having one important mission: **establish the basics for the creation of the gTLD .health**.

The goal and mission of the project is to respond first of all to the request expressed by ICANN to propose a generic Top Level Domain **.health** with a global and community based focus. It is not the intention of the consortium to go for financial benefit, but to generate the **required technical structure**, to build up the **necessary legal processes** and to **integrate all medical staffing and related structures** in this project. As both organisations have the necessary skills and relationships, ISfTeH being the representative partner in tele-medicine and e-health, ISOC Belgium representing the policy and technical aspects related to the Internet world and the Internet user (being an ALS inside the ICANN structure), we are confident in expressing the desire to start off this project and having the initial quick-off at this Med-e-tel conference.

The dot health consortium's basic methodology consists in bringing together interested and qualified partners in order to be able to cover all levels of medical authorities, staff and participants as well as the appropriate and qualified technical partners to accomplish the basic goals of the project. It speaks for itself, government will also be invited as many of the issues to be handled in cross border situations will depend on national and intercontinental law.

Conclusions

Why this specific project .health?

- Concentrate health sector within a well protected and regulated domain name • Basic platform for implementation of world e-Health projects
- Eliminate non-medical and fraudulent players

Who can be considered a valuable partner in the consortium?

- Addresses a clearly identified, organised and pre-established community with finite membership
- Endorsed by that community

- Features a string that is strongly and specifically associated with the community in question
- Has a dedicated registration and use policy

A first milestone is now accomplished, the second one to come : bringing you all together for the final concept of prove to enter the .health GTLD at ICANN.

About the Author

Since 2000 Rudi Vansnick is a president of the Belgian chapter of the Internet Society, an organization focusing on the promotion of a stable, accessible and safe internet for everyone. He participates in national debates with national and regional governments on topics such as cyber criminality and security issues related to Belgian citizens. In November 2004 he became more and more involved in Internet issues and debates all around the world - in Bangladesh, Tunis and Hannover. Later, he joined ISOC-ECC board (vice-chair) and was one of the signatories for the creation of EURALO (European Regional At Large Organization – ALAC). Actually he serves in the board of EURALO and participates in several working groups, especially with focus on privacy and security of the Internet.

In 2005 he became the national expert for the World Summit Awards and one of the 38 Grand Jury members from all over the world in electing the 40 best e-Content projects worldwide. For 2008 he will accomplish this task again.

2006 saw him focusing on breaching the Digital Divide through projects in regional and European organisations. His goal: to capture the voices of the Internet user, individual as well as in an organisational environment, understanding the needs and burdens of each. He considers the most difficult hurdle to be the fact that while culture and technology are far away from each other, they should be mutually supportive. December 6th 2006, Rudi participated in the FOSI International Conference in Washington focusing on the Rights and Protection of Children in the Web 2.0 World. An issue he was already involved in during the Round table in June 2006 in Brussels, in presence of Ms. Viviane Reding and several other important authorities. The technical evolution of the Internet keeps Rudi's attention on the initial mission of ISOC, safe access to the Internet while the openness is an increasing item of vulnerability, imposing new rules and policies, not

only from government but also from the industry. A task in which he wants to participate actively in the coming months.

Session 2

Tele-enabled Health Care - The Voice from the Field

Presented by EHTEL (European Health Telematics Association)

eHealth - Assisted Monitoring and Diabetes Risk Management of Type 2 Diabetes Patients

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***Abstract*: In this paper we present the results of our work and experiences developing an e-health assisted diabetes risk management and monitoring approach for large scale population settings. The computer-assisted diabetes risk management system (CDRM) combines several different clinical and information technology (IT) tools to improve diabetes care, patient adherence, and thus outcomes in population based disease management programs (DMP). Care provider and the patient take a centre stage within this approach which supports services of health care professionals, eases patients' dealing with their own disease, and enhances the value of diagnostic information by improving the integration of different health care services.**

Introduction

Since prevalence and costs of Type 2 diabetes are constantly rising almost everywhere in the world [1], effective managed care interventions are sensible from the medical and the economic point of view. Several scientifically evaluated diabetes management instruments do exist and can be used to improve medical outcomes and quality of life [2]. Thus, today, the critical question is less 'if' but much more 'how' preventive or therapeutic measures can be implemented in daily medical practice for a broad audience of suitable patients.

The following paragraph describes the computer-assisted diabetes care process design recently developed for the CDRM Project.

Care Process and Instruments

The integrated care model is based on the concept: *Collect, Analyze, Act*. After an initializing process preparing the patient for continuous diabetes monitoring (e.g. with self-management know-how and devices) a cycling realization process with regular 3-6 months health check visits in primary care practices starts. A care providing diabetes coach together with the patient can document and measure laboratory data, family history and vital parameters relevant for diabetes risk calculation and management. Information is further processed to prepare easy to understand reports. These can be used to communicate and compare historic therapy planning with current therapy profiles and with risk information corresponding to patients' individual health status to get cardiovascular complications (please see Fig. 1). Documents created together with the doctor can be uploaded in patient's PHR if appropriate.

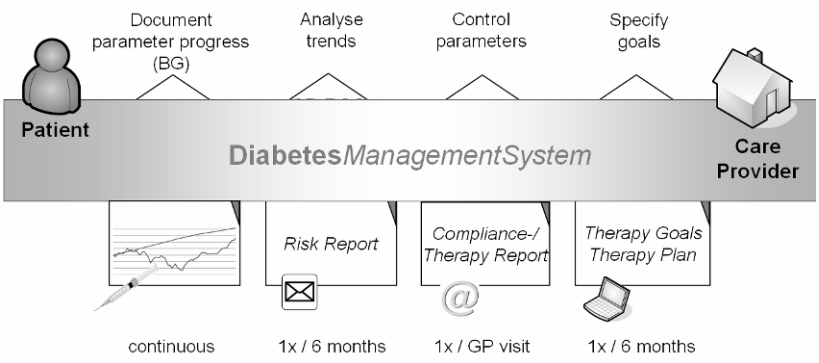

Fig. 1: Monitoring to enhance transparency and therapy communication

Process steps to be done during a health check are tracked via a workflow and task management functionality in the CDM Diabetes Monitor software. This way the care providing professionals (practice nurse, GP or diabetes coach) do not have to monitor the care process itself. They can focus on the patient and can communicate identified potentials to further stabilize the individual case. So although the overall care process is standardized for the use in large scale population settings, it is flexible enough to individualize therapy by using or not using instruments linked to the diabetes management system. Instruments to choose are:

- **Reminding tool** to control adherence of fixed therapy appointments
- Option to integrate devices for **blood glucose self management**

- Evidence-based **risk management and communication tool** to calculate individual risk to get cardiovascular complications
- **Guideline-based planning** and control of therapy measures
- **Coaching** information support
- Emergency **PHR** with automated mobile phone localization

With the help of the software-assisted diabetes management process, care providing professionals and patients will be able to continuously monitor outcomes and therapy progress. Care organisations can use the system to manage type 2 diabetes populations but also to systematically reduce individual risks and to realize a prospective therapy planning with individual therapy goals. This way the approach aims at improving effectiveness of population based disease management and the quality of diabetes care on patient level.

Technology Solution

There are three key requirements for the technological infrastructure necessary to realize the described computer-assisted diabetes care process: I. **Scalability** for a large scale population-based implementation II. Software-assisted **workflow functionality** on a case management level for patient individual decision support III) **Secure data exchange**. Core component of the IT infrastructure (please see Fig. 2) is the CDM Diabetes Monitor application as managed care software. It is linked to client PCs used by care providers and the study coordination, and to the point of care eHealth infrastructure components e.g. blood glucose device integration and patients' personal health record (PHR).

Aggregated data can be sent to a connected report generating risk calculation server (CDRM Tool). Here the system generates individual and evidence-based patient risks to get cardiovascular complications like heart attack, stroke, diabetes nephropathy or retinopathy, or amputations of the lower limb. The calculation is based on a Markov-chain disease model and includes the data of several epidemiological studies e.g. UKPDS, DCCT, CODE2, Framingham, WESDR. Key advantage of this tool is the easy to understand translation of risk information into reports which can be used as educational patient empowering instrument.

Conclusion

The prudent use of information and communication technologies can help to come up against ever increasing complexities in medical care of chronically ill patients. However, setting up a new organizational and technological care approach takes time and money. Collecting, calculating and communication patient individual information is complex in itself. To

reach ones target population physically and emotionally, it is crucial to not only have well trained personal care providers but also adequate software involved. IT support can enrich guideline conform case management and improve service quality to monitor individual therapy success. Furthermore, IT can ensure transparency on the complex monitoring process for large scale populations. A randomized controlled intervention study [3] just started to evaluate the effect of using the new CDRM health technology in clinical practice on clinical and self reported outcomes as well as on utilization of care.

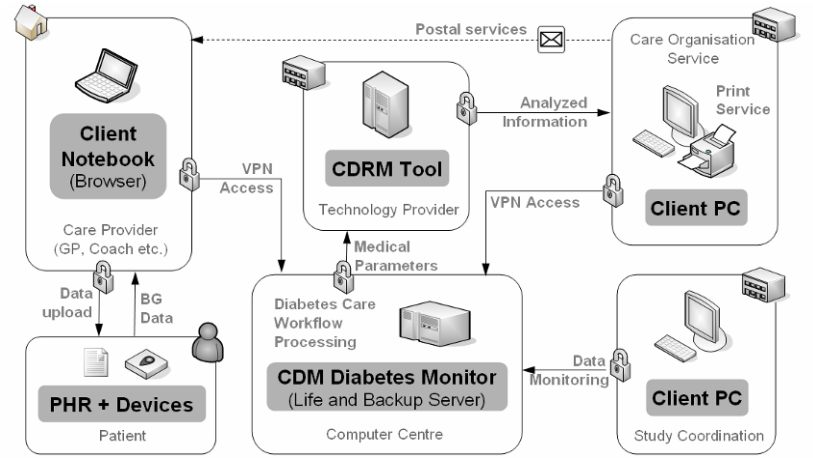

Fig. 2: CDRM eHealth Infrastructure

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Stefan Stadler: Following studies in Market Research and Communication, Stefan worked at the Centre for Survey Research and Methodology in Mannheim on the various scientific and commercial projects. He

joined InterComponentWare AG (ICW) as product manager with a focus on development of telemedical disease management solutions in 2006 to improve e-health communication between care givers and patients. Besides his engagement at ICW, Stefan is researcher and lecturer in medical statistics at the University of Marburg, and a researcher at the Department of Epidemiology at the University Medical Center Groningen, NL with the focus on diabetes management in primary care and is initiator and principal investigator of the CDRM-Study.

ICT-Supported Allergy and Diet Management

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Abstract: **New ICT based approaches for supporting allergy and diet management are set up in the MENSSANA project (Mobile Expert & Networking System for Systematical Analysis of Nutrition based Allergies). A mobile Personal Allergy Assistant (PAA) for keeping diary entries by scanning the EAN barcode of food packages has been developed. By linking the device with a central Electronic Patient Record for Allergies (EPRA), it is possible to give warnings before consumption, if necessary. The treating allergist has access to the electronic food & symptoms diary of the patient to draw conclusions and thus support the diagnostic findings.**

Introduction

The management of food allergies requires clear identification of individual allergens as well as avoidance strategies throughout daily ingestion [1]. The control of exposure by asking the patient on recent food intake and symptoms is unreliable and linked with inaccuracies and biases. Paper-based diaries have the potential to support medical diagnosis when the recording is close to the time of occurrence, although significant numbers of paper diaries are fabricated and of poor diagnostic value [2-3]. In "parking lot diaries," a patient reports about events from the preceding days or even weeks, just prior to an appointment with a nurse or a doctor. Computer based electronic diaries offer higher reliability, but the handling is often to complex and time consuming [4-5].

In the framework of the Luxembourg MENSSANA project (Mobile Expert & Networking System for Systematical Analysis of Nutrition based Allergies [6]), new approaches of Information and Communication Technologies (ICT) in allergy disease management are set up and evaluated. MENSSANA supports the idea to expand the use of electronic patient diaries for allergy diagnostics and for diet management purposes [7]. Fig. 1 gives a simplified overview of MENSSANA.

Methods

Mobile electronic patient diary

Within MENSSANA a mobile device called Personal-Allergy-Assistant (PAA) has been developed. The PAA is a mobile phone device equipped with barcode-reading capabilities to allow diary entries by simply scanning the EAN barcode of food packages. Automatic timestamps reduce potential data tampering and raise the data quality. Even the intake of non-packed food (e.g. fruits and vegetables) as well as pharmaceuticals (e.g. antihistamines) and suffered symptoms are stored in the electronic diary. The assessable time relationship between the consumed product and the suffered symptoms is of high value for diagnostics as well as for therapy control.

If the ingredient description is available and the food contains components that are dangerous to the patient, the PAA can warn before ingestion. The attending allergist manages the patients' individual allergy profile in the MENSSANA Electronic Patient Record for Allergies (EPRA). The individual allergy profile and the recorded diary entries are interchanged once per week remotely between the PAA and the central allergy information system.

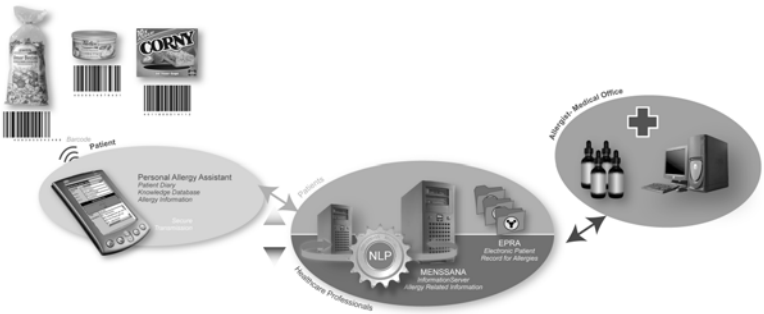

Fig. 1 MENSSANA Overview

Electronic Patient Record for Allergies (EPRA)

All diary entries made by the patient using the PAA are transferred to the central patient record. The physician can evaluate the diary to draw new conclusions and thus support the diagnostic findings. During this step, the doctor is assisted by the system that points out possible correlations between consumed food and suffered symptoms. The computer-supported interpretation of the patients' data should lead to advanced diagnostic results.

To adjust the patient's allergy profile in the EPRA, the allergist can select from more than 650 different allergens. Through the link between the defined allergens and possible ingredient names, food items are tagged incompatible for the respective patient. During the next synchronization the PAA receives the updated allergy profile and warns the patient of conflicting foods before ingestion. Thus, the person concerned receives immediate feedback about the further treatment. This provides a major incentive for the patients to continue to keep the diary and use the PAA in everyday life.

Computerized mapping of ingredients and allergens

Reliable ingredient lists of the food products have to be available in electronic format as well. To warn the patient about potential allergic reactions before consumption, the allergy information system needs to interpret the products' ingredient lists. The ingredient lists of food products are based on less structured free text, often in several languages, which uses synonyms and a variety of expressions for food ingredients and additives.

To compute the textual ingredient expressions and to point out the related allergens requires the application of natural language processing (NLP) algorithms. After the recognition of the used language, several morphological analysis algorithms are applied to divide the text in separated elements, e.g. clauses, nouns and adjectives. These elements will be compared with a list of known food ingredients. Especially in the German language this is it not a trivial task. The system has to determine that "Tomatenpaprika" must result to the allergen "pepper", in respect to the fact that in this case the word-combination "Tomaten-" acts as an indicator of the color and is not another ingredient component "tomato". The system has been trained with words found in the ingredient lists of 10.000 food products. The system proposes a potential solution that has to be validated by an operator before it will be used in the MENSSANA applications.

Conclusions

The barcode reading Personal-Allergy-Assistant supports patients and health professionals. The PAA-diaries have the potential to represent the patients' food consumption and related symptoms, which offers new opportunities in disease- and diet management. Tests have shown that patients can keep their food and symptom diary easier and faster. Higher amounts of items per day will lead to more significant datasets. Also, avoiding the manual evaluation of handwritten diaries impacts the doctors' workload positively and information biases can be ruled out.

Information and Communication Technology (ICT) has the potential to simplify the interdisciplinary exchange of patient information between health professionals among each other and as well between patients and medical experts.

Acknowledgment

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About the Authors

Andreas Arens-Volland studied Applied Computer Science at the University of Applied Science in Trier and has a Master degree in Computer Science of the University of Clemson, USA. He started working for the CRP Henri Tudor in 2004 and is involved in several healthcare projects. The main areas of interest are mobile applications, telemedicine and software quality.

Session 3

eLearning

3 D Modelling and Computer Graphics Animation as Technological Tools for E-Learning of Electrocardiography in the Medical Context

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Abstract: **I this text, the E-profissional Training Program for doctors of the Primary Health Care, in Brazil, is described. It uses modern instruments as computer graphics animation and e-learning courses. It focuses on the "medical trainning in job" and provides electrocardiographic interpretation course as a complement of the e-learning which gives support to physicians who work for the Public Family Health Program of Belo Horizonte city, Brazil. The E-Profissional Training Program was made by Health Department of Belo Horizonte in association with the Telehealth Center of Medical School of Federal University of Minas Gerais State. The main goal of the Project is to help doctors of the Primary Health Unit Center to be more capable to analyse electrocardiograms, normal and altered ones. As e-learning tools, 3D modeling, computer graphics animation, live-action videos, explanatory texts and clinical study cases were used in a open source e-learning software platform (Moodle) with quite success**.

Keywords: e-learning, 3D modeling, graphics animation, primary health care, electrocardiography

Introduction

Belo Horizonte has a Public Family Health Program (PSF) with 497 health centers, which give Primary Health Care Level assistance. A continuous trainning of the medical staff is fundamental for Program best results to improve the quality of the medical assistance and, as consequence, the resolution's capability in this level care. In fact, the Secundary Level Care, which is composed by specialists in several areas, as well as

cardiologists, is needless overloaded. There is a consensus that part of the medical cardiological problems most be adequatelly solved in the Primary Health Care if the physicians are trained to interpret the electrocardiogram and to take decisions based on it and on other clinical and pharmacological informations. This course has been created to provide permanent education for doctors of the Public Family Health Program.

Methodology

The teaching and learning process of electrocardiography, an essential complement to the medical practice, is usually so hard because it requires not only knowledge of cardiac electrophysiology- a quite complex subject in itself- but also the ability called spacial reasoning. Spacial reasoning is a natural skill that few people have; thus one of the most difficult issues in Medical courses. Considering such difficulties, the e-learning course of Basic Electrocardiography was criated using the 3D Modeling and computer graphics animation as tools for the teaching-learning process. Planned to attend doctors who work for the Health Department, the course was designed and produced by the Telehealth Center of the Medical School of the Federal University of Minas Gerais with the collaboration of a team of doctors specialized in cardiology, who were responsible for the course content, coordination and supervising of the 3D modeling and animation production. The e-learning course material also has live-action videos, explanatory texts and presentation of clinical study cases related to electrocardiography. The e- learning material is avaiable in a open source e-learning software platform (Moodle) to each physician in his work environment and he is authorized to use part of his working hours to access the course.

Discussion

Telemedicine represents a vast ground that is in great expansion. The wide variety of TICs tools allows new forms to qualify the medical assistants, with potential to modify and optimize the medical care. Considering the medical education, which needs anatomical models as an essential requirement, computer graphics has been as a powerfull tool that allows the production of three dimensional objects, still images and animations videos, which have interactivity sometimes. This technological resource makes the visualization of anatomical structures in three dimensional spaces and also the simulation of specific organical functions easier. Moreover, it allows the creation of cartoon characters which give a subtle funny feature to the material and contribute to the e-learning–teaching process when added appropriately. One of these characters, a telescope with legs, points to alterations in electrocardiography which

requires more attention from the students. Many anatomical representations of the heart, such as the cardiac conduction's system, were included in the production of this course. In other words, demanding medical issues and complex scientific concepts become easier to learners with computer graphics work.

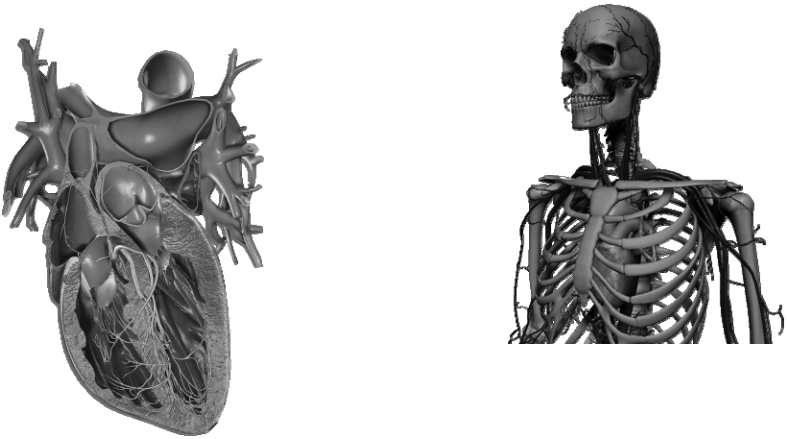

Fig 1. Anatomic presentation of the heart and chest

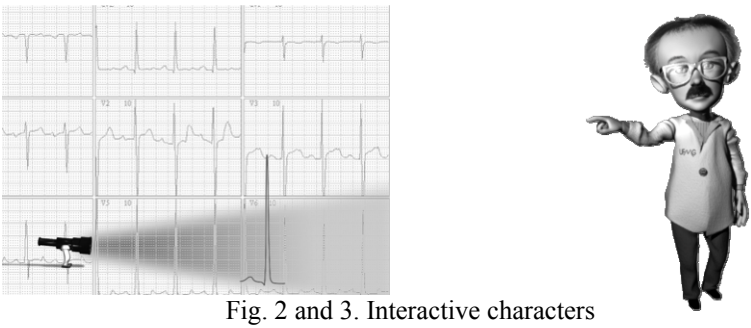

Fig. 2 and 3. Interactive characters

At the end of each module, students are invited to answer some quizzes and make practical exercices of electrocardiographic interpretation based on a clinical study cases. The exercices are complemented with a discussion forum in which students can make questions and take off doubts getting in

touch with professors. Such contact between students and doctors can make the e-learning more humane.

Results and Conclusion

The course was taught to almost 300 doctors connected to the Health Department of Belo Horizont city. The initial results were collected by a Questionaire and were considered quite satisfactory for the physicians. The Project signals that computer graphics work must represent a technological tool that can provide a succesful e-learning of electrocardiography in the medical context. This Project also represents a valuable opportunity to use the TICs potential in Telemedicine to improve the Public Health System in Brazil. Besides providing the interation between the physicians who works in the Family Primary Health Care and the academic comunity, the Project increases the qualification of medical assistance offered to the population.

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Development and Introduction of Intelligent Technologies into Health Care and Medical Education

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Abstract: **The paper discusses the development and introduction of the following intelligent technologies: multi-purpose knowledge bank in the field of clinical medicine; method of limiting generalizations; repository of formalized descriptions of clinical situations; concilium of intelligent agents and systems; computer-aided control and evaluation of medical care quality; intelligent personal systems; intelligent hospital systems, telemedicine systems, and educational systems; intelligent clinics and departments.**

Introduction

Intellectualization in medicine and education envisages the development and introduction of the following intelligent technologies [1-10]:

- Multi-purpose knowledge bank (MPKB) in the field of clinical medicine [1, 2, 10].
- Method of limiting generalizations (data retrieval and handling, diagnosis, prediction, management) [2, 4].
- Repository of formalized descriptions of clinical situations (on the basis of the MPKB and the method of limiting generalizations) [1, 2].
- Concilium of intelligent agents (program agents, experts, doctors, etc.) and systems [1, 8, 9].
- Computer-aided control of medical care quality and prevention of medical logical errors in diagnosis, forecast, and choice of treatment. [1].
- Intelligent personal systems (E-doctor, E-instructor, etc,) [2].
- Intelligent hospital systems, telemedicine systems, and educational systems (on the basis of the MPKB, the concilium, and the computer-aided quality control) [1-3, 5-7].
- Intelligent clinics and departments (on the basis of multi-agent technology, the concilium, and the MPKB) [1, 8, 10].

Multi-purpose knowledge bank

The MPKB serves as a storage for information objects of the subject domain, with which a variety of client applications (hospital, telemedicine,

instructional, and research ones) interact. By now, an architecture for the MPKB and a syntax for MPKB object description have been developed. The syntax allows one to develop computer-oriented descriptions of clinical theories. The basic structure for information representation in the MPKB is a lexical tree (LT). Its general form is as follows:

[*LT name*] $\underline{\vee}$ [*Part of lexeme*] {[[*File*:] *LT code*]

…

…} [*Comment*]

The MPKB should include, among other things, the following sections: formal theories and ontologies of clinical and related subject domains, formal languages of different levels to describe inquiries and doctor's orders, models of optimizing transformations of doctor's orders, models of standard lexicon (professional language), various logic and nonlogical models of knowledge derivation and extraction, various models of consilia of decision rules and intellectual agents, models of organs and systems, models of physical and chemical processes, patient models and doctor models, models of knowledge testing and training, a Bank of models of medical tests; a Bank of disease models, and a Bank of mathematical models.

The Bank of mathematical models is built on the basis of a knowledge model. A knowledge model k can be represented as $k = \{f/\mu\text{: } k^1 \rightarrow k^2\} \cup P_k$ where f/μ stands for the mappings realized by the mechanisms μ , k^1 stands for the problem input (description of the information environment and the objective), k^2 stands for the problem output, and P_k stands for the problem schematization rules. The mappings are also represented with the help of lexical trees [2, 10].

Consider problem specifications for some classes of knowledge models ($\underline{t}/T$ are the results of tests; d/D are the conclusions, diagnoses; h/H are the prediction hypotheses; r/R are the control programs; T, D, H, R are the sorts or the domains): $F_1 = \{f/\mu\text{: } \{\underline{t}/T\}_1 \rightarrow \{\underline{t}/T\}_2\}$ is the class of models for computing knowledge; $F_2 = \{f/\mu\text{: } \{\underline{t}/T\} \rightarrow d/D\}$ is the class of models of diagnostic knowledge; $F_3 = \{f/\mu\text{: } \{\underline{t}/T\}, \{d/D\} \rightarrow \{h/H\}\}$ is the class of models for prediction knowledge; $F_4 = \{f/\mu\text{: } \{\underline{t}/T\}, \{d/D\}, \{h/H\} \rightarrow \{r/R\}\}$ is the class of knowledge models for control optimization. The general knowledge model k includes all the above-mentioned classes of models. The closure of the set of data mapping F^+/P_k is built by means of the rules of composition P_k in solving a specific problem [1, 10].

Method of limiting generalizations

The method of limiting generalizations is an efficient method for the

solution of intellectual logical and computing problems. The method is based on the construction of a complete knowledge model of multilevel description of reality with limiting characteristics. When estimating, the current situation is generalized within the limits proper to the complete knowledge model. The method corresponds to the basic principles of operation of natural intelligence [2, 4]. The principle of the method of limiting generalizations lies in the following:

1. The maximally branched graph of domains (or multiple graphs with different domination relation realization mechanisms) is built for each test involved in the problem description. Experts in the subject domain play a large part in the graph construction.
2. An optimal model of knowledge (the minimal irredundant model) is built for each combination of domains defining the level of generality of description. The set of all optimal models of knowledge defines the complete model of multilevel reality description.
3. In searching for the solution for a new situation, the situation is generalized, to the limit, to one of the descriptions containing a true knowledge model (it is desirable to generalize to a critical description). The solution is sought for at the new level of description. If the solution is not available, it is necessary to correct the knowledge models.

Other intellectual technologies

The intelligent-system concilium solves the problem of maximizing the body of information derived from the source information (realizes the closure operator F^{+}/P_k). Each agent who takes part in the concilium mobilizes all available resources to estimate the past, present, and future of the system under study (the agents have knowledge banks and available resources of their own). Various concilium algorithms are described in [1, 8-9].

An important purpose of an intelligent system (IS) is to provide a clinical information record and display technology that would help in avoiding medical errors. Listed below are the doctor's logical errors the IS must account for in the permanent analysis of the clinical observation [1]: the narrowing of the initial information field for the construction of a diagnostic concept, the subjection of one symptom to another when their relation is weak or uncertain, the inadequacy of the dynamics of the guiding symptom (and the diagnostic concept constructed on its basis) to the patient's clinical picture, the adaptive interpretation of symptoms that are not a direct logic consequence of the development of the guiding symptom, the predominance of instrumental findings over the clinical picture of the disease in the doctor's mind, etc.

The objectives of intelligent personal systems: the monitoring of the partner's state parameters using a set of sensors; the execution of a detailed case record; the construction and continuous adaptation of an individual mathematical model of the partner' state of health; the forecasting of personal threats and the preparation of recommendations on their prevention; remote consultation; treatment and/or rehabilitation procedures using available resources, etc [2].

An intelligent clinic is a network, computer-integrated organization, which consists of dissimilar, interacting remote agents. Related by partnership, co-operation, etc. with one another, the agents draw up a joint treatment-and-diagnosis plan and monitor its implementation.

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Digital Intellectual Students Olympiads

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***Abstract*: Internet-Olympiad or Digital Intellectual Student Olympiad (DISO) in Latin and medical terminology is a new technology worked out in the Ulyanovsk State University in 2007 for the first time. Web-server teachers' company realized this new idea, devised Regulations, recommendations, variants, criteria of estimation and different aspects of digital technologies.**

Introduction

Digital intellectual students Olympiad (DISO) in Latin and medical terminology is a new technology created in Russia for the first time. Latin is a fundamental subject among humanitarian disciplines in higher medical schools. Latin, doctors' professional language, cultivates students' culture in medical terminology. Latin is also a substratum for all clinical disciplines and international science at all. For more than two thousand years the Latin language is the basis of European languages. The importance of Latin for world history is unquestionable.

A new digital technology

Internet-Olympiad or DISO was first worked out in the Ulyanovsk State University (UlSU). Web-server teachers' company realized this new idea, devised Regulations, recommendations, variants, criteria of estimation and different aspects of digital technologies. Distance Olympiad system becomes very popular because of rapid connections with Rectors and Latin teachers of medical Academies and Universities all over Russia and ex-union republics. DISO is a form of intellectual sports among medical students and a new digital technology in higher schools. Internet with its information function plays a great role in progress of humanitarian ideas. DISO variants contain teaching material both on anatomic, clinic and pharmacologic terminology and on cultural questions. The participants are also very much impressed by tasks on Ancient Greek and Rome history, medical riddles, proverbs and expressions.

Intellectual sports

The DISO opens a great number of clever, creative, gifted medical students and their teachers. Due to digital technologies and intellectual sports, so loved by medical students, the UlSU is famous now around Russia and former union republics. Thus, DISO or Internet-Olympiad is a splendid way of popularization Latin medical terminology knowledge and making new friends among students of different medical Academies and Universities not only in Russia, but all over the world. The task of modern high school is both preparing qualified specialists and creating students' computer needs and cognition. Modern educational system has got some distinctive features: interactive technologies, cognitive educational activities oriented on creative initiative of students and development of their intellectual potential. Computer technologies are of great importance.

Fig.1. The geography of higher medical school participants of DISO-2008 is shown on the map

Regional Centre of Telemedicine

Regional Centre of Telemedicine (RCTM) of the Ulyanovsk State University (UlSU) was organized in 2002 as a part of the Institute of Medicine, Ecology and Physical Culture. One of the trends of RCTM is Internet-Olympiads in the Latin Language and Medical Terminology. A system of distance Olympiads becomes very popular.


Fig.2. Regional Centre of Telemedicine of the Ulyanovsk State University

Internet Olympiad 2007

The first Internet Olympiad took place in RCTM of UlSU in 2007. Here are some tasks from the variant.

Short questions:

1. What is the tightest ligament of the human body?
2. Where are there the semilunary valves except a heart?
3. What skeletal bone names are connected with domestic things?

Riddles:

1. What tree does in the body grow?
2. What nerve does not find its place in the body?
3. I wear them many years, but can't count them.

The task is: to write underlined words in Latin in a vocabulary form (as they are given in vocabularies). For example, орган - organon, i n; pl. organa.

Четыре органа есть в теле основных,
А остальные – ответвленья их.
Важнейший орган – печень, и всецело
Зависит от него питанье тела.
Другой источник щедрый – это сердце,
И без него бы телу не согреться.
То, что выходит с кровью из него,
И есть основа жизни, существо.
Мозг головной – он через мозг спинной
Сердечной управляет теплотой.
Зависит от него процесс движенья.
Яички – это орган размноженья.
Благодаря им сохранится вид.
Их удалить – и целый род убит.
Суставы, связки с мышцами тугими –
Осуществляется движенье ими.
А перепонки, кости – факт бесспорный,
Защитой служит телу и опорой

Situation: Benzyl penicillin-sodium is used in pneumonia, endocarditis, peritonitis, cystitis, pyeamia, acute and chronic osteomyelitis, eye inflammations

Task 1.

a) Inflammation of the bladder is called.....
b) Inflammation of medullar substance.....
c) Inflammation of lungs…….

Task 2. Write the term which means "pus in blood".

Task 3. Write the term of the following diseases: panophthalmitis, keratitis, blepharitis, conjunctivitis, dacryocystitis.

Invitations for Olympiad

Two weeks before the Olympiad we have sent by e-mail invitations, recommendations and variants to the Rectors of different Russian and ex-union high medical schools. Students of fifteen medical Academies and Universities (Moscow, St.-Petersburg, Perm and others) took part in the Internet-Olympiad 2008.

Fig.3. Olympiad 2008

Our teaching books

We have written two teaching material books on Internet-Olympiads in the Latin Language and Medical Terminology. They are of great value to

the Latin teachers. Thus, interactive technology, such as Internet-Olympiad, is means of higher medical education quality. The Ulyanovsk State University is rather young. It was founded in 1988 as a brunch of Moscow State University named after M. V. Lomonosov. In 1996 it was renewed and renamed "Ulyanovsk State University". The University has been effectively developing as a strategic partner realizing federal programs as well as the programs of Volga Federal District and Ulyanovsk Region.

The University area located on University Embankment has been very quickly turning into modern campus with the advanced infrastructure. Sviaga river waterside is being equipped with modern amenities like a picturesque recreation area with the follow-up arrangement of a dendropark, a promenade esplanade sport facilities. The facilities are well equipped and comfortable, located on a picturesque site of Sviaga river quay. All elements of the university campus infrastructure blend into the natural landscape. A number of educational process problems of the university were solved owing to commissioning of the new buildings. This university area includes training laboratory buildings, a sports center, a student dormitory, a stadium with artificial covering, apartment houses for faculty of the Ulyanovsk State University.

Techno Park "UlSU HIGH TECH"

The Techno Park and e-library are located in a new "high-tech" style building on Sviaga river quay. Techno Park has more than 20 modern workplaces, Internet access, a high capacity server and up-to-date software which the University purchases according to the agreements directly from the developers leading world's companies. Techno park is a basis for the application of the ISP (informational support of production) - technologies, for conducting research and economic-contractual activity in accordance with the enterprises demands.

The e- library

The library has an access to full-text database which essentially lightens the daily of both a research worker and an application engineer. Users have access to all informational resources. "UlSU high tech" technopark and the e-library help the university disclose its innovation potential and integrate the operations of the government, science and industry for more successful development of the region.

A tradition

The Medical Faculty of the UlSU was organized in 1991. Since that time it has already got many traditions. One of them is Olympiad in Latin and medical terminology.

About the Author

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eLearning and Tele-Formation in Videoscopic Surgery: Istanbul University Experience

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Videoscopic (Laparoscopic-endoscopic) surgery is very popular and attractive development in surgical practice since the end of 1980's. Today most of the surgeons all around the world apply these new surgical techniques on many different surgical procedures.

There are about 12,000 surgeons in Turkey; of which 3,500 are general surgeons and the rest are urologists, obstetricians, orthopaedists, plastic surgeons, otolaryngologists, neurosurgeons, cardiac surgeons. Currently most of the actively practicing surgeons perform many surgical operations using the videoscopic surgical technique.

Parallel to the technological improvements, videoscopic surgery is developing continuously. For this reason continuous education fort his technique is very important. New educational modalities like e-learning and tele-teaching became an important contribution. İstanbul University is the oldest education center in Turkey and also performed first videoscopic surgery in Turkey in 1991.

Istanbul University as an acknowledged leader in Turkey, established the "Continuing Medical Education and Research Center - ISTEM". ISTEM has a leader position to teach and train of videoscopic surgery in collaboration with ELCD (National endoscopic-laparoscopic surgical association). It's also launched the National Telemedicine Project in Turkey with collaboration of European NetAdded (New Technologies to Avoid digital Division in e-divided areas) project.

In recent years, ISTEM has successfully used Teleconferencing, Tele-assisting and Telementoring applications for medical education and formation at distance especially at videoscopic surgery courses (basic and advanced), which has been continuously organized since 1992. Between 1992 and 2008, 62 videoscopic surgery courses which are 3 to 10 days are organized by ISTEM, which are suggested by EAES. In those courses 850 laparoscopic surgeon are trained.

In basic laparoscopic surgery courses, it is important for the participant to have workshop practice in trainer box as well as live surgical practice on

pigs initially. On the other hand, the advanced course covers the new laparoscopic surgical techniques and the procedures are demonstrated on patients during live surgery usually. Teleconferance and telesurgery is being used more and more in this type of advanced courses. There are two basic ways of doing this: teleteaching and telementoring.

The new laparoscopic techniques, performed on patients, are shown and taught to surgeons at distant places by using real time as well as interactive live surgery tele transmission, during the advanced courses organized by expert centers.

In e-learning and teleteaching the scientific activities(conferences, meetings etc.) at Istanbul University are released real-time on Internet, ISDN and satellite and also stored on the web for future reference and use by the doctors, surgeons and other medical staff.

After the videoscopic surgery courses when the trainees return to their hometowns, connection is kept via internet and satellite and coordination is sustained.

In Telementoring application the surgeon performing the laparoscopic surgery on a patient for the first time is supervised by an experienced surgeon via visual and audio connection.

A teleconference system established between the operating room and a distant experienced surgeon, enables the operating surgeon who has less experience, to benefits from the knowledge of the distant experienced surgeon with real time interactive connection. This way, the practicing surgeon is gaining experience on the new techniques while performing live surgery in a safe and secure manner.

The secondary activities of ISTEM is also international connections and arrangement of videoscopic courses with international reference centers like ILS, ESS (European Society of Surgery) etc. According to the recent arrangement with Saint-Pierre University Hospital- Brussels, the videoscopic courses which are given by Prof. G.B. Cadiere' group, seminars and other scientific activities are going to be shown real-time via satellite at İstanbul University. And then they are going to be distributed throughout different regions of Turkey.

Another organization which is founded with participation of 36 countries under leadership of ISTEM is MMESA (Euro-Medittearanean and Middle Eastern Endoscopic Surgery Association). It will also start its tele teaching program in the first half of 2009 using new communication Technologies like internet, satellite and terrestrial Networks installed at concerning countries. The arrangement between Istanbul University and Saint-Pierre University Hospital- Brussels will also contribute to MMESA members and all the data coming from Brussels will be distributed to MMSEA countries.

ISTEM continuous to keep its leadership position in videoscopic surgical education and formation in Turkey by using all of the new technologies and applications.

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Global Link for Online Biomedical Expertise (GLOBE)

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Abstract: **Global Link for Online Biomedical Expertise GLOBE is a portal launched by Fondation Mérieux (an independent foundation serving the public health interest, particularly regarding infectious diseases in developing countries) dedicated to the improvement and the strengthening of expertise as well as the development of the networking between health professionals. GLOBE is oriented towards three topics: Diagnosis, Surveillance and Epidemiology, and Vaccinology. The portal provides e-tools: e-community, e-learning, e-resources as well as news and events information. Besides the experts and the partners implicated, Globe users would play a major role in the progress of the portal both in terms of the content and the network.**

Almost 17 million people die each year due to infectious and parasitic diseases (30% of all deaths due to disease burden) [1]. Most of these cases occur in developing countries.

Fondation Mérieux is an independent foundation (with an official charitable status) which aims to prevent and diagnose infectious diseases in developing countries. To achieve its mission, four main areas of action were identified:

- Enhancing clinical biology and healthcare infrastructure
- Supporting applied research
- Assisting patients particularly women and children
- Training and disseminating scientific information

In this framework, a programme to reinforce and capitalize on expertise and networking between health professionals via an e-portal was launched: GLOBE Global Link for Online Biomedical Expertise (**www.globe-network.org**)

GLOBE is official supported by Biologie Sans Frontières (BSF), the University of Geneva, the United Nations Children's Fund (UNICEF) and the World Health Organisation (WHO).

GLOBE is oriented towards three topics: Diagnosis, Surveillance and epidemiology, and Vaccinology.

- The Diagnosis is related to the development and reinforcing of the management, the quality and the operating procedures (testing, sampling, interpretation of results) in biomedical laboratories.
- Surveillance and Epidemiology aimed to the strengthening of the basic knowledge and the dissemination of specific tools required for implementing epidemiologic studies, managing outbreaks as well as setting surveillance systems.
- Vaccinology is dedicated to the reinforcement of vaccine awareness and skills but also for establishing local expertise and specific networking for exchanging experiences in this field

GLOBE portal provides for each of these topics different tools and resources:

- A web-based community: aiming to ensure discussion opportunities related to the main topics and to establish private working and exchange area for different networks of specialists. These communities would promote north-south and south-south scientific, medical and biomedical interactions.
- E-learning: aiming to support the continuous training of scientific experts, clinical laboratory staff and public health professionals. Interactive modules as well as a large panel of Standard Operation Procedures (SOP) and courses related to vaccines, laboratory testing, laboratory safety and management will be available on GLOBE. These tools will strengthen the capacities and the awareness of the healthcare workers regarding infectious diseases and could contribute also to the reduction of the "brain drain".
- Resources: aiming to make available evidence-based and international guidance, reports and articles related to GLOBE area of interest; but also, to involve users in the enlargement and the updating of the content by giving them the possibility to submit to GLOBE new resources to be shared on the portal. In this case, a validation process consisting of an internal review, followed by a consultation of the “GLOBE expert advisory committee” will be carried out (if necessary) before the online publication. This committee is a consultative group of experts identified amongst GLOBE official and potential partners.
- News and Events: aiming to inform local professionals of new developments, training sessions, interesting meetings, etc.

GLOBE portal has a double entry (see Fig 1):

- Vertical so that the user can choose the topic that he is interested in and its associated tools
- Transversal so that the user can choose the tool he needs in relation or not to a specific topic.

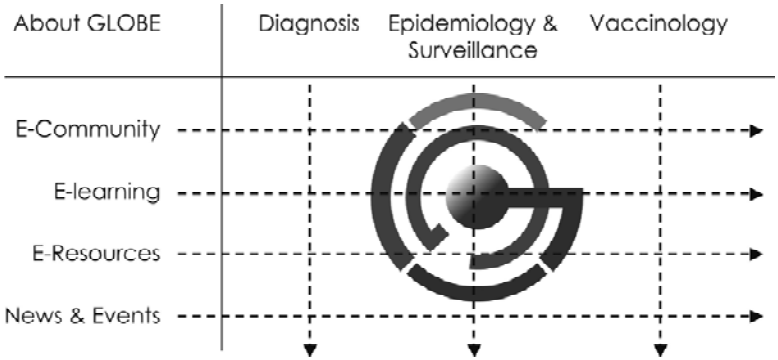

Figure 1: GLOBE portal structure

GLOBE portal is specifically designed to be easily accessible by taking into account technical barriers in developing countries. Moreover, due to the lack of availability of access and to reduce printing, the content will be more often downloadable.

One of the GLOBE challenges will be to encourage the user to be the major actor in the progress of the portal both in terms of the content (by submitting new resources, using and rating the proposed content) and the network (by participating actively the forums and being engaged in different communities).

Finally, GLOBE seeks to the establishment of new partnerships with other institutes, organizations, networks and projects concerned and involved in infectious diseases and in online support of professionals in developing countries.

Acknowledgment

Globe coordination would like to thank experts who participated in the production and the validation of GLOBE content: Ellen Jo Baron, François Simon, Louis Deweerdt, Antoine Pierson, Nicole Guérin, Claire-Anne Siegrist. We thank also the program official partners: Biologie Sans Frontières (BSF), the University of Geneva, the *United Nations Children's Fund* (UNICEF) and the World Health Organisation (WHO).

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Improving Emergency Care with eLearning

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Introduction

The need for new ways to provide more efficient health care services, coupled with major advancements in information and communications technologies have resulted in the increased use of the Information and Communications Technology (ICT) applications over the past decade (1).

One of the great challenges facing humankind in the 21st century is to make high-quality health care available to all. The World Health Organization (WHO) has expressed this vision for health-for-all strategy in the 21st century (2).

The Brazilian Unified Health System (SUS) development reached a new level after the consolidation of the Family Health Strategy (PSF) as government policy. Its stabilization among the nation strategies decisively enhanced citizen access to continued integral health care. Telemedicine must be seen as a national strategic action. In this context, the Brazilian Ministry of Health has developed the "Brazilian National Telehealth Program". It emerges as a modern alternative to consolidate the new model of health care in Brazil (3). Taking into consideration Brazil huge territory, the pronounced contrast among the different regions in terms of health infrastructure availability and the large health care deficiency, telemedicine is one of the alternatives of health logistics.

Tele-education, defined as the application of information and communication technologies (ICTs) in the delivery of distance learning, has been used for many years to deliver continuing education programmes to health care professionals. The main categories of tele-education delivery modes are audio, video and computer. In the 1990s, there were significant advances in information and communication technology. These developments enabled a new generation of technologies for facilitating tele-education (4).

In Minas Gerais, the Federal University of Minas Gerais (UFMG) School of Medicine has been working with technology for health. The Health Technology Centre (CETES) is composed by: Medical informatics Centre, Simulation Laboratory and Telehealth Nucleus.

The *'Telehealth Nucleous'* (NUTEL) has been providing care and educational support through online e offline teleconsultations and videoconferencing.

The NUTEL has developed several telehealth activities with the objective of spreading health knowledge and producing digital educational contents. We have been using 3D modeling, educational videos and animation effects. Until this moment we have prepared 5 courses for e-learning about ´Dengue`, Arterial Hipertension, Electrocardiogram, Emergency Care and Trauma.

This paper aims to describe the emergency care e- Learning course that is been developed in NUTEL for health professionals in Belo Horizonte City, Minas Gerais State, Brazil.

Material and Methods

The course development is the result of a partnership between the Belo Horizonte City Health Department and NUTEL. The scope of the course was defined after meetings involving health professionals of the metropolitan area and experts at UFMG School of Medicine.

Figures 1, 2, 3 and 4 are example of images for emergency care distance learning course.

Figure 1 Tracheal intubation

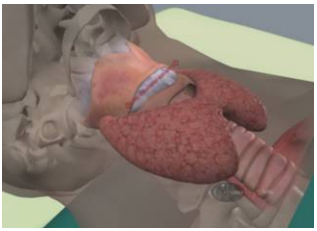

Figure 2 Cricothyrotomy

Figure 3 Jugular venous access

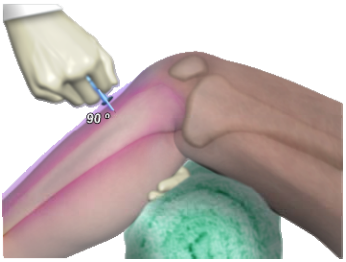

Figure 4 Intraosseous access

The main objective of ´Emergency course` is to use the Information and Communication Technologies (ICTs) and the telehealth resources to improve the provision of knowledge in health units in Belo Horizonte for health professionals continuing education, as well as improve ability to diagnosis and care of doctors working with emergency care.

The functional survival of critically ill and injured patient is influenced by the provision of timely and appropriate emergency care in both the hospital and prehospital environments. Nowadays in Brazil the SAMU (Mobile Urgency Assistance Service) is providing assistance for out-of-hospital emergencies. To improve out-of-hospital care, SAMU personnel should be optimally trained to care for victims and use protocols appropriate for emergency. Although this process is often taught as a sequence of distinct steps to enhance skills retention, several actions may be accomplished simultaneously.

In Brazil there are still very incipient experiments using telemedicine for the pre-hospital care. In Belo Horizonte city the telemedicine tools have been improving for the last few years. Nowadays the City Hall is encouraging the development of SAMU tele-urgency project. The objective is to incorporate resources of telemedicine in this ambulance service in Belo Horizonte to expedite and improve the process of providing patient care and allowing greater interaction between the emergency care units and pre-hospital system. Meanwhile, health professionals need to be trained for better assistance in emergency cases. The distance courses should help this process.

The emergency course presented in this paper was organized by experts from Medical School and Municipal Health Department. A distance course was developed and distributed for the health family professionals of the Brazilian Unified Health System in the city of Belo Horizonte (state of Minas Gerais). The course uses videos with 3D model and animation resource to improve student learning and interest. In a period of 9 months, 1.000 health professionals have been already trained. After the distance course they will attend a presence course at the Simulation Laboratory of the Medical School at UFMG. The health professionals have been training in simulation laboratory with case-based scenarios to help the assimilation of the key concepts and the practices skills within the context of real-life situations. They have been using mannequins and simulation equipments. Experienced healthcare providers may teach and review the most important concepts from emergency care.

The selected contents are: basic life support, advanced life support, cardiopulmonary failure, shock, respiratory distress and failure, cardiac

rhythms disturbances, metabolic and electrolyte disturbance, accidents by poisonous animals, poisonings and trauma.

The text for e-learning is structured to improve the assimilation of content. It uses case scenario, learning objects, critical concepts and summary points. The purpose of a standardized approach to assessment is to enable the health professional to recognize alert signs and give fast treatment for a seriously ill or injured patient. MOODLE Platform is the software that we have been using for e-learning.

Discussion

The benefits offered by telehealth are indisputable, especially the possibility of social redemption, equity and universal access to services (3). The integration between Public Health Service and Universities is an important tool to the development of social impact programs. In addition, the current project implementation will have remarkable significance in terms of strategy to improve health professional capabilities.

According Urtiga and Costa Louzada (2004) telehealth may be the only health care solution for isolated populations (5). This fact highlights in countries like Brazil where there is a patchy distribution of health services, in addition to its huge territorial dimensions.

Another author reports that, over time, telemedicine can dramatically reduce the cost of health services because of their potential effect of restructuring care received by patients and changing practices, reorganizing services (6).

The computer-mediated learning technologies refer to computer-mediated learning varies. Its becoming an increasingly common method of enhancing nursing and medical education due to its ability to simulate clinical conditions and its versatility in providing applications in distance learning have also been referred to as computer-managed instruction, computer based-training and in recent times online, Web-based or e-Learning. Examples of the present-day computer-mediated technologies in tele-education include: the internet and World Wide Web, e-mail, synchronous and asynchronous computer-mediated communication applications, and interactive multimedia applications on CD-ROM (4).

This emergency course in Belo Horizonte City has been training and improving the knowledge for 1,000 health professionals in public health service. The proposed method mixes e-learning and presence attendance in the simulation laboratory, which will increase the capacity and learning tools for the professionals.

Health-care professionals need timely, appropriate and evidence-based learning resources for continuous knowledge and skill development so that

they can provide a competent level of health-care service. A common deterrent to practice in rural and remote areas is lack of access to professional development. The delivery of tele-education programmes via information and communications technologies enables the dissemination of the new developments, provides training opportunities for hospital staff and employees, and enhances educational experiences for primary care (7)

In Brazil, where a new model of public health care is being structured, telehealth has shown as an important tool for assistance and management. The continuing education programmes will improve the update of health professionals and improve the assistance for the patients.

Conclusion

The emergency course is improving the knowledge and the continuous education of health professionals, specially the family health program team members, of the Unified Health System in Belo Horizonte city. Minas Gerais, Brazil. After the health professionals in Belo Horizonte city are trained and the course evaluated we intend to offer this course for others states and national health organizations.

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Integrating collaborative troubleshooting and wiki-based system to support training in healthcare organizations

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Abstract: **The use of ICT in healthcare systems is continuously growing and, in the last years, a new scenario is arising. The focus of research and applications is moving away from the field of automation of procedures and protocols, going towards an integrated management of services so that processes of communication and knowledge management tools are connected together with operational processes. Looking at the specific case of Italian National Health Service, one can observe that the daily hospital practice is still far from showing a high degree of adoption of ICT-based management tools. Within a complex organization, employees always need to be periodically (re-)trained on emerging work-practices and on the use of newly introduced procedures or systems. To cope with training problems we are introducing into a hospital ICT support service an experimental tool: the use of a wiki-based collaborative tool integrated with a ticketing system is presented in this paper.**

ICT state of art in e-health

The adoption to ICT in Italian healthcare organizations in past years has not been developed homogeneously, and now we have to consolidate a variety of situations. Due to a lack of investments, Italy is nowadays in a back warded position pertain to e-health development. In fact there are programs (e.g. Mattoni's Project [1]) focused on modernization and updating National Health Service, but they foresee investments not sufficient with regard to employees training on ICT and innovation. Within hospitals ICT-based tools are used in activities connected to patient management procedures. Most part of these tools are in preliminary stages of adoption, and we haven't reached a good standardization level and interoperability between networks of structures (inter-domain) or even within the same organization (intra-domain). Normally the software application used in health structures manages the workflow of patient hospitalization that is the management of patient from check-in to discharge. The automation of patient workflow has been faced with good results, but there is a lack of integration with communication tools to cope

with either training/supporting activities and troubleshooting tasks. The introduction of ICT in health field involve the necessity of training and support actions for doctors, nurses and all the employees as it is entails new working procedures and organization management. In Italian health organization training actions related to the adoption of new bureaucratic, administrative and managerial procedures must be very frequently arranged because of the high turnover within hospital units. This is either an economical and organizational issue, with high costs in terms of human resources management and internal relationships.

Updating and training in health field

In a complex organization training and updating of employees are for sure two of the most important points, in fact employees of a company must be always up to date about introduction of new operative procedures, so actions of training have to be arranged. The training actions can be carried by means of e-learning or even in presence and consist in specific training actions, related to the knowledge and use of new procedures or new working tools, or in supporting actions in which the main purpose is to consolidate the knowledge of employees and to make them deeply self-sufficient in the knowing and managing a work procedure or in using tools.

Setting up a call center for troubleshooting is not a suitable solution for a complex organization because it leads to solve problems without structuring and sharing the knowledge [2]. In this way knowledge remains unspoken and doesn't allow any increase and reaching self sufficiency for users. Beyond being both economical and a managerial burden, a call center is not useful for knowledge and for employees training because the communicative flows among operators and users aren't traceable and it's necessary to use a software application able to manage it. This system isn't equivalent neither of call center nor relationship between operator and users but it is enhancing positive features of a call center. Solving problems connected to the introduction and the use of new working procedures usually take place "vis-à-vis", in an informal way. Finding help from skilled colleague working group collaboration increases but without achieving effective and structured training actions. For a complex organization as a hospital it could be better to choose a collaborative solution-wiki-based-for passing on and sharing knowledge [3]. Even this kind of solution has a fundamental problem: a collaborative tool needs that there could be people attending the project and producing useful documentation to sharing knowledge. Whoever has faced a problem using new work procedures and has solved it could produce documentation explaining his troubleshooting experience. It is unusual that inside a company, in this case inside an

hospital, there are users willing in writing this kind of case history that contribute in creating a collaborative tool.

Trouble Ticketing system integrated with FAQ search engine, wiki and microblogging

We suggest the adoption of a ticketing system in troubleshooting that could derive from the introduction of new working procedures. At every user's request, a ticket is associated, just right as in every kind of customer care service. The next step that we suggest to achieve the building of a collaborative system is that at every help request it will be connected the own solution and make it available to users. In this way the production of useful documentation is automatic without any burden to user that has solved problems. In a collaborative working group is definitely useful for knowledge join FAQ, wiki tool and a microblogging to ticketing system [4].

Using FAQ allows having a complete view of all necessary information for user about a precise subject. In this way user can exploit a further tool to achieve self-sufficiency in find out needed information reaching a high level of self-sufficiency in solving problems.

Using a wiki tool we can recover the social feature of web 2.0 and we can contribute to increase a collaborative and vital working environment [5]. A wiki tool set in an hospital is useful to administrate and organize the knowledge produced. Through the use of a wiki tool we can reach transparency in production information processes, insertion and updating of information and collaboration in increasing know-how.

Microblogging connected to ticketing system provide the possibility to find the most expert person in solving a problem. The aim of microblogging is also to inform users about development and evolution of procedures and working systems. In this way every user able to solve a problem through using a microblogging has the possibility to inform partners and keep them up-to-date. Obviously microblogging can't be a separate tool, but it is useful if it is used together with other tools.

In this way different tools are provided to user, and he is able to find autonomously the needed resources for solving problems. This kind of instruments are available to every users, so they represent a structured and shared shape of knowledge and contribute to growth and sharing know-how needed in a complex organization. In a collaborative system this kind of process is self-improving without needing production of documentation to whom has faced and solved some problems. This system allows both gathering information about problems that medical employees have to face, allowing creation of a training collaborative tool, and moreover monitoring the updating of systems and procedures based on user own experience. The

purpose of a ticketing system isn't just to structuring and sharing know-how, but even to monitoring the use and the development of the system itself.

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Margherita Gervasoni

MIOGATE: The First University Course in the World in Oil and Gas Telemedicine and Telepharmacy

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Abstract: **Purpose and organization of MIOGATE, the University Master In Oil and GAs Telemedicine and tElepharmacy established in collaboration by Camerino University (UNICAM) and SAIPEM, a company of Eni SpA (Italy) are detailed. MIOGATE intends to provide a specific training in e-health, telemedicine, telepharmacy and their practical applications to health professionals working in oil and gas fields or offshore platforms. It is the first articulated postgraduate university course in the world in oil and gas telemedicine and telepharmacy and in 2009 has reached its second edition. MIOGATE is divided into 6 didactic units and its activities comprise 60 ECTS (European Credit Transfer System). Each didactic includes different modules (total No. 27) and courses are delivered using an e-learning platform. MOGATE represents an opportunity to achieve an academic background and qualification for improving healthcare to remote patients in oil and gas fields and offshore platforms through telemedicine.**

Introduction

People employed by oil and gas industries work very often in remote and offshore locations. Offshore oil and gas exploration and production can be found in extremely different environmental conditions ranging from tropical to Arctic, from remote deepwater to inshore shallow waters locations. Health protection and medical care in these situations may be a difficult task.

Telemedicine and other health applications of information and communication technology (ICT) are used to treat/monitor patients working in oil and gas remote and offshore locations [1-2]. This technology will contribute to improve in the future the quality of health care to workers in oil and gas fields and platforms.

To guarantee the best care of remote patients via telemedicine is important an adequate background in the field of health professionals involved. Unfortunately, university education initiatives both in this area as well as more in general in the field of e-health, telemedicine and other ICT applications to health problems are sparse.

MIOGATE (Master In Oil and GAs Telemedicine and tElepharmacy) has been established to provide to health professionals of oil and gas industry a specific training in e-health, telemedicine, telepharmacy and their practical applications. This university course lasting one year was developed as collaboration from Camerino University (UNICAM) and SAIPEM, a company of Eni SpA (Italy). MIOGATE represents the first postgraduate university course in the world in oil and gas telemedicine and telepharmacy and in 2009 reached its second edition.

Organization and activities of MIOGATE

MIOGATE is delivered using an e-learning platform specifically designed for this Master. Teaching is articulated in 6 didactic units (Table 1), including activities/facilities listed below. MIOGATE's activities comprise 60 ECTS (European Credit Transfer System).

Didactic modules

Didactic modules (No. 27) represent the core of the syllabus of the Master and correspond to one or groups of lectures per each different topic (module). Each module is articulated into lectures, accompanied by specific texts enlarging and integrating lecture's contents. These texts are placed in the module's library. Learning of lecturing materials should be documented by passing the test/examination proposed for each module. It will be not possible to follow the subsequent didactic unit without having passed 2/3 of tests of the previous didactic unit.

Forum/live discussions on selected topics/clinical cases

These activities consist in discussions on selected topics between attendants and one and more teachers. These activities will take place in a virtual class in which all participants can intervene. Attendance of at least 2/3 of forum/live discussions activities is required for being admitted to the final examination.

Table I

Didactic units and main practical activities of MIOGATE

1. e-Health without borders
Forum/live discussion : The informed consent
2. Telecommunication systems and their use in transferring biological and medical data
Forum/live discussion: Medical sites on internet. Practical drill of how to find relevant medical guidelines from authoritative sources
3. Organization of health-care systems. Organization, collection, handling and use of medical data in telemedicine
Drill 1: Case study: The optimal use of electronic medical records in assisting selected cases (via live teleconference)
4. Telemedicine support to medical care in gas and oil industry (1)
Forum/live discussion: Presentation of relevant pharmacotherapeutic guidelines in the field of cardiovascular, pulmonary and urinary diseases.
5. Telemedicine support to medical care in gas and oil industry (2)
Forum/live discussion: Presentation of relevant pharmacotherapeutic guidelines in the field of neurological, psychiatric, sense organs diseases and diabetes.
6. Medical assistance in particular situations. Role of telemedical services.
Forum/live discussion: Source of drug activity, pharmacokinetics and drug interactions and safety data.
Drill 2: Treatment and handling of selected cases of diseases and injuries. This drill will take place at the situation room of Eni headquarters in Rome

Drills

Two drills will be proposed. They consist in practical activities of assistance of patients in oil and gas fields or platforms. Drills are designed for improving capabilities of attendants to manage medical emergencies and evacuations may be required in their working places. The first drill will be made on-line using the same system of forum/live discussions. Both drills are compulsory required for being admitted to the final examination.

Final examination

Final examination will consist in the review of the Master's career of each attendant and in an oral examination focused on selected pharmacotherapy guidelines. After final examination, attendants will be admitted to thesis discussion. Thesis is a synthetic but exhaustive deepening of a topic covered during the Master. It is prepared under the supervision of a Master's teacher. A presentation of the main results of thesis will take place at the graduation ceremony.

Conclusion

Providing medical care to oil and gas industry personnel working in remote areas is a difficult task requiring a complex organization. The possibility of supporting *in loco* with telemedicine doctors or other health personnel working in oil and gas fields and offshore platforms will certainly improve the quality of medical assistance and will reduce avoidable medical evacuations. Education and training in telemedicine, a new field of medical sciences not included yet in university curricula worldwide, will represent a real opportunity to achieve qualification for improving healthcare to remote patients through telemedicine. Adequate education and training in this area will also contribute to improve potentialities of second and third level specialist advice in case it is required.

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mLearning for HIV/AIDS care in Peru

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Abstract: **'mLearning' or "mobile learning" means learning happening across locations, taking advantage of learning opportunities offered by portable technologies. We hereby present an innovative approach to healthcare workers' training with utilization of mobile technology as personal learning environment in the field of HIV/AIDS care, developed jointly by the Institute of Tropical Medicine, Antwerp (ITMA) and the Institute of Tropical Medicine Alexander Von Humboldt (IMTAvH), Lima.**

Introduction

Health care workers (HCWs) have indicated the need for an autonomous mobile solution that would enable to access the latest medical information for lifelong learning with low cost material and to exchange ideas on difficult clinical cases with peers, through social media [1-3].

As Peru is a developing country, there is limited access to information and teaching resources and a great need to enhance learning and teaching environments enabling HCWs with little or no conventional access to the Internet to interact and gain knowledge [4].

The advent of mobile and wireless technology has changed the level of ICT penetration in low resource settings (LRSs) and mobile devices in particular are playing a major role in the stimulation of information society, being the most important social technology used worldwide.

In order to enable health workers involved in HIV/AIDS care in urban and peripheral stations in Peru to access the state-of-the-art in HIV treatment and care, we set up an educational mobile application, allowing download of the latest medical information, knowledge sharing and data contribution using mobile devices.

Methods

A set of learning scenarios simulating interactive clinical cases (i.e., 'clinical modules') are developed and adapted to mobile devices and sent to physicians working in remote areas in Peru. The technology used to develop

the didactic material sustains links to trustworthy sources of information (i.e., Pub Med, WHO library…) and back-ups for possible assistance.

Learning outcomes of the acquired knowledge are assured by multiple choice questions at end of each module. A functional stable platform, web-based (MLE Moodle), is offered to support the learning events, tracking students' progresses over time. The web based platform also functions as a forum for participants for peer-to-peer learning with a set of specialists to assure content quality (Figure 1).

Out of 24 Peruvian Department Capitals, 20 are already involved with the IMTAvH in a distance learning project, which started in 2004 having as aim the scaling up access to antiretroviral treatment in Peruvian peripheral regions. All those facilities, where almost 70% of the total HIV-patients can get free treatment, are involved in the current mLearning pilot project, which will take place during the whole year 2009. The health centers in the Department Capitals are run by medical doctors and staffed by 5-10 health care workers as social workers, counselors, and data clerks.

Individual mobile devices equipped with a portable solar charger and

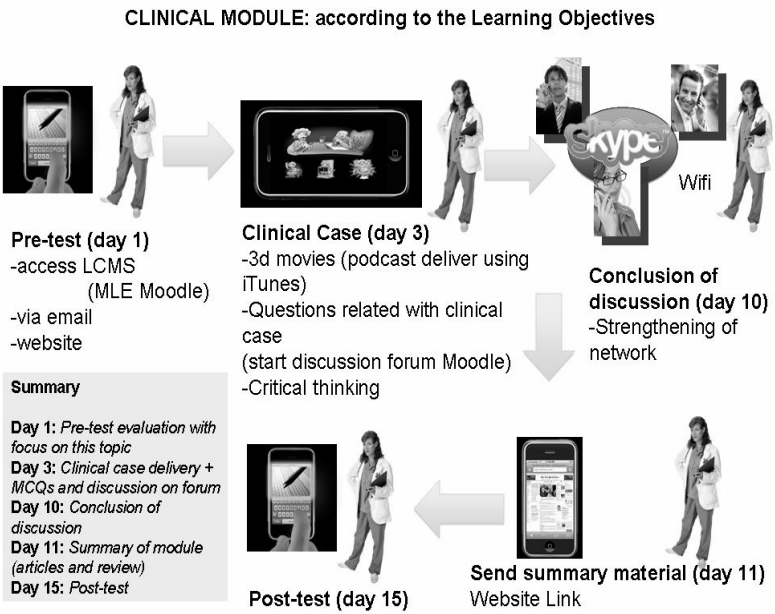

Figure 1 mLearning flow chart

wire-free, will be used in the peripheral centers. A router connected to a DSL or cable modem, available in all stations, allows up to 10 users at a time to surf the web wireless, download didactic material and guarantee interactions, without the need of participants to purchase a complete computer and reducing the cost of communications.

Discussion

Many developing countries would move towards the use of distance learning programs avoiding peripheral health stations being left unmanned, because of HCWs moving out for short or long training programs. Mobile technology offers a unique possibility to reach the end-users at the point of care and even out in the field [5-6].

With mobile devices learning environment is enhanced and ability to share knowledge through online discussion is strengthened through social media (web-based platforms) or directly on phone line. The sharing of experiences in a network facilitates the transformation of learning outcomes into permanent and valuable knowledge assets [7].

Some of the mobile devices are relatively low-cost, powerful, small and lightweight, and they can well perform in difficult environments because of very little power required for the internal battery, which can be recharged using inexpensive solar panels. HCWs can learn how to use mobile devices, how to search for information, how to upload and download information in a relatively short time frame.

Use of Smartphone's enables users to upload and download information using the wireless, infrared or Bluetooth capacity, having as addiction the telephone capacities (Figure 2). The Smartphone can be very useful in distance learning giving to the users the opportunity to contact their mentor by phone, receiving immediately feedback and helping to establish a network (Figure 3).

The benefits to education of some of the mobile tools include the delivery of multimedia materials to classrooms through simple TV connections, enhancing the opportunity for formal or informal learning and knowledge sharing with the different cadres involved in patients' care at health centers.

The unique future of this project is that the skills the healthcare providers acquire with mobile technology are easily and effectively transferred to other areas of their lives (from acquired knowledge to computer literacy, with impact on digital divide) and so such kind of innovative training program enables peripheral health settings to develop the local capabilities needed in order to thrive. The fact that the learners context is reflected in both the case studies of the health platform as in educational module, benefits the learning curve of the learner.

Moreover the development of up-to-date modules on comprehensive treatment and care of people living with HIV/AIDS can be contextualized and customized for other scenarios, cultures and languages (production of standardized knowledge, applicable to multiple operating systems/ countries).

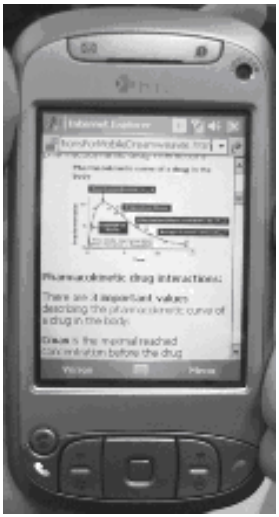

Figure 2. Clinical module through Smartphone

Conclusions

Mobile devices can create an inexpensive, reliable, learning environment between healthcare providers in a 'one-to-one personal learning' and between colleagues in a network.

Educational modules available on mobile computing give flexibility to the HCWs who can carry content anywhere. At this moment mobile learning is growing towards this ideal learning situation, but there are a lot of challenges along the way, especially in low resource settings (cost, connectivity…).

Among the main desired impacts of ICT in developing countries the creation of knowledge, the support of capacity building and the empowerment of people are considered to be essential. Increasing mobile learning will provide learning that is truly independent of

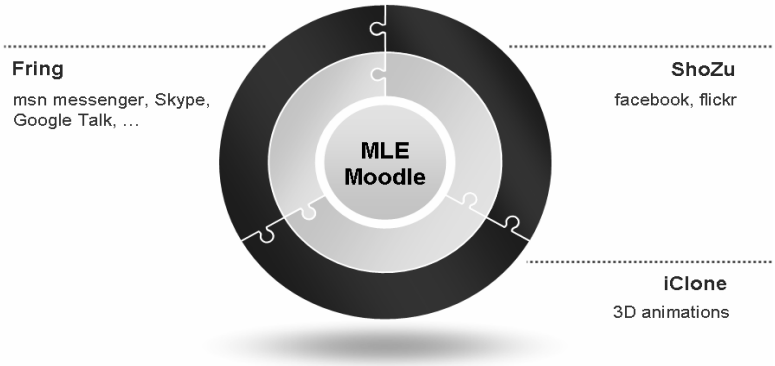

Figure 3. Some tools used for mLearning

time and place and facilitated by portable devices capable to provide rich interactivity, total connectivity, and powerful processing.

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SENACA (Senior Health Academy)

A Solution for Conscious Prevention

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Prevention (primary, secondary and tertiary) of chronic diseases is one of the most important driver to sustain or improve Quality of Life after 50. Its success depends to a large extent on compliance of patients to follow advice and clinical decisions of medical professionals, ideally to co-share such decisions.

Conscious co-sharing of clinical decisions however, as well as patient-inclusion in general, requires a minimal level of understanding the respective rationales, i.e. of *health literacy*.

In 2006 *PatientView* – a partner of *EMN* - conducted a global survey of health campaigning groups on behalf of *HEART EU*, a major pan-European patient organization. The survey aimed to determine the needs of patients in the area of prevention and risk management of heart disease and stroke. Its Executive Summary highlights a.o.:

Health campaigners are alarmed by the extraordinary gaps in public information on issues to do with the prevention of heart disease and stroke. Responses suggest that an ill-informed public has difficulty adopting preventive action According to respondents, high-risk patients—even after diagnosis—take inadequate precautions to avoid the onset of disease....

Almost 90% of respondents state that the public are unaware of the symptoms which indicate the onset of cardiovascular disease (CVD). Nor do respondents think that people know about the links between diabetes ...and CVD. Hardly surprisingly, respondents indicate that many of the public are complacent about prevention and that a significant proportion of high-risk patients do not adhere to their high-blood-pressure or cholesterol medication.

Respondents also report that the majority of patients do not exercise, or change to a healthy diet. Although some patients may be fearful, in denial, or insufficiently motivated, respondents advise that poor quality information is to blame for people's reticence to take preventive action.

Several further studies have found that older adults have lower health literacy and patient activation levels than younger adults. (The term "health literacy" includes skills that encompass the ability to process and understand basic information needed to make appropriate health decisions.

The term "patient activation" refers to having the knowledge, skills, beliefs, and confidence to manage one's health.) There is increasing evidence however that health literacy and patient activation are related to how well patients understand and manage their health and health care. (*AARP, 2005*).

At first sight health–related websites aimed at the general public are abundant, yet relatively few independent providers offer first-hand, scientifically approved and accredited medical information and/or more than "text-formats. In particular the "50+" online market for health education in Europe in particular – despite its demography-driven potential- so far seems not to have been approached yet on a large and focussed scale and in relation to other population-oriented health sites looks definitely under-supplied.

It therefore is necessary to offer to the 50+ market quality information that is unbiased or potentially affected by secondary interests, as well as relevant and approachable through user-friendly applications designed on the target's requirements.

EMN has developed an ICT- based health-literacy solution focussed on chronic diseases to be regionally adapted and implemented

The web-based platform *senaca.eu (for Senior Health Academy)* hosts

a) an integrated knowledge supply-chain on chronic diseases with input from and output to - ultimately- all stakeholders, concerned with healthcare of senior citizens. Original evidence-based and unbiased knowledge provided from leading European university clinics is level-adapted and –focussed for professional caregivers (Primary Care Providers) as well as for the public (informal caregivers, patients as well as healthy citizens); the shared knowledge basis as well as –relative- understanding should lead the way to better compliance and ultimately co-shared clinical decisions..

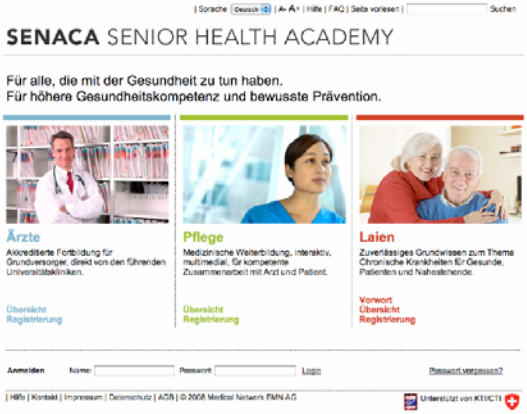

Fig. 1 English version in preparation

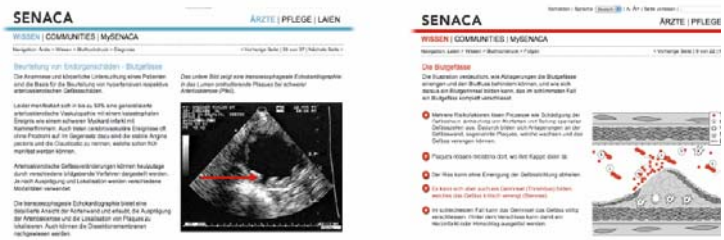

Fig. 2 Same content in different level-adapted formats

b) Integrated applications to encourage senior users (healthy and patients) literacy to build and keep their personal health log. An interoperable interface will assure (wireless) input of patient-recorded clinical and further health data for secure storing as well as transmission.

c) Improved health literacy will furthermore enable greater participation in collaborative user networks, i.e. informal virtual patient organizations, as a third key element of the platform.

The concept already has strong foundations in Switzerland and won the support of Swiss university clinics, professional healthcare schools and the Swiss government (KTI/CTI). An online version currently is in its beta-testing phase and will be distributed from mid-2009 on, starting with a core curriculum of eight major chronic indications (such as Diabetes Mellitus, Osteoporosis, Hypertension, Colo-Rectal Cancer a.o.). A top-rated virtual faculty of internationally leading teachers/scientists in cooperation with the respective medical faculties of Swiss universities implies a guarantee for scientific quality.

With a focus on Health and Diseases of the Elderly, the exclusive feature and driving force of this platform is the provision of the same level-adjusted syllabus of current evidence-based and accredited medical content along an integrated "Health (care) Knowledge Supply Chain": (Fig.3):

Fig. 3 An integrated Knowledge Supply Chain

Cascading and adapting knowledge from the same accredited sources to the end-user along an open and transparent chain (all content open to all

registered users) will be combined by "upstream" expertise as gathered and distilled in "virtual patient organizations". Respective feedback throughout and within this knowledge supply chain will be facilitated with adequate web 2.0 application solution.

Such integrated solution *de facto* has already been asked for by the *Health Telematics Working Group of the High Level Committee on Health, European Commission, DG Health & Consumer Protection, 2003: „It is important to develop information and education for patients, healthcare providers and assisting professions which are based on the same clinical guidelines and scientific evidence*." SENACA so far seems to be the first concept explicitly following such challenge.

Health literacy should help to be better in control of one's own health situation- and feel it. Such condition in turn should contribute to improved Quality of Life.

Quality of Life (QoL) by common understanding is the degree of physical and psychological well-being. The physical aspect includes such things as health, diet, and protection against pain and disease. The psychological aspect includes stress, worry, pleasure and other positive or negative emotional states, such as feeling in or out control, a.o. of one's own health.

It seems evident, that the degree of health literacy and patient activation directly relates to both aspects by helping

- To keep a healthy lifestyle and preventive behaviour
- To consciously comply with chronic disease management if ill.
- And thus contribute to preserve Quality of Life.

EMN is looking forward to discuss international cooperation with interested partner organizations.

About the Author

John Winistoerfer, M.A., is a Swiss, Managing Director.

In 1966 he graduated at Zurich University (M.A. in Economics). In 1969 founded and since that time is managing Blackbox AG, a Swiss TV and Corporate Video Production enterprise (over 500 corporate and TV programmes; numerous international co-productions and awards). In the period 1978 - 1985 he is a President of Swiss Film Producer Association.

In 1984 - founded Limelight Studios; initiated and developed European Business Channel, an international financial broadcaster; founded Medical Network EMN. Since 1999 – a full-time MD, EMN (a.o. coordinated two ESA - supported development projects (EMN, emn.net). At the same time he developed SENACA (Senior Health Academy).

Tele-education in an African Country

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Abstract: **There is a dire shortage of medical specialists in sub-Saharan Africa and many countries lack suitably qualified doctors to train medical specialists. Videoconferencing offers the opportunity to share scarce human resources. This paper reports an eight year experience of videoconferenced postgraduate medical education in a South African setting and proposes its expansion into Africa.**

Introduction

Africa has some of the poorest nations in the world. In 21 sub-Saharan African countries the government spends less than US$10 per person, per year, on health [1]. It carries a disproportionately high percentage of the World's burden of disease, 24% [2]. Added to this, the total population of sub-Saharan Africa is expected to double by 2050[3]. Sub-Saharan Africa has an acute shortage of doctors and healthcare professionals, with fewer than 10 doctors per 100,000 people in 30 of the 48 sub-Saharan African countries, for which there are data [1].

Theoretically, telemedicine holds much promise for the continent, but the reality is somewhat different. Access to information and communication technologies is limited and expensive, with 20 hr of internet access a month, for a year, exceeding the annual Gross National Income, per capita, in 26 countries.[4] Internet penetration for the continent is 5% and broadband access is less than 0.2%.[5] Telemedicine adds additional tasks to the workload of already overburdened doctors. As a result many doctors in rural areas are unwilling to participate in telemedicine programmes but want to have tele-education programmes for continuing professional development.

Objectives

The aims of this paper is to describe an experience in establishing and using videoconferencing for post graduate, medical specialist education in an urban and rural South African setting; present a model for the expansion of this service into South Africa and Africa; and outline alternative ways of disseminating teaching materials.

Setting

The problems of Africa are common to South Africa. The Nelson R Mandela School of Medicine is the only medical School in the Province of KwaZulu-Natal, a region of approximately 100,000 km^2, with a population of 10 million people, half of whom live in rural areas. The medical school teaches undergraduate and postgraduate students at 16 hospitals around the province, the furthest of which is 350 km from the medical school.

Videoconferencing Infrastructure and Support

Following an unsuccessful national telemedicine pilot project in 2000, the province was left with 11 videoconference units. With the approval of the Provincial Dept of Health (DOH) these were then used for education. As hospitals in the region are provided with only 128 kbs^{-1} of IP bandwidth for all the hospital's activities, point to point videoconferencing was started in 2001 using leased ISDN lines, with 128 kbs^{-1} bandwidth. The network of videoconferencing facilities has grown to 37, eleven of which are able to link to between three and five sites. Currently, hospitals still only have 128 kbs^{-1} bandwidth and there is no access to a videoconferencing bridge.

At the peripheral hospitals, the standard and size of the venues in which videoconferencing takes place varies, and include consulting areas that can accommodate 10-12 people, a large room for 30 people, a communal-lounge dining area for up to 75 people and a lecture theatre venue seating 80. At each venue, the videoconference is projected on to a screen via a data-projector. Only one video-camera is used at each site and no special lighting is provided. Five teaching venues have been established at the medical school, accommodating, from 5 to 180 people in a lecture theatre.

Videoconference sessions are recorded to a DVD recorder. Sound amplification has been installed at three of the large venues and wireless microphones are used to facilitate questions and interactivity at the end of a teaching session.

The five sites at the medical school are supported by two technicians who are responsible for the maintenance of equipment, taking bookings, initiating and overseeing all videoconference sessions, keeping detailed records of each session and going to peripheral sites to undertake maintenance and upgrades. There are no formal site co-ordinators at the peripheral sites. Participants at these sites have been trained to initiate and end sessions. Trouble-shooting support is provided by cellular telephone contact with the two support staff at the medical school. The lack of dedicated staff at the peripheral sites is unsatisfactory.

Programming and Assessment

One of the principles adopted was to use existing postgraduate seminar and lecture programmes so that nobody was expected to do any additional work. The only change to the existing routine was that some departments had to move from their traditional venues to a venue with videoconferencing. Three of the academic programmes have been evaluated by questionnaire, completed at the end of a videoconference session or module. The questionnaires were aimed at assessing the respondent's experience with videoconferencing over several sessions and not merely the session that they had just completed.

Results

Videoconferenced education began in second half of 2001 with one programme linking with one site. Over seven and half years there has been a steady increase in the use of videoconferenced teaching. (Table 1) In 2008, an average of just over three and half hours a day of teaching took place 7 days a week throughout the year. Use is cyclical, following the University's academic calendar and ranged from 5.5 hr in December to 165 hr (5.5 hr per day) in September. Teaching also took place to 3 medical schools and students and staff participated in teaching links with 8 other countries.

Table 1. The number of academic programmes offered each year, the total number of hours of videoconferencing undertaken each year, the total number of people involved in videoconferencing both at the local and distant sites and the number of sites involved in videoconferencing.

Year	Academic Programmes	Total Hours VC	Total People Involved	CPD Points (1 hr/person)	Receive sites
2001	1	98	493	493	1
2005	6	473	15,088	58,627	12
2006	17	765	23,125	72,308	26
2007	30	886	30,256	68,846	36
2008	31	1,298	39,781	96,793	33

Assessments of several of the programmes have shown that students and lecturers have adapted to the new technology with very few users, <5%, negative towards the use of videoconferencing. Students at distant sites are saved travel time and costs. All but one of 73 lecturers involved were satisfied with the method.

Discussion

Within our environment, videoconferenced tele-education has become an integral part of postgraduate teaching. It is feasible because of the funding model in place. Infrastructure has been purchased with donor funds and the DOH and the University have taken on the cost of ownership. The line rentals and the cost of calls made from peripheral hospitals are met by the DOH. In exchange, doctors at the peripheral sites who are not students have free access to the teaching provided.

Doctors from other African countries who have participated in teaching sessions while visiting the medical school have requested that their medical schools receive some of the teaching sessions, especially in specialties which are underserved in Africa. This has proved difficult because of high set up costs and lack of bandwidth. With the first of three new undersea cables bringing bandwidth to the East coast of Africa, it is expected that the availability of bandwidth will increase and its cost decrease and that videoconferencing will be achievable. In the interim, DVDs of recorded sessions are being posted to three medical schools in Central Africa. Use is also being made of relatively low bandwidth desktop videoconferencing and a pilot project with students in Rwanda has commenced.

We envisage a network medical school, around Africa, sharing teaching, by videoconferencing with the aim of improving training and serive provision in under-resourced specialties.

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About the Author

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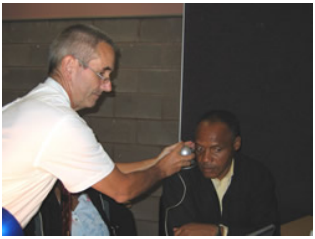

The 3D Virtual Eye: An eHealth Educational Tool

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Abstract: **The establishment of a partnership between the Microgravity Centre and the School of Informatics of PUCRS and the Telemedicine Centre of Kaunas University of Medicine enabled researchers from both Universities to develop successful joint projects in the area of telemedicine. The 3D Model Eye project, with a graphic design team of students and professors from the School of Informatics of PUCRS, had the main goal of developing a virtual tool for educational and medical proposes. As a result of knowledge exchange between the two universities, a 3D stereo animation of a healthy human eye was created using open source graphic modeling softwares. This model was accepted by consultant ophthalmologists of both universities as a clear representation of a human eye.**

Keywords: eHealth Technologies, Teleeducation, Virtual Eye, Graphic Model, Stereo Image animation

Introduction

The constant advances in graphical computing software together with the fast improvement of computer processing power has allowed the development of very complex modeling tools. This has made possible the creation of more realistic graphic animations, widening their application range to different areas, including health care education [1-3]. Human organ modeling has been used to better explain to students and patients characteristics of body structure, human physiology and the evolution of a wide range of diseases [2-5]. This project was developed under the co-

operation (Figure 1) between the Microgravity Centre/FENG-PUCRS, Brazil, and the Telemedicine Centre of Kaunas University of Medicine, Lithuania, signed in February of 2008 (Figure 2), having as the graphic design team students and professors from the School of Informatics of PUCRS.

Objective

The aim of the 3D Virtual Eye project was to develop a complementary educational tool to assist professors and physicians in demonstrating the physiology of the eye to both students and patients, respectively, to motivate the use of virtual technology in eHealth education, and to promote further development of Telemedicine technologies through international cooperation between universities in the eHealth education area.

Figure 1: Meeting between researchers from both Universities at Telemedicine Centre at Kaunas University of Medicine, Lithuania

Figure 2: Meeting at Kaunas University of Medicine, Lithuania, between representatives of the two Universities to formalize the establishment of the international cooperation agreement

Methodology

The 3D Eye draft model was designed using anatomical detail drawn from books on human physiology and from the consultancy of experienced ophthalmologists from Brazil and Lithuania. The Blender software, an open source graphical modeling application, under the General Public License (GPL), was used in an Intel Core 2 Duo T5550 computer to create the 3D Eye model. The 3D model development was divided into the following steps:

- Discussion between development team and ophthalmologists regarding eye structure;
- Image and data selection for model development;
- 3D Eye modeling (Figure 3, 4):
  - Design of eye geometrical forms;
  - Structure shaping;

- Adding of texture and color;
- Animation recording:
  - AVI video;
  - OpenSceneGraph software;
- Stereo visualization:
  - Use of OpenSceneGraph software together with a NVIDIA Geforce 8800 GTS video board to generate stereo animation;
  - Use of Asus shutter glasses to allow users to properly see the stereo animation (Figure 5);

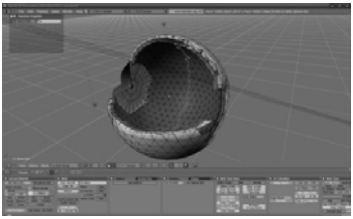

Figure 3: Initial steps. Building first structures and textures

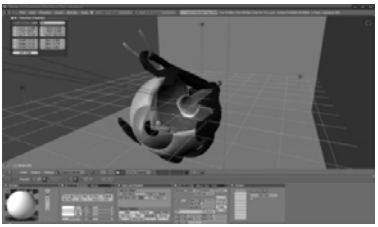

Figure 4: Further construction. Adding final structures to the 3D model

Figure 5: Asus Shutter Glasses

Results

The final product obtained at the end of this project, presented to partner universities in a video-conference multisession as a tele-lecture (Figure 6), was a 3D stereo animation of a healthy human eye (Figure 7, 8),. The 3D Eye model (Figure 9) was accepted by the consultant ophthalmologists as a clear representation of a human eye which can be utilized by physicians to demonstrate basic structures and physiology of the eye. The 3D Eye model is useful as a virtual tool to be applied in health education and also can be further modified in order to represent the establishment, causes, evolution and treatment response of a wide variety of eye diseases.

Figure 6: Presentation of the Virtual 3D Eye project to Aachen University, Kaunas University of Medicine and PUCRS at a video-conference multisession.

Conclusions

Information technology based visualization tools used for biomedical information can open up many promising possibilities for further use

in education. Such tools can also be used for the sharing of experience in clinical practice. The 3D Virtual Eye project presented here is a prototype, the like of which could be extended into other fields of medical information and education

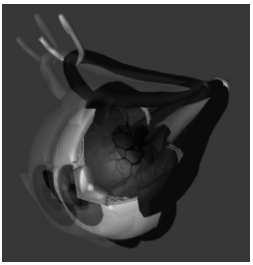

Figure 8: Stereo animation: use of anaglyph image technique

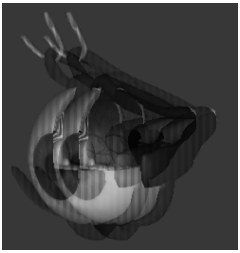

Figure 7: Stereo animation: alternate-frame sequencing technique.

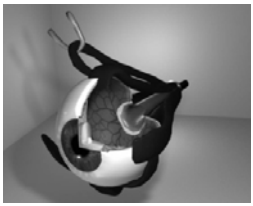

Figure 9: 3D Eye final model

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About the Author

Ricardo B. Cardoso is currently an Electrical Engineering student of PUCRS University, Brazil, research assistant for telemedicine projects of the Microgravity Center FENG/PUCRS and president and co-founder of the eHealth Student League of PUCRS. He has participated in several eHealth projects of the Microgravity Center since 2006: developing systems to obtain second opinion from a distance; assisting in the coordination of missions of the Amazon Region and responsible for the technical aspects of the mission and training of the teams; organizing the transmition of live surgeries over the internet to partner universities.

The Use of the Virtual Learning Environment to Discuss Classical Signs and Symptoms of Type I Diabetes with Nursing Undergraduates

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Abstract: **The virtual learning environment (VLE) is a scenario that includes tools for autonomous action, offering resources for collective and individual learning. The focus of the environment is learning. It is not enough to make contents available. There is a need to program interactions, reflections and establish relations that conduct concept reconstruction (VIEIRA; LUCIANO, 2002).**

Chatting **is a VLE tool that permits real-time conversation between students and tutors. In view of the above, this descriptive study aims to characterize the profile of undergraduate nursing students in a teaching diploma program at a public university in Brazil, who were enrolled for an endocrine physiology course, and to verify their participation in a chat session about the classical signs and symptoms of type I diabetes.**

The sample consisted of 44 students and Teleduc was used as a VLE. For the chat session, students were divided in two groups, A and B. A script with the case study of a type I diabetes patient, which was the goal of the session, four guiding questions, rules for participation and results expected by the tutor were put at the students' disposal in the Teleduc tool called *obligatory halt.* The students signed the Free and Informed Consent Term (FICT). Data were collected from an entry questionnaire the students filled out with data related to sociodemographic characteristics, use of Internet and Microcomputer and from Teleduc records of the messages sent during the chat session.

The results evidenced the predominance of the female gender 41 (93.2%) and that most (75%) students were between 19 and 23 yrs old. The Internet was the most used means of obtaining updated knowledge by 23 (59.0%) students and all 44 (100%) had Internet access. 23 (56.1%) students used computer and most of them (58.1%) learned how to use it on their own. 26 (60.5%) students participated in chat A and

17 (39.5%) - in chat B. The mean participation in chat A and B was 22 students. The mean number of messages students sent was 16.35 in chat A and 14.23 in chat B. The use of the VLE and its interactive tools, such as chatting, revealed its importance, making students participate more actively in the teaching-learning process, asking more questions, which is not always possible in traditional teaching.

Key words: distance education; nursing; diabetes mellitus

Introduction

The virtual learning environment (VLE) is a scenario that includes tools for autonomous action, offering resources for collective and individual learning. The focus of the environment is learning. It is not enough to make contents available. There is a need to program interactions, reflections and establish relations that conduct concept reconstruction [1]. *Chatting* is a VLE tool that permits real-time conversation between students and tutors. In view of the above, this study aims to characterize the profile of undergraduate nursing students in a teaching diploma program at a public university in Brazil, who were enrolled for an endocrine physiology course, and to verify their participation in a chat session about the classical signs and symptoms of type I diabetes.

Methodology

It is a descriptive study. The sample consisted of 44 students and Teleduc was used as a VLE. For the chat session, the students were divided in two groups, A and B. A script with the case study of a type I diabetes patient at a health service, which was the goal of the session, four guiding questions, rules for participation and results expected by the tutor were put at the students' disposal in the Teleduc tool called *obligatory halt.* The students signed the Free and Informed Consent Term (FICT). Data were collected from an entry questionnaire the students filled out with data related to sociodemographic characteristics, use of Internet and Microcomputer and from Teleduc records of the messages sent during the chat session.

Results

The results (Table. 1) evidenced the predominance of the female gender, 41 (93.2%), and that most students (75%) were between 19 and 23 yrs old.

Table 1 – Sociodemographic characteristics of students participating in the module. Ribeirão Preto, 2008

Sociodemographic characteristics	Students	
	f	%
Sex		
Female	41	93,2
Male	3	6,8
Total	44	100,0
Age (years)		
<=19	13	29,5
20-20	12	27,3
21-23	8	18,2
24+	11	25,0
Total	44	100,0

The Internet was the most used means of obtaining updated knowledge by 23 (59.0%) students and all 44 (100%) had Internet access. Twenty-three (56.1%) students at the institution used the computer and most of them (58.1%) learned how to use it on their own, according to Tables 2 and 3.

Table 2 – Distribution of the Internet use by students participating in the module. Ribeirão Preto, 2008.

Internet use	**Students**	
	f	%
Mean used to obtain updated knowledge		
Internet	23	59,0
TV	11	28,2
Newspapers	3	7,7
Magazines	2	5,1
Total*	39	100,0
Place from where most frequently access Internet		
At the institution where I study	30	68,2
At home	13	29,5
At my workplace	1	2,3
Total*	44	100,0

* Considered only participants who answered the question.

Table 3 – Distribution of the computer use by students participating in the module. Ribeirão Preto, 2008

Computer use	Students	
	f	%
Place where most frequently uses the computer		
At the institution where I study	23	56,1
At home	17	41,5
At my workplace	1	2,4
Total*	41	100,0
How did you learn to use the computer?		
Alone, by trying	25	58,1
In specialized courses	17	39,5
With orientation, at the institution where I study	1	2,3
Total	44	100,0

* Considered only participants who answered the question.

Regarding students participation in the chat sessions about classic signs and symptoms of type I Diabetes, it was verified that twenty-six (60.5%) students participated in chat A and 17 (39.5%) in chat B. The mean participation in chat A and B was 22 students. The mean number of messages students sent was 16.35 in chat A and 14.23 in chat B.

Final considerations

The use of the VLE and its interactive tools, such as chatting, revealed its importance, making students participate more actively in the teaching-learning process, asking more questions, which is not always possible in traditional teaching.

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Session 4

Mobile eHealth

Are Mobile Tele-Workplaces for Radiologist for Final Reading an Alternative to Stationary from Well-Known Vendors?

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Introduction

The aim of this study was to evaluate the usability and quality of mobile-home-radiology-workstations for more time-flexibility to radiologists with special demands like single parents or radiologist with long travel-times to work at home. We evaluated the home-radiology-scenery about their concordance with the Austrian medico-legal requests and the routine-demands of radiologists.

Methods and Material

7 radiologists of the Univ.-Clinic for Radiology II used during the time period of March 2007 and January 2009 a MacBookPro (2,6-MHz-Intel-Core-Processor) in combination with a 30-inch Apple-Monitor. Virtual Private Networks (VPN) between their home and the campus of the MUI (Medical University of Innsbruck) was realized with different local-network-providers (bandwidth from 2 to 6 Mbit). The used radiology-information-system (RIS) was an online-client via CITRIX® of software Magic-SAS® (Siemens-Medical-Austria-AG) and the medico-legal-certified version of OSIRIX, the aycan workstation OsiriX CE1 Manager® (Aycan-GmbH-Germany) with a real-time-connection to the Multimedia-Long-term-Archive of the LKI (Landeskrankenhaus Innsbruck) Advanced Image Manage (AIM) ® (ITH-icoserve-GmbH) and the short-time-storage Picture Archive and Communication System of the Radiology-Clinic MAGIC-STORE® (Siemens Medical Austria-AG).

Results

458 studies (CT, Chest-X-rays, Ultrasound and MRI) transmitted over VPN, 761 studies were copied on the mobile Workplace during daily routine over LAN (local area network). The used home-workstations

showed a sufficient diagnostic-accuracy. The mean time for training was 68 minutes; the mean reading-times differs from 2 (Chest-X-rays) to 16 minutes (large CT-Studies with over 2500 images). The diagnostic tools show no significant advantages between the used workstation at the MUI or at home. The online connection over the used VPN-networks worked stable and very sufficient with low error-rates. Total-investment for one workplace was 7500,00 EURO, average-costs for VPN 69,00 Euro/month. The release-time of final-reports was reduced for hours up to one day by finalizing them in evening from home.

Conclusion

The used home-radiology-workstations offered radiologists new opportunities for higher-flexibility for their workplace and no significantly quality-decrease of radiology performance.

Keywords: Mobile teleradiology workplace, Life-quality increase for Radiologist, affordable teleradiology workstations

Assessment of the Use of Telehealth in the Emergency Mobile Service (SAMU) in the City of Belo Horizonte, Brazil

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In order to assess the deployment of resources of telehealth in the Emergency Mobile Service (SAMU) in the city of Belo Horizonte and its metropolitan area, doctors, technicians and medical students reviewed literature on the subject, followed by a prospective analysis, during its implementation, assessing the impact on pre-hospital emergency medical care.

The study reviewed scientific articles that discuss the use of a computerized system linking the mobile emergency units to their control centers. These articles provide the basis for the formulation of a questionnaire with statements that will be sent to specialists from several countries. The results will be analyzed and consensus affirmative are to be formulated.

An analysis will be carried out concurrently to the deployment of this technology in an unit of the SAMU of Belo Horizonte, comparing it to another unit of the SAMU were this technology is not present, assessing its possible impacts on pre-hospital health, such as reduction in care time and the morbid-mortality, the feasibility of data transmission and various other possible impacts of its deployment. The technology being used is composed of a multiparametric monitor holding digital sphygmomanometer, digital thermometer, oximeter, automatic external defibrillator, digital glucose meter, digital electrocardiograph, apparatus noninvasive intracranial pressure apparatus, capnograph and also frontline and tablet pc. All data will be sent in real time for the regulating center of the SAMU and then sent to the hospital to provide the appropriate care.

Finally, we will compare data of the SAMU unit in Belo Horizonte (BH), equipped with this technology, with a unit of the SAMU of France, which also uses resources of telemedicine for pre-hospital care.

This step will consist of the analysis of various parameters of care in order to compare mobile units holding resources of telemedicine with the units that do not have the system yet. This information will be obtained from the collection of records and clinical data of patients and the care

provided by the SAMU-BH Regulating Center. At this stage, the selected ambulances will be compared for a period of time of 12 month.

The city of Belo Horizonte and the Federal University of Minas Gerais are quite able to formulate and deploy the resources of telehealth to the SAMU units since they were already successful in formulating a model of telehealth to primary care, which currently serves as reference to the Brazilian national telehealth program. The choice of partners, mainly French and Italian is due to similarity in structure of pre-hospital care in these countries with the Brazilian reality, and their dialogue and intense experiences in the process of incorporation of telehealth resources in SAMUs.

Key words: emergency mobile service, SAMU, pre-hospital care

Deaths on Board Ships Assisted by Centro Internazionale Radio Medico (CIRM), The Italian Telemedical Maritime Assistance Service (TMAS) From 1984 To 2006

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Abstract: **Causes of deaths on board ships assisted by Centro Internazionale Radio Medico (CIRM) from 1984 to 2006 were analyzed. CIRM is the Italian Telemedical Maritime Assistance Service (TMAS) and provides free of charge medical assistance to ships of any nationality, sailing in all seas of the world. In the years considered, CIRM has assisted 21,869 patients on board ships. Deaths occurring were 339 (1.55%). In the sequence of the distribution of causes of death, on the first place were cardiovascular diseases, followed by accidents and violence, infectious and parasitic disease, alcohol and drug addiction, respiratory system diseases. In approximately 8% of cases, cause of death was not established. This kind of epidemiological analysis derived from data of a maritime telemedical centre and not from a post event evaluation of mortality reports may be relevant for the identification of situations of high risk of death for seafarers and for undertaking possible prevention measures.**

Introduction

The majority of people on board ships are in a disadvantaged situation in comparison with ashore-living people which, if necessary, may have medical services available within a short time. Only a few ships carry a doctor or adequately trained paramedic personnel on board and the majority of vessels are at sea for days or weeks before they can reach a port. Hence, the most reliable possibility of treating diseases or accidents on board is to provide medical advice via telecommunication systems. At the present, about 20 different organizations world-wide give medical assistance to ships without a doctor on board [1-2]. The Italian experience in the field of medical advice to ships started on April 1935, with the activity of Centro

Internazionale Radio Medico (CIRM), established with the purpose of providing free medical assistance to ships without a doctor on board of any nationality and navigating on all seas of the world [1,2]. CIRM, recognized by the Italian government as the national Telemedical Maritime Assistance Service (TMAS) [3] has assisted more than 60,000 patients, mainly on board ships, being the organization with the largest experience in the world in the field of maritime telemedicine.

Seafaring represents a particularly hazardous occupation when compared with shore-based activities and seafarers are exposed to risks rarely encountered by workers in other occupations. Unfortunately only sparse epidemiological data are available on the reasons for the death of seamen during their career. The present study has analyzed causes of deaths on board ships assisted by CIRM from 1984 to 2006.

Epidemiological analysis

Retrospective analysis embraced all deaths among seafarers assisted by CIRM between 1st January 1984 and 31st December 2006. CIRM provides via telecommunication systems medical assistance free of charge to ships of any nationality, sailing in all seas of the world.

Analysis was made by reviewing 21,869 files of patients assisted by CIRM during the time chosen. Presumptive diagnosis of CIRM physicians was classified according to the International Classification of Diseases (ICD)-10 [4]. The ICD is the international standard diagnostic classification for all general epidemiological, many health management purposes and clinical use. When possible, causes of deaths were referred to the age of individuals, their rank on board, to the circumstances and to the number of crew members in the ship where it occurred.

Extrapolated death data were analyzed statistically by assessing cause specific mortality rates, relative risks, and Spearman's rank correlation coefficients.

Results

As mentioned above, during the period considered CIRM has assisted 21,869 patients on board ships. Deaths occurring were 339 (1.55%). On excluding deaths involving passengers or other transported people, deaths were 300 (1.37%).

Specific causes of deaths are summarized in Table I.

Table I

Causes of deaths among patients assisted by CIRM in 1984-2006

Cause	Deaths total		Deaths excluding transported people	
	No.	%	No.	%
Diseases of the circulatory system (I00-I99)				
- Ischaemic heart diseases (I20-I25) - Hypertensive diseases (I10-I15) - Cerebrovascular diseases (I60-I69)	138 6 5	40.7 1.8 1.5	116 5 5	38.7 1.7 1.7
Diseases of the respiratory system (J00-J99)	11	3.2	9	3.0
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	12	3.5	11	3.7
Certain infectious and parasitic diseases (A00-B99)	17	5.0	17	5.7
Endocrine, nutritional and metabolic diseases (E00-E90)	6	1.8	5	1.7
External causes of morbidity and mortality (V01-Y98)				
Accidental poisoning by and exposure to noxious substances (X40-X49) Water transport accidents (V90-V94) Exposure to electric current, radiation and extreme ambient air temperature and pressure (W85-W99) Falls (W00-X19) Other external causes of accidental injury (W00-X59) Burns and corrosions (T20-T32)	12 2 14 18 25 4	3.5 0.6 4.1 5.3 7.8 1.2	12 2 14 18 25 4	4.0 0.8 4.8 6.0 8.3 1.3
Intentional self-harm (X60-X84) / Assault (X85-Y09)	7	2.1	6	2.0
Other	38	11.2	27	9.0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	24	7.9	24	8.0
TOTAL	**339**	**100**	**300**	**100**

As shown, in the sequence of the distribution of causes of death, cardiovascular diseases were on the first place, followed by accidents and violence, infectious and parasitic disease, alcohol and drug addiction,

respiratory system diseases. In approximately 8% of cases, cause of death was not established.

Discussion

In general, deaths in shipping are not usually registered with the local registrars of deaths, and are not considered in routine national mortality statistics, but are included in separated registrars depending on the flag of the ship or on the country of the port where the corpse landed. This investigation is the first study on the causes of death on board ships obtained from data of a maritime telemedical centre. Our analysis therefore derives not from a post event evaluation of mortality reports, but from actual data of the reasons for deaths when patients were still alive or immediately after the event. This may be relevant for the identification of situations of high risk of death for seafarers and for undertaking possible prevention measures.

Among the causes of deaths, diseases of the circulatory system were at the first place. This observation deserves particular analysis for preventive measures including the availability on board ships of automated external defibrillator (AED) and digital electrocardiographs. These may have a real utility for diagnostic purposes and also for verification of deaths.

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Integrated Information Exchange of Mobile and Stationary Nursing Care Using an IHE-Compliant IT Infrastructure

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Abstract: **Integrated, round-the-clock patient care is becoming one of the key topics for IT applications in eHealth. We present the interim results of our e-Care project, aiming at efficient electronic care data exchange for stationary and mobile care providers. Our system is based upon international standards like HL7 and IHE, thus allowing for easy extensibility and integrability of systems in use.**

Motivation for integrating nursing care information

In the course of caretaking, elderly people who require additional care often find themselves meandering between different care systems: from nursery homes or home care to the hospital and, often with a different amount of care required, back home or to a nursery home.

So far, there is (in Austria) no sufficient data connection between different care systems. Current studies [1] show that information relevant for care is often communicated only inadequately or with considerable delay between ambulant (mobile) care, home, and nursery home. Insufficient communication processes affect the quality of care and nursing due to time delay and risk of errors due to repeated data entries, and the quality of life for elderly people or patients in general [2]. Even the recently inaugurated U.S. president B. Obama includes new IT solutions for better health care in his top priority programs to be implemented [3]. However, without standardizing technology and content, suboptimal care is inevitable [4].

A pilot installation connecting a nursing home with a hospital

Patients are sent regularly from the nursing home in Gallspach to the hospital in Grieskirchen and back. Previous to our pilot installation there has been no connection between the care documentation systems of the nursery home and the hospital. If a patient was admitted to the hospital, a care summary was printed and given to the patient to take with her/him (Fig.1).

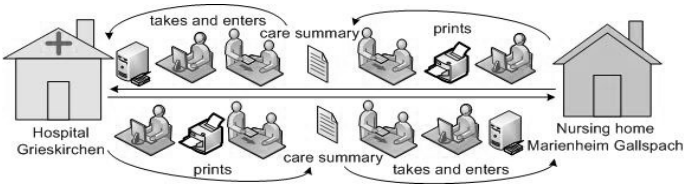

Figure 1. Current documentation workflow

If the relevant data arrived at the correct station, they had to be registered anew. The same process was necessary at the return from the hospital to the nursing home. This multiple recording of data led to an administrative overload of the nurses and frequent transcription errors.

The goal of our pilot project was to make all patient care-relevant data electronically accessible and readily available. Due to the use of different care models, it was difficult to build a mutual basis of care-relevant information. As semantic interoperability is necessary for the technical interoperability, we analyzed the two different care documentation systems to define common definitions and categorizations of care-relevant data. The analysis showed that no standardized vocabulary had been used and the interpretation of certain terms spans a wide range of meaning. Therefore we included a delegation of affected caretakers to develop an *electronic care* (*e-Care*) *summary* [5] that meets the varying needs of the recipients (Fig. 2).

We built a system architecture which integrates the analyzed systems and assures efficient and secure data export as well as easy access of stored e-Care summaries [5]. If a patient is now admitted to the hospital, the caretaker in the nursery home presses a button and the system automatically generates and stores the e-Care summary. The caretaker in the hospital can easily access the stored e-Care summary using a standard web browser.

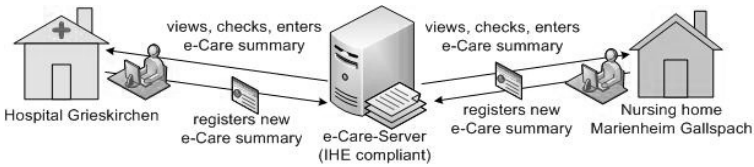

Figure 2. New documentation workflow

Generalizing our pilot approach towards an IHE-compliant solution

Most IT-supported care documentation systems are manufacturer-specific solutions that do not allow communication over interfaces [6]. In order to guarantee widespread acceptance of our system we rely on the international *Integrating the Healthcare Enterprise* (IHE) initiative using the *Patient*

Care Coordination (PCC) profiles [7] and an IHE-compliant server architecture. In conformance with the PCC profile, the e-Care summary is implemented as a HL7 CDA Release 2.0 document. CDA is a widely used standard in the exchange of health care documents, based on XML, which makes documents both machine- and human-readable [8].

For sharing CDA documents, we base our infrastructure on the IHE profile *Cross Enterprise Document Sharing* (XDS) [9], which is also suggested by the national, EU-backed electronic patient care initiative (ELGA Austria). XDS suggests guidelines for document exchange and defines transactions that guarantee easy integrability. Therefore our infrastructure (cf. Fig. 3) comprises a patient identity feed, a source that provides and registers documents, a registry that maintains document metadata, one or more repositories that maintain documents and a consumer that queries the registry and retrieves documents from the repository.

A major difficulty in saving and accessing e-care summaries is that the involved systems are based on different patient databases with different patient IDs. In order to register a document to a specific patient, the patient identity feed has to provide a unique ID for each patient as well as a collection of identity traits. The IHE profile *Patient ID Cross Referencing* (PIX) that we use specifies guidelines for cross-referencing a unique patient ID between healthcare organizations. The care documentation systems in our pilot project are not IHE-compliant, but each system provides necessary document information, in form of HL7 messages or a database. Thus, adapters were implemented that function as document sources.

Integrating mobile care providers

Since the number of elderly people steadily grows, 24/7 patient home care increased tremendously in Austria during the last few years. Most mobile care providers in Austria still have no IT-supported care documentation system in use, although increased documentation is demanded by law. Therefore we include easy accessibility of our system also for mobile care providers in form of a system-independent solution for mobile devices accessible via a standard web browser and a secure internet connection.

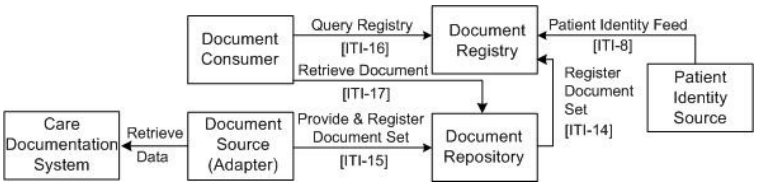

Figure 3. Architecture of the e-Care infrastructure

Benefits, Extensibility to other districts providing nursing care

Our integrated e-Care approach enables health care providers with different IT-systems to exchange care data in a space- and time-independent way. Besides healthcare benefits for the patient, it also guarantees cost savings due to avoidance of administrative efforts for multiple data acquisition.

As our approach is based on IHE guidelines, but does not necessarily require an IHE-compliant documentation system, it is applicable to a wide range of different care documentation systems. The infrastructure is easily extensible which enables a larger range of application than the city of Wels, like for instance Upper Austria or Austria. The IHE infrastructure is applicable worldwide, as experiences by Tiani SPIRIT, one of our project partners, show in South Africa and Canada.

Acknowledgment

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Internet and Mobile Phone-Based eHealth Systems for Outbreak Management and Safe Motherhood Program in Community Health Center Environment

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This paper describes our continuous development activities of simple internet and mobile phone-based e-health systems for community health center environments in Indonesia. Two different e-health applications covering both urban and rural areas will be emphasized, namely: in supporting outbreak management, and safe motherhood program. With more than 7600 community health centers (CHCs) for the whole country, such e-health development will be very valuable to support a large variety of health care services to be provided by a CHC.

In supporting the outbreak management program, two different dedicated e-health prototypes have been developed. An internet-based e-health system consists of: a web-based outbreak management system with a specially developed database, a PC-based monitoring station (health office, base unit), and a number of PC-based reporting stations (CHCs, remote units). Outbreak reports and regular weekly reports can be sent through the internet, by any CHC through any PC-based reporting station or any internet access point, using a valid user name and password. In locations where internet access is not available, a PC and Mobile phone-based e-health system for outbreak management has also been developed. Outbreak reports and regular weekly reports are sent in a modified SMS (short message service) format.

Another internet and mobile phone-based e-health system has also been developed to support the Safe Motherhood Program at the CHC level. In general, the system consists of: a web-server PC with database application software and an SMS server (with Safe motherhood SMS database) connected to both internet and mobile phone networks. The system has been designed to be able to send various standard text messages to registered mobile phones at particular pre-programmed dates. The system will also be

able to automatically respond to questions in the form of standard keywords sent by a registered mobile user.

Encouraging evaluation results have been obtained from both laboratory and field tests conducted to the outbreak management e-health system. The safe motherhood e-health system has also undergone laboratory tests successfully. Therefore, the internet and mobile phone-based e-health systems for both applications are under further improvement, to support essential community health centers and hospitals in both urban and rural areas of Indonesia.

Keywords: e-health, outbreak management, safe motherhood, mobile phone

About the Author

S. Soegijoko (born in 1942) received his Electrical Engineering degree from Institut Teknologi Bandung (ITB), Indonesia in 1964, and obtained his Doctorate degree from The USTL Montpellier (France) in 1980. After completing his duty from 1966 to 2007 as a teaching staff at ITB, he is currently an Adjunct Professor on Biomedical Engineering at the same institute (ITB). His current research interests include: Biomedical Engineering education, e-Health & telemedicine, and Biomedical Instrumentation. He is particularly interested in Engineering education and research collaborations involving international institutions/partners.

Key Challenges in Large-Scale Mobile Healthcare Deployments – A Mobile Operators Perspective

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Mobile/Wireless healthcare solutions are expected to grow substantially over the coming years. Similar to other type of large-scale machine-to-machine solutions, mobile healthcare solutions involves complete data connectivity services that require a new approach, new products and expanded service levels from mobile operators. The telecom industry is in general facing 3 main challenges in meeting the future demands, partly driven from the expanding Mobile healthcare area:

- Mobile healthcare solutions involve full and automated integration of connectivity solution into different objects, terminals and machines. This fact implies many challenges from a mobile operator's perspective including technical integration, logistics, provisioning and new business models.
- Mobile healthcare solutions will be integrated in units (mobile and fixed) indented for an international marketplace. The telecom industry is in general pursuing a national business approach thereby lacking the products, services and business models needed to provide connectivity solutions suited for international deployments.
- Mobile Healthcare solutions include large-scale deployments of machines interacting with the mobile network implying completely new requirements on reliability, security and scalability from a mobile operator perspective.

The presentation will focus on addressing challenges faced by the mobile operator industry when moving into machine-to-machine, telematics and Mobile Healthcare solutions in GSM/GPRS networks. There will be a clear global approach also including key learnings from already deployed M2M solutions on an international level. Key presentation cornerstones include:

1. Key learnings in setting up global connectivity solutions for M2M and Mobile Healthcare purposes

- Key challenges from a technical, business and operations perspective
- Case studies and learnings from other industries with similar connectivity requirements as Mobile Healthcare

2. Success Factors in integrating connectivity in large-scale automated production of mobile healthcare machines, terminals etc

- Connectivity and SIM solutions in automated production processes
- Logistics and Provisioning aspects
- Technical Infrastructure (combining HW, SW and communication).

3. Optimization of technical solution and business value from a connectivity perspective.

- Need for new and flexible business models on international basis
- Business model drivers and fundamentals

4. Future outlook and trends for Mobile Healthcare and overall M2M connectivity solutions

- New possibilities in line with evolving mobile technology
- Key future challenges for mobile operators

Keywords: mobile communication, GPRS, mobile healthcare, data communication

About the Author

Robert Brunbäck is responsible for strategic business development within the area of M2M / Telematics at Telenor Connexion. He brings 7 years of experience in large-scale M2M deployments and goes to market strategies from an European mobile operator perspective.

Mobile Solutions for Healthcare Delivery in Argentine

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Abstract: **In Argentina, health institutions face the serious problem of an always increasing demand of services, without real possibilities to extend neither their infrastructure nor the human resources to adapt to these needs. This leads to the collapse of the hospital services, increasing costs for institution and reducing the healthcare quality.**
The high penetration of Internet and mobile technologies in the country have allowed us to implement telemedicine applications based on SMS/MMS, with low cost and a huge social impact. Combining web-based applications and GPS/GPRS devices, a home care control system was implemented, for patients with chronic diseases like diabetes, hypertension, coronary and respiratory pathologies and others. In addition an appointment management system was implemented.
First results have demonstrated the effectiveness of the solutions; both specialists and patients are satisfied with them. By now we are adding new features such as intelligent monitoring, advanced signals processing for automatic pathologies recognition using neural networks and rule-based expert systems to aid in the decision making. Also data encryption; compression and GPS features will be added.
These efforts intend to shorten the technological gap with advanced countries, trying to reach the future of the medical attention incorporating concepts of ambience intelligence and health domotics.

Introduction

The demand of public and private health services in Argentina is always increasing; most of the institutions have no real possibilities to extend neither their infrastructure nor the human resources to adapt to these needs. So hospitals services collapse, increasing costs for the institution and reducing the healthcare quality.

Many of these issues can be solved by telemedical applications based on massive technologies like Internet and mobile telephony, especially

healthcare delivery in remote and rural areas. Home Care is an excellent alternative for controlling elderly people or chronic diseases like diabetes, hypertension, coronary pathologies, obesity, pregnancies and others [1]. Home care services can be improved and augmented by adding features of ambience intelligence, continuous monitoring and health domotics [2].

There are a number of successful implementations that act as references. Diabetes control is widely referred in literature everywhere. SMS has also been used in many experiences with patients [3, 4]. In Europe, the CHS Project (*Citizen Health Services)* worked under the paradigm of citizen centered health services using mobile technologies. In Spain, the *Cardiosmart* system was a remarkable experience for intelligent and continuous monitoring using GPS/GPRS networks. United States also have a wide trajectory using informatics tools medical applications and preventive health. In our country, there are no serious experiences in health based on SMS or mobile technologies [5].

We described here the first stages of a project in progress that uses low cost mobile technologies for supporting medical applications with a huge social impact, completely developed at the facilities of the university, in collaboration with health institutions.

Design

Two solutions were designed using SMS technologies, both inside the same general platform architecture, shown in Fig.1. The system relies on client/server architecture with a Windows XP Server, ADO database engine and it runs a web interface written in ASP language, fully customizable, for both user and administrators.

Short Messaging Services (SMS) was the chosen technology because it is available for all mobile phones users with instant reception at a very low cost. Solutions consist on a System for Appointment Management (SGT) and a Home Care Control System (SCP). A modified open source SMS server controls the emission and reception of SMS messages through a *Wavecom® Fastrack Supreme 10/20* modem. It also handles the validation of users, errors and data storage. A specific mobile phone number was set for the messages exchange; the SIM card (*Subscriber Identification Module*) was located inside the Micro-SIM Type card holder of the modem. Users must be validated by a policy of User ID (based on his mobile phone number) and a password. When the system validates a user, it shows a customized options menu, according to the application selected by the user.

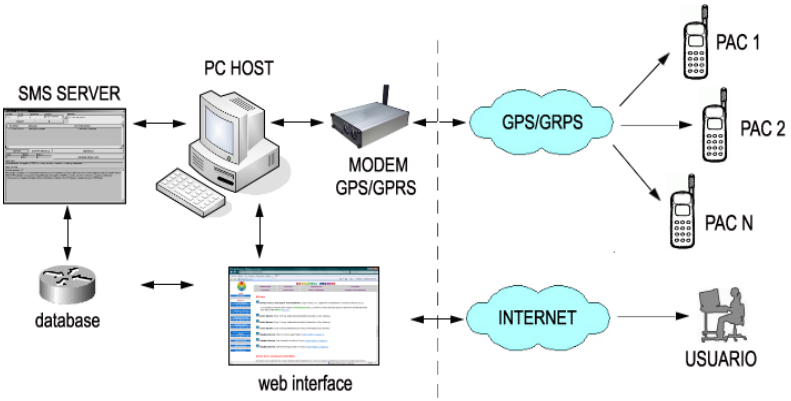

Fig.1. General architecture of the system

There were included 20 users of ages from 18 to 65 for each system during the first stage of the trial, whose results are reported here. Home Care control system includes four different groups of patients: diabetics, pregnant, obeses, and hypertensive.

We defined a protocol for each group of patients. Diabetics and hypertensive patients should send two daily measurements, obese should send their weekly weight, and also pregnant should send the weekly weight. All messages should be sent in a special format. An expert system based on rules was added to administrators' web interface that allows for sending messages upon the detection of a particular event, such as alerts in parameters values or appointment reminders.

Results

Table 1 Resumes and classifies the results during trial period

Table 1 First trial results: a) Appointment management system

	SMS / Day	Valid SMS per day	Total SMS in period (60 days)	SMS daily average per user	Efficiency factor
SGT	108	85	6480	5.4	28%

b) Home care control system

	SMS / Day	Valid SMS per day	Máx. SMS possible in period	Answers sent per day	Use factor	Efficiency factor
SCP	37	35	2400	11	92,5%	87,5%

Table 1(a) shows data collected from 20 users during the 60 days of the trial period and calculates an Efficiency factor (28%), which represents the percentage of reduction in the flow of patients across the hospital just to make an appointment with a specialist.

Table 1(b) resumes the evolution of home care control for the diabetics group. It shows two remarkable factors: a Use factor, that reflexes the number of users committed with the system, that send their measures through SMS everyday; and the Efficiency factor that represents how the system controls the patients and the format of the messages.

Other important result is the patients' supervision feeling generated by the intelligent alerts and messaging system, in spite of not having contact with a specialist. The system provides a fast, reliable telemedical tool for specialists to review and control patients' evolution through web interface, being able to advice or asks a patient for an appointment at any time.

Conclusions

The concept of success on telemedical applications is based on several items, such as the technological innovation, social acceptance, rentability, persistence in time, health benefits achieved and the multiplier effect that generates new experiences elsewhere.

The limited functionality of SMS will be overcome when MMS technology reaches to a critical mass of users, allowing for exchange text, images and video, facilitating applications in health environment, under HL7 standards [5, 6, 7]. This will be impelled with the recent expansion of UMTS technology and 3G mobile units. Further steps will include a larger number of users to test system scalability.

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Monitoring Emergent Remote Care and Treatment Market

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Abstract: **This paper describes the start of the EU-SIMPHS-project. The Strategic Intelligence Monitor on Personal Health Systems will monitor innovation and market dynamics of PHS within Europe, in order to support the European Commission in understanding diffusion and uptake of PHS. This paper describes the basic elements of the SIM.**

Introduction

Personal Health Systems are a relatively new 'phenomenon' in the eHealth environment. The PHS2020, a recent EU-project dealing with the development of a EU roadmap of PHS, defines PHS as follows [1]: "Personal Health Systems (PHS) assist in the provision of continuous and personalised health services to individuals regardless of location for various purposes including lifestyle management and prevention, early diagnosis, treatment, and disease management. They include both solutions aimed at fully empowering individuals' "respons-ability" of self-caring and solutions supporting collaboration between individuals and healthcare professionals and organisations.". PHS are part of Telemedicine, which by itself is part of eHealth [2]. Today, PHS only captures a small part of the 21 Billion Euro eHealth market [2]. But this is expected to grow considerably, PHS being central to the paradigm change which is taking place within health care, due to socio-demographic changes and economic pressure on health care resources, both in terms of staff and budget. Notwithstanding its apparent promises, the existence of many pilots and trials, and the increasing evidence pointing at the benefits of PHS, a real market has not yet taken off [3-5]. Although a relevant barrier is to be found within technology (standardisation and interoperability) the main difficulties encountered relate to legal and regulatory constraints as well as organisational hindrances [2]. In this context, and in order to support the realisation of a lead-market in eHealth, the European Commission has requested the EC Joint Research Centre Institute for Prospective Technological Studies to set up a monitor which follows the innovation and market developments within PHS.

Innovation dynamics

The project only started at the beginning of 2009. Its aim is to study the Remote Patient Monitoring and Treatment (RMT) market during its first year while setting up the necessary tools for the strategic intelligence monitor (SIM). The conceptual framework of the SIM is based on a neo-Schumpeterian analysis of innovation processes. Product innovation (innovation of goods and services), process innovation (new or improved ways of organisation the production of a good or a service), organisational innovation (new or improved management structures, routines and work practices), institutional innovation (new or improved habits, norms, rules, and laws) and market innovation (new or improved markets) will be studied [6]. Barriers with respect to the diffusion of innovations may occur in each of these 'innovation angles' and may be a hindrance to the transition from emerging services such as RMT towards a real market.

Innovation within the health domain needs to be understood in the context of complex structures of firms, health care centres, public authorities and patient organisations. The function of such a system of innovation is to pursue innovation processes, i.e. to develop, diffuse and use innovations [7]. Within this system of innovation we discern three types of networks: a business network consisting of suppliers, system integrators, service providers, medical practitioners and patients, a knowledge network which also includes knowledge centres, standardization organizations, consultants and health care authorities and a regulatory network which adds the various administrative layers (local, regional, national and EU) to the system [8]. The monitor will use the systems of innovation approach in order to shed light to the distinct forms of barriers that have been identified in various (policy) documents but that require more in-depth exploration, so as to improve the understanding of the dynamics of change within the networks and the actor strategies and identify successful innovation trajectories.

Indicators for innovation and markets

Having set the boundaries of the conceptual approach to unveil innovation dynamics, the second step is the identification of indicators which will be used to report our findings. Besides several methodological problems linked to the delivery of reliable figures on the PHS market, robust data concerning categorisation of ICT for health in particular and inventorying diffusion and adoption of ICT in general is scarcely available [9]. The OECD study on Health ICT presents a first selection of indicators which serve as starting point for the SIM (see Table 1, adapted for PHS).

Table 1 – List of indicators, adapted from [9]

1. Access and Availability	
Access to PHS	Readiness
Practices with PHS	Readiness
1.1 Computer literacy skills	
Physicians/Patients with specific levels of ICT skills	Readiness
2. Adoption and use	
Adoption and use of PHS by physicians/patients	Readiness/ Intensity
2.1 Purpose of use	
Practices using PHS	Readiness/ Intensity
2.2 Specific electronic interfaces with other health care businesses	
Practices allowing patient access to web-based services	Intensity/ Impact
Use of certified applications/data exchange standards	Intensity
3. Barriers and Incentives	
3.1 Barriers	
Practices which report barriers to the adoption of PHS, by level of barrier	Readiness/ Intensity
3.2 User satisfaction	
Physicians/Patients reporting satisfaction with use of PHS in practice	Intensity/ Impact
Physicians/Patients with attitudes about success factors of PHS	Intensity/ Impact
3.3 Net benefits	
Physicians/Patients reporting changes caused by PHS on health activities	Intensity/ Impact
Physicians/Patients reporting specific clinical benefits from the use of PHS	Impact

The three categories of issues chosen (Access and Availability; Adoption and Use; Barriers and Incentives) reflect those issues which today have the highest relevance for policy makers, given the state of affairs concerning the introduction of Health ICT. Data sources on the categories mentioned have been identified (though scattered and hardly comparable) for Health ICT. Whether they exist for PHS remains to be explored. As indicated in the OECD study, given the limited availability of data, case studies will have to be used to acquire an initial understanding of the field. Surveys might be one way to collect and aggregate data on the topics mentioned.

With regard to the diffusion and adoption of PHS in Europe, the use of the three types of indicators 'readiness', 'intensity' and 'impact' will be used to analyse the developments in PHS. In settings where PHS is introduced – as a pilot, a test, a field trial, or as real market – we will check the intensity of use (compared to traditional means) and the impact it has on the care process. A systematic analysis of the information already available in other studies will offer a starting point. Market figures will add to an

understanding of the differences in readiness/intensity between European countries.

Initial data categories

Alongside the definition of the conceptual framework and the indicators, a further task is the identification of the data categories in order to populate the SIM. This is closely related to the original research questions which were phrased when formulating the project. The data will be divided into four main categories: products and services (leading to the identification of product-market combinations); actors (firms and public actors; differentiated by disease and by country; alliances and networks); market structure (value chains); and research and development (mainly innovative activities). Data collection on the basis of existing market reports, desk research, interviews and surveys will in the end contribute to populating the SIM. This populated SIM will be used to arrive at an understanding of the innovation and market dynamics of PHS which hopefully contributes to an improved PHS-market uptake, to the benefit of all.

Acknowledgement

The views expressed by the authors are not necessarily those of the EC.

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The Potential Co_2 Emission Reduction from a Mobile Telemedicine System

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Telemedicine has been used for several years and numerous different uses and solutions have been described in the literature. However, few assessments of the CO_2 emission reduction potential for different telemedicine solutions have been made. For this work a simplified Life Cycle Assessment (LCA) has been carried out in order to assess the CO_2 emission reduction potential for a possible mobile push and forward telemedicine system. The patient group selected for this assessment is elderly with leg or foot ulcers assisted by homecare nurses. With a telemedicine system the homecare nurse can capture and transmit digital photographs, videos, sound recordings and text from the patient's home to a general practitioner (GP) using a mobile phone with digital camera. The GP can view the material and respond to the homecare nurse using a voice or text message or call the nurse for medical counseling. The GP can also refer the case to a colleague. Based on previous studies (Binder et al. Teledermatological Monitoring of Leg Ulcers in Cooperation With Home Care Nurses; Arch Dermatol. 143(12):1511-4. 2007) it is assumed that approximately 50% of the conventional face to face consultations can be replaced by appropriate teleconsultations with maintained medical results and quality of care.

In this assessment statistics and data for an average Swedish homecare patient was used. The average distance of a patient transport in Sweden is 25.3 km and for this patient group most transports are by taxi. It was assumed that the number of yearly consultations with the GP can be reduced from 12 to 6 which will directly reduce the number of patient transports to and from the clinic. This would result in an average transportation reduction of 300 km/year for one patient and also reduce CO_2 emissions. However, the telemedicine system itself consumes energy and this energy can also be translated into CO_2 emissions.

The CO_2 emission reduction will be 65 kg/year due to transportation reduction for an average patient. The increase in CO_2 emissions due to manufacturing and operation of the telemedicine system is 2.6 kg/year for 12 consultations. The yearly CO_2 net reduction when introducing this telemedicine solution for an average Swedish homecare patient with leg

wounds is estimated to be 62 kg. Consequently, approximately 20 times more CO_2 is reduced due to less travel than added by the introduction of telemedicine.

In Sweden with a population of about 9 million approximately 33 000 patients are treated in their homes for leg and/or foot ulcers. If mobile telemedicine would be introduced nationwide for this entire patient group the total CO_2 reduction would be 2100 metric tons yearly with a resulting total transport cost saving of about 8.4 million Euros.

The potential for mobile telemedicine from a medical perspective is huge and as shown in this study the potential to reduce the environmental impact is also great. It is important to point out that the given example is limited to only one of many care processes where mobile telemedicine can be introduced to reduce CO_2 emissions.

Keywords: Life Cycle Assessment, LCA, m-health, CO_2

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The Role of Telemedicine in Long Term Care Facilities

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Abstract: **The last decade has witnessed an increased demand for intensive care unit (ICU) beds. Long Term Acute Care Hospitals (LTACH) have emerged as a new paradigm to assist in caring for long term critically ill patients, while assisting to decompress the demand for ICU level of care. The patient population of the LTACH is patients who require aggressive pulmonary management, extensive wound care management, other medically complex patients such as those recovering from cardiothoracic surgery, organ transplants and left ventricular assistive devices (LVAD). Challenges to LTACH admissions include a lack of knowledge regarding the level of care LTACH's provide patient apprehension about transferring to an outside facility, and the perceived inability of the critical care physician to participate in the continuum of care. In an effort to resolve these challenges, the University of Pennsylvania Health System partnered with Good Shepherd Penn Partners (GSPP) to introduce a telemedicine ICU in the long term acute care facility. This presentation will discuss the components of the telemedicine system including how the nurses and physicians utilize the software to identify early, subtle changes in a patient's condition and work in collaboration with the bedside staff to impact patient care and improve outcomes. Use of an eICU® mobile device and a bi-directional telemedicine consultation room to enhance physician access and communication will also be discussed. The installation of a separate work center serves as a consultation room allowing for hospital physicians to remain in contact with the physician and offer input into care. Through the use of this telemedicine program, there has been a reduction in the number of discharges or acute send-outs for a higher level of care. Initial outcomes demonstrate that telemedicine in LTACH's is a viable solution to providing a seamless transition from ICU to LTACH level of care.**

Keywords: telemedicine, long term care facility, mobile healthcare, remote patient monitoring

Introduction

Long Term Acute Care Hospitals (LTACH) have the ability to provide care to medically complex patients. However, LTACH's are faced with many of the same challenges that exist internationally with the decreased supply and high demand for Intensivist's and the nursing shortage [1]-[2]. An e-ICU® program provided an opportunity to optimize the clinical arena with telemedicine as the practical solution for an LTACH population. Integrating the e-ICU® program into the LTACH presented several benefits as well as unique challenges.

e-ICU®

Historically telemedicine has been used in a variety of ways to offer support, medical consults, and to provide a continuum of care for patients and medical staff. Once such use of telemedicine is the eICU® which is a safeguard or an additional layer of protection for Intensive Care Units (ICU). The e-ICU® concept was originally developed to combat the Intensivist physician shortage in ICU's but has been adopted in other care environments such as Post Anesthesia Care Units (PACU), LTACH's, and Emergency Departments [3-5].

The e-ICU's® is emerging as a viable solution to aid in safety and quality of care for intensive care patients. An eICU® telemedicine system allows physicians and nurses to closely monitor patients from a remote location. The e-ICU's® use data streams from physiologic systems, ancillary systems, intelligent decision support and data mining tools integrated with an electronic medical record to permit coverage of large numbers of geographically remote patients from a central physical location. The technology leverages nurses and Intensivist's around a designated set of work hours strategically defined to support hospitals during hours of vulnerability [3]. These intelligent technologies channel critical care and hemodynamic data to the appropriate clinicians at the appropriate time to proactively impact patient care. The immediate benefit to using this innovative and effective technology is that critical care units are improving patient care in the face of an increasing Intensivist and nursing shortages [1-2].

The e-ICU has the distinct advantage much like that of a panoptical where the flow of historic and real time data continually flows. The ability to have data and patient information centrally located through the eICU's® electronic data system, coupled with interfaces allows physicians and nurses to intelligently intercede for the patients benefit using smart alert systems [4]. The benefit of transparent data flow allows for the entire care team,

whether physically located on site or remotely, to improve communications that positively impact on the patients care [3].

Long Term Acute Care

LTACH's evolved in the 1980s in response to an increased demand for ICU beds and an inability or lack of step down units to care for these patient populations. There are approximately 385 LTACH's in the United States [6-7]. Typical conditions or diagnoses for LTACH admission include but are not limited to ventilator weaning, skin ulcers or wounds, long-term antibiotic therapy, and stable but complex medical conditions. Historically these patients are ICU outliers with an increased length of stay. Medicare rules for LTACH's indicate that the average length of stay must be greater than 25 days [6-7]. Acute care facilities often do not have the multidisciplinary teams and resources to optimally provide care for these types of patients whereas in an LTACH resources are optimized.

Challenges in LTACH

Some of the most pressing challenges impacting patient care aside from the above mentioned human factor shortages is ensuring the transparency of data flow, it was reported [3] that the eICU® impacted positively on decreasing patient length of stay and infection rates. Decrease in these measures increases the return on investment in an ICU setting but these outcome measures remain to be seen in the LTACH environment. One documented eICU® impact on the LTACH has been the ability of the eICU® to provide oversight in the management of patients without needlessly transporting patients to a higher level of care. LTACH's operate under stringent guidelines around patient length of stay that impact payment structures to the LTACH's. The financial implications to send a patient to a higher level of care has a significant impact on the return on investment compared to the costs to institute an Intensivist led telemedicine program that can effectively manage patients within the LTACH structure [6-7].

A number of approaches have been employed to combat the Intensivist shortage. To date, efforts to decrease the Intensivist shortage, primarily with ICU support in mind, has lost ground in terms of supply and demand with some estimates indicate a 48% shortage by the year 2020 [1-2]. This reduction in physician workforce has allowed for one such LTACH to creatively utilize the eICU® telemedicine services and institute teleconsulting as a means to provide consultation for the unit's medically complex patients.

Benefits of Integrating an e-ICU® Program in an LTACH

Integrating an eICU into a LTACH enhances a culture of safety within the hospital. Clinicians in the Clinical Operations Room (COR) track compliance with evidence based practice for stress ulcers, ventilator bundle, sepsis bundle, low tidal volume ventilation, deep vein thrombosis prophylaxis, transfusions parameters, glycemic control and beta blocker usage. Processing large volumes of information in real time allows both the eICU® clinicians located in the COR and bedside clinicians to identify harmful trends in a patients' status. Recommendations are made by the critical care nurse or the Intensivist in the COR to the bedside nurse that initiates a proactive intervention. The COR team may be consulted by the bedside nurse or a hospitalist to discuss any complex LTACH patient from the room or in a designated consult area. The LTACH is meeting or exceeding national benchmarks in infections rates, falls, and response to alarms.

A mobile e-ICU® unit was integrated into the hospitals' Rapid Response Team (RRT). The e-ICU® mobile unit is used with all patients housed in the building and not a part of the LTACH. Patient rooms throughout the building can be connected via a landline port to the eICU® mobile unit allowing other patients access to the clinical expertise of the Intensivist and critical care nurses working in the COR. Safety promotion, service excellence and evidence based practice were deciding factors in developing this model of care.

Hospitalists and a Critical Care Pulmonologist cover the LTACH seven days a week during the day for twelve hour shifts while night time coverage is provided by the e-ICU® Intensivist. Research demonstrates the strength of the Intensivist model in optimizing and improving patient outcomes [1-2].

Consults with a specialist or the patient's primary physician using the eICU® mobile unit in a patient's room promotes communication across the healthcare continuum. The consultant or primary care physician at the acute care hospital or from their personal computer can communicate with the patient by way of a bidirectional AV feed and patient's can converse and see the consultant. Physicians across the health system have the ability to follow a patient from preadmission, hospitalization, discharge and rehabilitation which increased patient, family and physician satisfaction.

Comment

A night time Intensivist model of care is not feasible for most LTACH's due to scarcity of the resource and expense of this care model. However,

this LTACH found this model cost effective because of the reduction of inappropriate transfers, improved outcomes, healthcare providers, and patient/family satisfaction. The e-ICU® model of care in a LTACH is a viable solution that can provide a second layer of protection during the day while protecting the patient's during the most vulnerable time period at night. An e-ICU® can assist a LTACH in ensuring safety standards, service excellence while maintaining research based practices and processes.

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Joe DiMartino, a graduate from Temple University School of Nursing in Philadelphia, Pennsylvania, has worked as a trauma critical care nurse for over 3 years and has been a nurse for 1o years. Joe now serves as the Penn E-lert's Outcomes Coordinator and is responsible for effecting patient outcomes through clinical inquiry and quality initiations. Joe is also responsible for educating all staff about the function of the online documentation system and how it plays a vital role with Penn E-lert. Joe is currently pursuing his Masters Degree in Clinical Research Trials from Drexel University.

The Use of Telehealth Resources for Qualifying the Care Provided by the SAMU of Belo Horizonte, Brazil

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Abstract: **This project was proposed to deploy in the SAMU (Mobile Emergency Service), of the metropolitan area of Belo Horizonte, the use of resources of telemedicine to qualifying and expedite the process of providing assistance to patients by SAMU and to allow greater interaction between emergency units and pre-hospital system.**

The project was structured into five distinct steps: (1) discussion of tele-emergency project to be implemented in the metropolitan area of Belo Horizonte with French partners and the Brazilian Ministry of Health; (2) assembly of network infrastructure aimed at transmission of vital data in real time, including the mobile units and units of the SAMU, located in the municipalities, where the project will be deployed; (3) specification and procurement of equipment for telemedicine (tablet, ultrasound, multifunction monitors) and geo-processing, which comprise the Basic and Advanced Life Support and Units, the SAMU headquarters and the work stations of different structures in hospital responsible for monitoring patients in the pre-hospital care and (4) deployment and training of teams of one mobile unit, which transmits the data to the regulating doctor and the Rizoleta Neves Hospital. As a result, the pilot project is currently in stage of implementation, with preliminary assessments, indicating a positive impact on the care provided to patients.

Introduction

The experiments related on the telemedicine use in pre-hospital care are virtually nonexistent in Brazil. The Belo Horizonte City Department of Health and the Federal University of Minas Gerais with successful experiences in the formulation of a telehealth model for primary care united with European partners, like France and Italy, made a telemedicine project

in SAMU, applied to Brazilian reality, from existing practices in Europe. The project aims to incorporate telemedicine features for pre-hospital care provided by SAMU in Belo Horizonte, to streamline and improve the patient care process and allow greater interaction between the units of emergency care and pre-hospital system. It has the following specific objectives: 1) To provide the pre-hospital care units with medical equipment, which allow to collect and transmit information about users' health, 2) To allocate mobile telecommunication resources to enable the Medical Regulating to access the patient information online, facilitating the process of decision making and clinical guidelines needed to care, 3)To install in hospital references units work stations to receive data and medical images of pre-hospital performed, 4)To incorporate in SAMU central technological resources that enable collection, receiving and transmitting data and care images of patients who are under pre-hospital care.

Methodology

The structuring of the project happened in five different moments: (1) The discussion of the telemedicine model to be implemented in the metropolitan area of Belo Horizonte, involving the partners like French SAMU and the Ministry of Health, (2) The assembly of the network infrastructure to the vital data in real time transmission including the mobile units and units of the SAMU emergency located at the city, (3)The specification and purchase of telemedicine, geoprocessing and data equipments that comprise the Central of SAMU, the Basic and Advanced Units of life support and the different structures responsible for the monitoring of hospital patients in the pre-hospital, (4) employment and training of the staff of mobile units of Central SAMU and reference hospitals in the pilot project (University Hospital Risoleta Neves, Municipal Hospital Odilon Behrens and Julia Kubstchek Hospital, (5) Development and application of assessment methodologies, using comparative method - the mobile units that have deployed the resources of telemedicine will be compared with units that do not yet have the system. The variables to be monitored will fall into the following dimensions: agility of care, impact on morbidity, interaction between the care processes from pre-hospital structure and emergency care system. Phase 5 has not been applied in the pilot project presented, whose official launch was in November/2008.

After carrying out visits in French SAMUs to understand the model in operation in that country, a workshop was organized to define the scope of project. This workshop had participation of French Ministry of Health and SAMU in the metropolitan area of Paris, emergency and urgency coordination of the Ministry of Health; Medicine College from Federal

University of Minas Gerais, the Belo Horizonte City Department of Health and Prodabel.

The scope defined in the workshop include the following items: multi-parametric monitor of vital signs (using the following parameters: sphygmomanometer, thermometer, 0^2 and CO^2 digital measure, glucometer, electrocardiogram), automatic external defibrillator; Frontline Tablet in the Units and Basic Support. On the Units in Advanced Support, beyond the equipment described above is added to the Ultra-sound equipment and more: an apparatus for intra-cranial pressure and capnography in noninvasive multi-parametric monitor.

The technological structure used for the implementation of the Tele-urgency project was developed for the clinical data generated within the ambulance could arrive in sync with the regulatory unit and in the same way could be routed to the nearest hospital for treatment and care. For this, the ambulances will be equipped with 3G modems connected to a notebook that affect the speed of 1 mega to download and an average of 100 kbps for upload. These modems work as a GPRS / EDGE in the outside areas of the 3G coverage, thus solving problems of connectivity during the expansion of this technology in Belo Horizonte. The notebooks have received the information generated by multiparametric monitor connected bluetooth via and USB via ultrasound sending data in real time. Moreover, the ambulance also enabled the transmission of voice and video directly from the local service using 3G technology.

For the information security, it was implemented a VPN (Virtual Private Network) that will take the information generated by ambulance directly to the intranet Municipal Informatics Network (MIN/RMI).

Through a firewall implemented exclusively for this project, this information will be sent to a file server located in SAMU. This server shall operate throughout the data entry system to the governor and immediately after the notification will send these files to a database for storage.

With the entry into operation of the USB of telehealth feature, the central service already receives the data sent to SAMU integrated management system. The regulator reviews the data and guides the care service performed by teams of pre-hospital system. The data of the ultrasound images are also displayed. After the arrival of these parameters and analysis of the case, the regulator doctor decides which hospital has the appropriate level of complexity and sends an ambulance and the data for the emergency unit team who will receive the patient. Currently, the project is located in 2 SAMU units as pilot.

The experience of this pilot has shown so far results similar with different countries, with the characteristic of involving a single project in a range of medical equipment that provides for regular medical access to relevant care information to different parameters. This process, complex of technological point of view, has allowed an important qualification in the care provided to patients, adding gains already identified in other experiments of telehealth resources incorporation. Also, a study from the University of Massachusetts [1], using some of these solutions, concluded that the use of telehealth enhances the support to trauma quality and may potentially reduce morbidity and mortality. Others have reported similar results [2-11].

In summary, the project located in Belo Horizonte innovates concentrating a number of telemedicine resources and make them available for pre-hospital care, with specific gains in relation to the quality and efficiency of care provided.

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Session 5

eHealth and Image Transfer

A Study to evaluate Dose values of Computed Tomography in Luxembourg 2007

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Abstract: **Computed Tomography (CT) contributes up to 50% of the resultant collective dose from diagnostic radiology. In the year 2007 a study to evaluate dose values of CT was performed in Luxembourg. In comparison to the reference dose values established in Luxembourg, the results showed slight increase in several protocol types. Actions to overcome this problem and to optimize the different protocols will be carried out. To sensibilise and involve all involved professions, a symposium was organized. An internet platform with dose related information was developed. The platform provides updated information, resources and a contact point for all CT dose related questions.**

Introduction

At the beginning of Computed Tomography (CT) the primary concern was to develop new standards for scanning protocols. The priority in dose aspects was low [1]. Today CT contributes up to 50% of the resultant collective dose from diagnostic radiology. Therefore it is recognised as a high dose modality. In 2007 the Radioprotection department of the Ministry of Health, the Federation of Radiologists and the Public Research Centre Henri Tudor investigated in a CT dose study for Luxembourg to raise the awareness regarding this topic and give an overview of currently established dose values in Luxembourg.

Material and Methods

The first step in this study was the collection of the data using paper-based questionnaires. Luxembourg has nine hospitals with radiological departments and eleven CT scanners, five General Electric CT scanners (Waukesha, USA) and six Siemens CT scanners (Forchheim, Germany). The assistant medical technician (AMT) in the different radiological units randomly collected about 1400 sample patients. For each of the protocols head, facial bones/sinuses, lumbar spine, chest, abdomen and cervical spine

data of at least 15 patients has been collected. The information of the individual scan protocols in the questionnaires was used to assess the dose values. CT Expo [3], a Microsoft Excel application to calculate dose values in CT, considers all existing scanner models including correction of scanner-specific influences. With CT Expo the relevant dose values for each sample was calculated. The relevant dose values are weighted Computed Tomography Dose Index ($CTDI_w$), effective Computed Tomography Dose Index ($CTDI_{vol}$), Dose-Length Product (DLP) and Effective Dose (E). The mean dose values of the six considered examinations have been calculated and assessed.

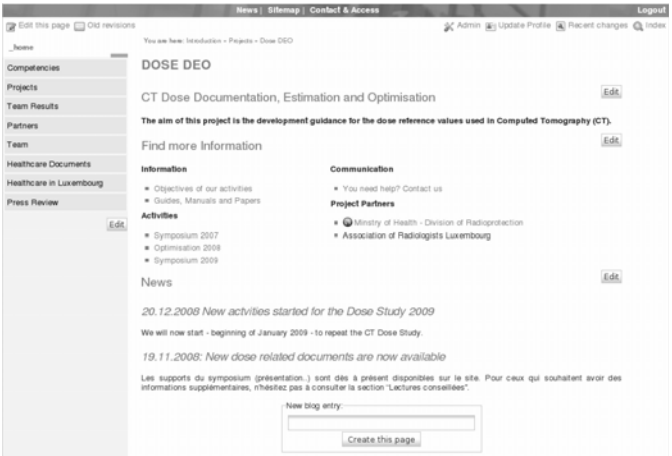

Fig. 1: Internet platform provides information about the Study 2007

An internet platform (Fig. 1) has been developed to communicate with the different professions involved in the project. To enable easy, fast and multi-user access for updates and news entries, wiki [5] technology was used.

Results

The $CTDI_w$ is conforming to the reference dose values in Luxembourg (Fig.2). In several cases, the DLP had been slightly increased (Fig.3). Besides other reasons, the increased dose values have been:

- The used current and the sampling time was increased
- The pitch was smaller than one
- Contrast agents have been used (results in additional series)
- The scan length was long.

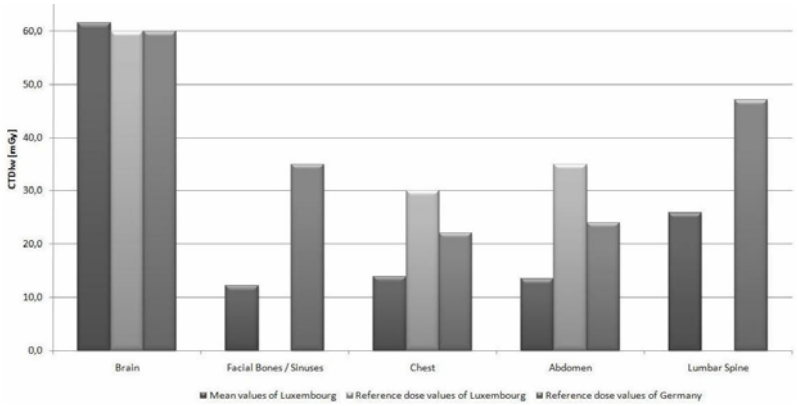

Fig. 2: Mean CTDIw of all examinations in comparison with reference dose values of Luxembourg and Germany

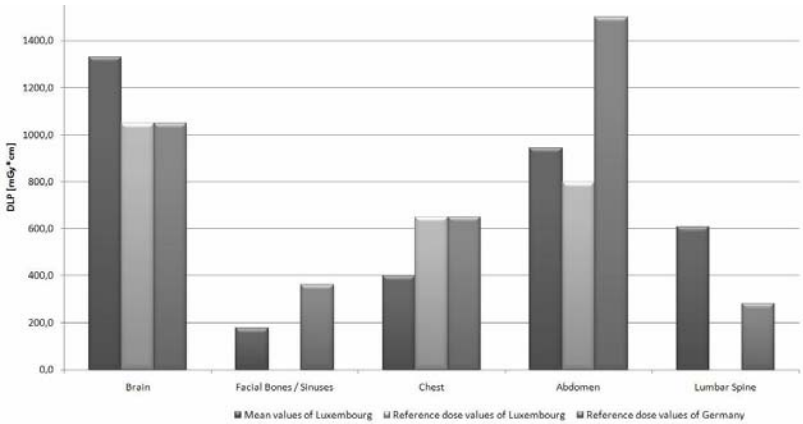

Fig. 3: Mean DLP of all examinations in comparison with reference dose values of Luxembourg and Germany

The mean Effective Dose per hospital is 9.5 mSv. This is a significant increase compared to Effective Dose values 15 years ago [2]. Due to improved tube loading capacity, the user is able to adjust the scan settings to higher dose values and larger volumes.

Conclusion

The reference dose values of Luxembourg are based on the European Guidelines on Quality Criteria for Computed Tomography EUR 16262 [4] of the year 1999. Today the reference dose values of 1999 are not

representative, because in the last years the technical development of computed tomography was a rapid progress. These days with this highest level of development it is possible to obtain images with high image quality and low dose. Therefore an optimisation is mandatory needed.

This optimisation is not only necessary on technical level, more important is the review of the deployed protocols for the different standard examinations: A radiologist specialised in radiation dose optimisations has to review the protocols and suggest optimisations without sacrificed diagnostic accuracy. This task can only be performed in collaboration with the local radiologist and the AMT.

A well visited symposium discussed the results of the study with all involved professions. Dedicated information, developed by technical and medical experts in CT optimizations, was made available to the Luxembourgish hospitals to provide them with means to optimise their systems. All information during the process are available at a newly developed web platform. This includes not only the data measured, but also tries to raise the awareness of dose related questions in general.

To further increase the awareness for dose related questions and to ensure a continuous optimisation, dose values will now been reported yearly. The next study will be this year in 2009. To present the results in comparison to this study again a symposium will be organised. To assist the hospitals in collecting the data of the different scan protocols, a computer supported data acquisition is planned for the future. In this scope a project started to develop this tool in close collaboration with the Ministry of Health and the Research Institute Henri Tudor.

Acknowledgment

The authors would like to thank the ATMs, the IT specialists and the radiologists of all Luxembourgish hospitals for their help during the study.

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Concept and Strategy for a National Quality Assurance Programme in Medical Imaging

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Abstract: **It is important to establish adequate quality assurance measurements in medical imaging. There are two different levels of mandatory tests in Luxembourg: Level A tests are performed by the hospital staff and Level B tests, which represent complex tests, are performed by a group of medical physics experts. In a joined action, all involved parties work on the development of automatic reading to standardize and facilitate the evaluation of phantom measurements. The already established procedures and phantoms can now be evaluated with the software package Optimage with a minimum of manual interaction. Furthermore Optimage provides documentation, result statistics and reporting features for the taken measurements.**

Introduction

In diagnostic imaging the ALARA ("As Low as Reasonable Achievable") principle requires the accurate configuration, proper use and faultless operation of medical imaging devices. It can not be tolerated that wrong diagnostics or repeated exposures are performed due to insufficient image quality or faulty imaging modalities. Therefore it is very important to implement an adequate quality assurance program.

Image quality on radiation equipment is tested using dedicated phantoms. These phantoms are built of materials, which have similar absorption than the human body and allow a quantification of different important image quality parameters. Tests are mandatory and compulsory by law in Luxembourg. This includes two test levels: Level A tests, which are performed by the hospitals, are frequent tests that are easy to perform. Level B tests, which are performed by a group of medical physics experts at the Entente des Hôpitaux Luxembourgeois (EHL), are more complex and test advanced imaging parameters. Both types of tests are supervised by the department Radioprotection of the Ministry of Health.

During the last 4 years, the Centre de Recherche Public Henri Tudor, the EHL and the Ministry of Health work on a multidisciplinary project to standardize the test procedures, to support the evaluation with automatic reading and proper documentation of the tests for Level A.

Materials and Methods

The software package Optimage (see screenshot in figure 1) is implemented in Java [1] technology and is using ImageJ [2] based image processing and several other open source libraries [3]. The package supports the automatic evaluation of phantom images taken on CT, MRI, nuclear medicine, digital radiography and digital mammography equipment. During the automatic evaluation the software segments the supported phantom images into different measuring areas.

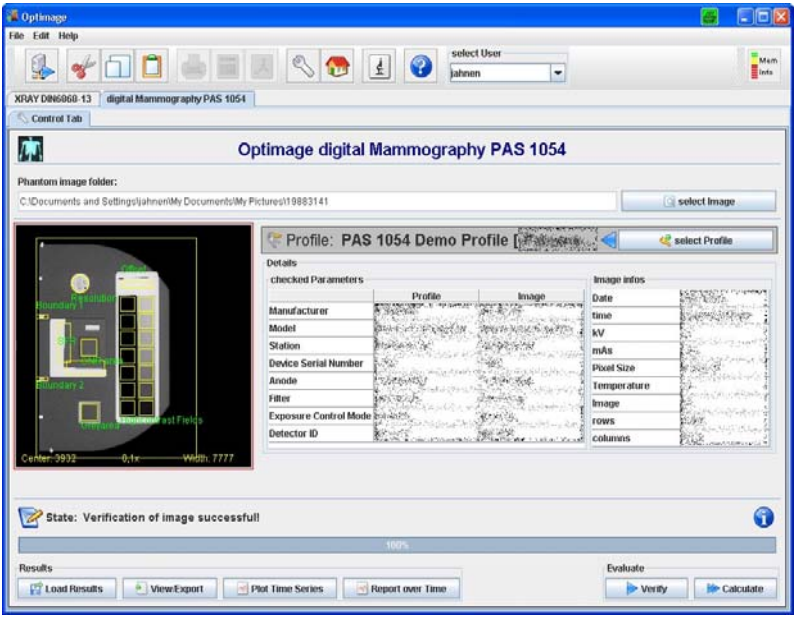

Figure 4: The Optimage Software package in action: The loaded mammography phantom image is correctly segmented and ready for evaluation

This enables the calculation of the different image quality parameters like noise, high and low contrast, spatial resolution, distortion, etc. depending on the modality. For every test, already established methods and regulations have been chosen that have standard phantoms available on the market. These calculation results are documented in a central database and compared to deposited reference and tolerance values.

Despite of the support and usage of Optimage, the institutions are still accountable regarding the mandatory tests. Therefore, every institution deploys its own database containing the measurement results: They cannot transfer their liability to software. The taken measurements need to be validated and verified regularly. Based on this, yearly or even monthly reports are supported to enable an easy supervision by the Ministry.

Results

It was complex to implement the segmentation of the phantoms, due to different phantom models of different vendors and due to unique characteristics of machines from different manufactures. The important thing was to have enough phantom images, which have been taken under practical conditions to implement robust phantom segmentation.

Figure 2 gives details of the supported tests and the measured parameters to date.

Module	Test procedure	Phantom type	Measured parameter
CT level A	Basic measurements	Manufacturer phantoms	Noise, SNR, homogeneity, CT numbers (water, air)
CT level B	CATPHAN Manual[3]	CATPHAN 500	Noise, SNR, homogeneity, CT numbers (air, LDPE, acryl, teflon), low contrast, resolution, pixel size, slice thickness, table incrementation
MRI level A	IPEM recommendations[4]	Standard bottle phantom	Noise, SNR, homogeneity
X-ray level A	DIN 6868-13[5]	DIN 6868-13 phantoms	Noise, homogeneity, low contrast, resolution, dynamic range, collimation
CDRAD	CDRAD Manual[6]	CDRAD phantom	Number and position of detected points
Mammography level A	European Guideline[7] and PAS 1054[8]	PAS 1054 phantom and PMMA block	Noise, SNR, CNR, grey-area reference, homogeneity, resolution, dynamic range, boundary
Mammography level B	European Guideline[7] and PAS 1054[8]	PAS 1054 phantom with LCD24 insert	Noise, SNR, CNR, grey-area reference, resolution, dynamic range, boundary, low contrast detail
Nuclear Medicine level A	DIN EN 60789[9]	No phantom needed	Intrinsic non-uniformity

Figure 5: Currently available modules/tests [1]

The clinical trial showed a good acceptance in the hospitals. The users appreciated the automatic evaluation and the comfortable documentation feature of the software. All tests and modules use the same workflow. This makes it easy to get used to this new way of working. It was crucial to train

people to take valid phantom images. For example, the software does not accept phantoms that are placed lopsided on the detector.

The software is available as open source at the project homepage [3].

Conclusions

During the implementation of the project we have been able to show that the proposed concept is feasible: automated reading and the documentation save time and improve the evaluation service. The developed procedures are used in five Luxembourgish hospitals for several types of modalities. Due to small differences of the phantoms from different vendors and several unique characteristics of different modalities the implementation of a 100% error free automatic reading was a difficult task and is still not finished for all modalities. The communication between the different involved organizations and professions was important during the project. It is essential to take the requirements and needs of these different opinions into account.

Acknowledgment

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About the Author

Andreas Jahnen has a degree in Computer Science at the University of Applied Sciences in Trier, Germany and a Master of Science – Frontiers in medical science – degree from the Open University / UK. His main research interests are medical image processing, especially the evaluation of image quality. He is also interested in topics related to free and open source software.

How Can Teleophthalmology Benefit from the Developments in Three Dimensional Imaging?

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Ophthalmology is a medical discipline that can mostly benefit from the use of telemedicine (TM) developments. Patients' education, diabetic retinopathy screening, retinopathy of prematurity screening and web based eye care consultation are examples of the use of telemedicine in the ophthalmology practice. The Eye Clinic of the University of Regensburg has been a pioneer in instituting a store-and-forward teleophthalmology program in Bavaria (Germany). The purpose of the program is to screen premature babies for the presence of the Retinopathy of Prematurity (ROP). The images taken from a network of retinal cameras located at five neonatal clinics are transmitted to the University Eye Clinic and steps are taken based on a follow-up protocol. The program has received notable national and international recognition and can be mentioned as a success story of teleophthalmology (TO).

TO has the potential of moving towards comprehensive telemedicine programs to include distance learning, second opinion provision, tele-treatment, as well as coaching and/or supervision for ophthalmic surgery. The main limitation for some of these targets is the two-dimensional format in which the digital images are produced by the diagnostic and surgical equipment. Ophthalmic surgery is a good illustration. On one hand, the operating microscopes produce three-dimensional images that enable the surgeons to perform interventions in a "three-dimensional world. On the other hand, the digital images captured by the camera and displayed in the screen are only two-dimensional.

A few approaches can be proposed to mitigate this handicap in the case of surgical teleophthalmology. The first option could be replacing the classical camera that captures images from a single viewpoint with a system of two or more cameras that take images from different angles. The images can later be rendered to produce the digital 3D view. This technology is already being used in non-operating microscopes and, therefore, it might be only a matter of time until it is available for the operating microscopes as well. The second approach concerns a fully digital system that is already manufactured. It is able to capture produce 3D images on a screen. The fact

this system produces only digital images, requires a modification in the operation technique, especially the hand-eye coordination from the operating surgeon and assistant(s). These lasts will have to look on the screen instead of the traditional binocular while operating. Both developments need to be followed and their potential use in teleophthalmology training and practice needs to be carefully evaluated.

Key words: Teleophthalmology, 3D imaging, distance learning

About the Author

Erion Dasho, MD, MPH is an Albanian public health expert and ophthalmology resident. He is currently spending a year at the University of Regensburg to research possible opportunities for the use of telemedicine solutions in the benefit of his country's health system. For a few years, Mr. Dasho led the Health Management Information Systems component of a USAID funded project in Albania and the results of the project are now being taken for nationwide implementation by the Albanian Ministry of Health.

Solving Annoying DICOM Problems Using Imagej and the TUDOR DICOM Tools

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Abstract: **In a hospital environment there are often particular DICOM problems that need to be solved. The TUDOR DICOM Tools are a free and Open Source Java library to perform high-level DICOM operations. On top of this library and the ImageJ image processing software, custom DICOM applications can be build without a big effort.**

Introduction

Digital Imaging and Communication in Medicine (DICOM) is the standard for the storage, transfer and the processing in medical imaging. The standard defines the file format to store the image data, a data dictionary for meta information and a network communication protocol.

Today, DICOM is used in most radiology departments for the implementation of Radiology Information System (RIS) and Picture Archiving and Communication System (PACS) to ensure smooth operation and vendor independence. For standard workflows and applications the systems are feature complete and well tested. Besides the normal hospital workflow, for which the PACS fulfill all the needs, there are often particular problems in importing, converting or processing images that need to be solved contemporaneously by providing an in-house solution.

As several applications developed in our department needed enhanced DICOM functionalities, we started setting up the TUDOR DICOM Tools as a Swiss army knife for these kinds of problems.

Materials and Methods

The TUDOR DICOM Tools are a Free and Open Source (FOSS) Java library to perform high-level DICOM operations. They are based on dcm4che [1] version 2, a free Java implementation of the DICOM standard, the Java Advanced Imaging API from SUN Microsystems [2] (JAI) and ImageJ [3] and a public domain image processing program developed by Wayne Rasband at the National Institutes of Health (NIH).

The package is grouped into different parts to allow different DICOM related operations:

DICOM header handling

It is possible to change the DICOM metadata for example to anonymize images or fix metadata related problems. Header data can be used in conditions to take decisions depending on the provided data. Headers can be viewed as text or hex values for debugging purposes. A comparison of headers from different files is possible too.

Opening and writing

The toolkit offers functionality to read DICOM files in various image compressions and formats from a disc or DICOM-DIR file-set (DICOM CD). Images from a kind can be saved as uncompressed DICOM files.

DICOM Store

It is easy to create a lightweight, but standard conforming STORAGE-SCP that is able to receive DICOM objects via a network and store them into a DICOM-DIR file-set or directory.

Sending and receiving

DICOM objects can be queried from a PACS by their patient name, study, series and image UID using the integrated QUERY/RETRIEVE-SCU. A DICOM sender (STORAGE-SCU) can be used to send images to any configured DICOM node in the network.

Viewing images

Additionally it offers components to view DICOM images with features like windowing, zooming, shifting, measuring etc. The Tudor DICOM Viewer, a simple but yet powerful DICOM viewer application (figure 1) is able to display multiple images in several split-screen or multi-monitor configurations. Multiple series can be loaded and managed in the viewer from different available image sources.

The library is written completely object-oriented; most of its components can be used, modified or extended easily. All functions are implemented as ImageJ Plugins as well. This enables the prototyping and testing inside the ImageJ environment. Even the ImageJ macro language can be used to test and prototype quick workflows and solutions.

It also includes a lot of demo applications, which demonstrate the functionalities and give a good hint for own implementations. This includes also the Tools like the DICOM Transcode-Node, a DICOM note that receives images, converts them to another format or anonymizes them and sends them to a PACS, can be implemented with a few lines of code.

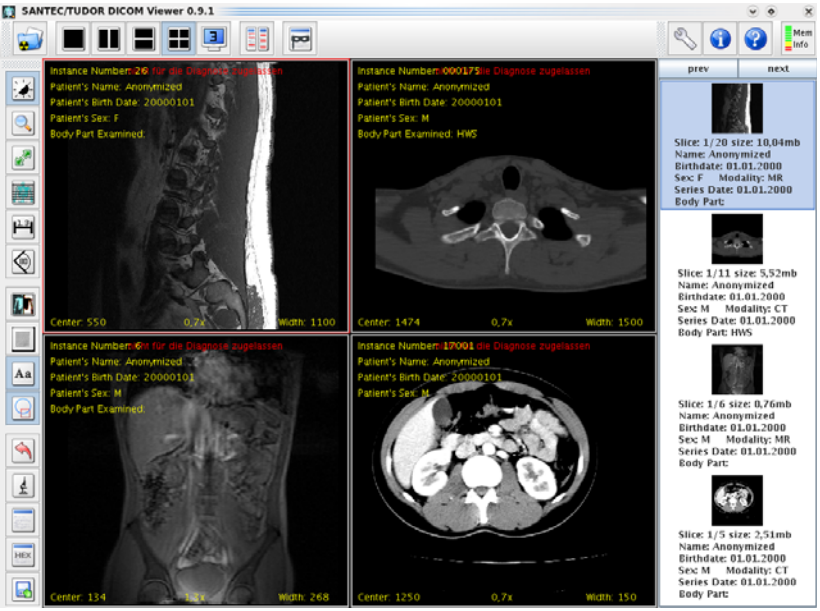

Figure 6: The TUDOR DICOM Viewer

Results and Conclusions

The power and ease of use of the toolkit has been proved in several projects in our center as well as in hospital environments. Custom applications can be tested within the ImageJ environment and then implemented as a Java application. As it provides high level access to the main DICOM features, it is well suited to solve in-house problems and it can be used as a library for custom DICOM applications.

The TUDOR DICOM Tools can be downloaded from our homepage [4] as they are licensed under the L-GPL FOSS license that allows the usage in free of charge and even commercial applications.

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System to Visualization and Measurement of Renal Ultrasound Video

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Abstract: **This article describes a system for visualization; capturing, storage and measurement of images obtain from renal ultrasounds. The goal's system is to contribute in the training in the diagnosis by images and the creation a database with clinical cases.**
The system consist in the integration of a graphical user interface (GUI) that has a visualization library "Visualization Tool Kit (VTK)" with a peripheral equipment for videos capture, a ultrasound equipment and a computer. The work protocol as fallow: the doctor performed the ultrasound study of the patient and it's stored in real time in a computer. The GUI allowed the doctor performs the tasks of: a. visualization of video from the ultrasound, b. capture images or video frames in real time c. measurements of parameters of interest through "widgets" and d. store the information about videos, images, and data of the patient and the medical diagnostic of the study in files.
The video acquisition is done with the peripheral Advantek ATV-U600, the input of the ATV-U600 is connected to the output of the ultrasound equipment through a coaxial cable RG59 and the output of the ATV-U600 is connected to computer's USB port, for communication between peripheral equipment is used a algorithm.
This system was validated in the Teaching Institute of Urology, was assessed technical aspects of design, protocols for using and usability through a satisfaction survey to test users and the test "think aloud". With this assessment the data were collected about to the views and experiences of users when will interacted with the system and suggestions to improve the best practice. This work constitutes a contribution to optimize resources and equipment to diagnostic by images, moreover provides to healthcare professionals a tool to acquire, store and manipulate images for medical teaching or medical diagnosis.

Keywords: medical diagnosis by images, graphical user interface, video measurements, usability.

Introduction

The system was development though the integration of hardware equipment to video capture and a GUI, those facilities at user the task of visualization and record of video signal, capture images from video signal, make measurement of these images and write your diagnosis in text file. All this information is store in files that can review in other session.

Methodology

Capture of ultrasound video signal.

The capture of ultrasound video signal is done with the peripheral Advantek ATV-U600, the input of the ATV-U600 is connected to the output of the ultrasound equipment through a coaxial cable RG59 and the output of the ATV-U600 is connected to computer's USB port.

Design of Graphic User Interface

The graphic user interface (GUI) was development using the visual programming language "Visual C#", additionally using the visualization tool kit library, this consists of a compiled C++ core wrapped with various interpreted languages (Java, Tcl, Python)[5]. This consists in three form or module integrated. The first module is the principal interface, has four task a. initialize a new session, b. learn over the system and c. exit. If the user does the selection in the option "initialize a new session" the GUI show a new window that is used for register the data over the patient and doctor.

When the select the option to initializing the video capture, will see other window with two sections, the principal is locate in the left of the display and show the video of renal ultrasound, at right are six windows uniform distributed this receive the image capture by the user and will make the tasks: a. Capture and visualization of videos signal, b. Capture and visualization of images, c. Measurements of parameter and d. Store of information.

Video Record

When the user capture a video signal, internally the application call the method *AddVideoToWindow*, the input parameter are a object type window create of class vtkRenderWindow this indicate the windows where is visualization the video signal, additionally in this method was used objects created of class *vtkWin32VideoSource*, *vtkTexture*, *vtkPolyDataMapper and vtkPlaneSource*.

Image capturing

The process of capturing image occur when the user doing click in any of six windows secondary locate in right side of the display when the user capture all images, stop the video capture and Initialize the measurement process. In this module was created two methods, the first is named *Photograph*, this capture the photogram of video in any time determined by user using the class *vtkWindowToImageFilter* and formatted with the class *vtkPNGWriter*, have two input parameters the window where show the image and the string to indicate the name of file and the location in the disk. The second is *AddImageToWindow* this permit show the selected image for the user in the window.

Measurement

The next step is doing the measurement, to realize this task the user move the image to principal window and press the button "Realizar Mediciones", the widgets will show over the image and the user can manipulate to adjust the dimensions; when the widget are adjusted the user doing click in button *Ver medidas* and the measurements valor's show in display. It is development two method one is called *Medir* this show the widgets over the principal window to doing the measurement. The second is called *Mostrar medidas* calculate the distant using the method of "Euclidean distant" based in data of vector give by *Medir* method and the *calibration factor* this permit that measurements are approximate at real valor, to this was calculate a factor that relation the measurement in ecograph with the data of the widget.

Stored data

The protocol of work is this: to any patient was created a files identify with the record number CI, inside this file have other files identifying with the date of consulting; additionally a text file contain the data of patient e.g. name, CI, sex, birth day and others. The video files, the images and text file are stores inside this principal file.

Evaluation

This system was validate in the Teaching Institute of Urology, was assessed technical aspects of design, protocols for using and usability through a satisfaction survey to test users and the test "think aloud". With this assessment the data were collected about to the views and experiences of users when will interacted with the system and suggestions to improve the best practice.

Results

The GUI of this system can be see in the figure 1, this is the principal interface, when the user make click in the option “Iniciar Sesion” was display the second interface, in this the user input the data patient an medical. Next step carry to third windows, the user can record a video session, capture images of interest, make measuring over images, write your diagnosis, clear he windows and exit(see figure 2).

Figure 1 Principal interface. This permit at user initializing a new session

Figure 2 GUI to record video signal, capture images and make measurement. The line red and yellow represent the widgets. This are calibrated with respect at ecograph equipment.

Acknowledgements

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Session 6

Telecardiology

New Tele-Cardiology Service for the Regional Healthcare System in Finland

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The paper describes a pilot study made for a new concept of tele-cardiology services implemented in the community healthcare system in Finland.

Satakunta Hospital District takes care of the main part of specialised health care for 225,000 people living in 20 municipalities in Western Finland. Within the district, primary health care is organized by municipalities. The pilot involved Rauma municipality (37,000 people) and a joint group of municipalities from Keski-Satakunta (35,000 people).

The pilot involved the use of Aerotel Medical Systems wireless hand-held electrocardiogram (ECG) recorder/transmitter devices for measuring 1-lead and 12-lead ECG signals, by the regional hospital's medical staff.

Aerotel's Heartline Receiving System (HRS) remote monitoring software application was used in a special centralized configuration that enabled each community clinic to have secure remote access only to the records of its own patients. Thus each clinic can benefit from the full features of tele-cardiology call centre without having to invest the full costs of the infrastructure.

The functional targets in primary health care organizations are those units/ functions nearest to patients and potential patient groups (seniors), first level units without physicians presence totally or partially (evenings, weekends) and home health care settings.

Over 50 nurses were trained to use the ECG devices and receiving application, including a 15 persons home health care team at Rauma. Five primary health care doctors were involved in the pilot as well as three specialists in the Pori Regional Hospital Emergency Department, which were trained to interpret the transmitted ECG signal using the HRS application.

The results so far indicate that the devices are easy to use, the professional 12-lead ECG device was found to be the easiest to learn; while the personal 12-lead ECG device needed a few repetitions in order to adopt the right technique.

The nurses were satisfied with the ECG service and motivated to utilise it. The doctors were satisfied with the quality of ECG signals that the HRS system provides and with easy-to-use parameter and comparison features.

One problem emerged during the first half of the pilot period with the integrity of the process of ordering ECG diagnostics for certain patients, as nurses felt they needed a doctor's referral for taking ECG; However, after gaining experience, during the second half of the pilot nurses were more confident to decide themselves if a patient was in need of an ECG test.

The medical directors were satisfied with the input/ output of the pilot, and acceptable quality diagnostics can be served to citizens even at the first organisational level by existing stuff at a very competitive cost level and without the need to invest heavily in the hospital information system (IT) at the district level.

ECG signals saved in the database can be transferred to Electronic Medical Record (EMR) systems that support the Standard Communications Protocol (SCP) ECG.

Keywords: telemedicine, tele-cardiology, ECG, Finland

Opportunities and Challenges for eHealth in Cardiac Rhythm Management

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Abstract: **Implantation of cardiac rhythm devices (CRD) like pacemakers and implantable cardiac defibrillators is only the first step in care. As a patient's welfare depends on proper CRD function, comprehensive device follow-up and continuity of care are crucial. In the present paper an eHealth infrastructure for data management in the cardiac rhythm management (CRM) domain is presented. Opportunities and challenges for such IT-infrastructures are discussed from the following points of view: clinicians, CRD vendors, hospital IT personnel, and researchers.**

Introduction

Implantable cardiac rhythm devices (CRD) include pacemakers, implanted cardioverter defibrillators, and cardiac resynchronization therapy systems. These devices are usually implanted in individuals with abnormalities in their cardiac electrical system and require accurate long-term follow-up during lifetime. Cardiac implants have been advancing rapidly over the past decades from isolated, stand-alone-devices to sophisticated networked devices with the possibility to transmit diagnostic and therapeutic data from inside the heart using mobile communication technology [1]. The rapidly growing number and the increasing complexity of cardiac implants require new strategies in cardiac rhythm management (CRM) with respect to therapy regime, optimisation of clinical processes, and follow-up.

To tap the full potential of CRM, integration aspects are expected to evolve as the prime catalyst to make therapy management more effective and efficient. Moreover, integrated health care is expected to provide new opportunities to overcome the traditional separation of in-clinic and out-clinic care (e.g. telemedicine / home-monitoring), as well as to improve the quality of care for the patient and the medical outcome, all while reducing costs. Therefore, two major integration aspects have to be addressed:

- *Data integration* refers to accumulation of data from different sources in a central data management system (e.g. electronic health record).
- *Process integration* is essential to provide continuity of care and includes synchronisation and coordination of tasks and workflows between participating sites. This is particularly challenging in complex telemedicine scenarios when the patient is no longer at the site where an action has to be taken.

Methods & Results

To address these integration aspects, the Austrian Research Centers (ARC) have developed an electronic health record for data management in the CRM domain (*EHR.CRM*), witch additionally provides the central communication and collaboration platform for health care professionals [2, 3]. To guarantee interoperability i.e. to allow data exchange between vendor specific programming and home-monitoring systems and the eHealth IT-infrastructure an interoperability framework has been developed. The following IHE Profiles and standards have been considered:

- IHE Implantable Device Cardiac Observations (IDCO) Profile for data exchange between programming devices / home-monitoring services and the *EHR.CRM*.
- IEEE 1073.1.1.3 (Implantable Device Cardiac – Nomenclature) for semantic interoperability within the interacting systems.
- IHE Patient Identifier Cross-Referencing (PIX) Profile to resolve the patient identifier from the implant to the *EHR.CRM*.
- IHE Cross-Enterprise Document Sharing (XDS) Profile for the exchange of clinical documents.
- Clinical Document Architecture (CDA) to summarise device data, observation data, and diagnostic findings in a report. For classification of medical information within the document the ICD-10 and LOINC nomenclature have been considered.

Fig. 1 shows the general IT architecture and the interoperability framework of interacting IHE profiles and standards. In such configuration the *EHR.CRM* provides the central, integrating component to enable data exchange between vendor specific devices and services and the associated IT infrastructure i.e. the hospital information or an electronic health record.

The *EHR.CRM* provides the physicians with a platform for collaboration and an additional link for communication. Moreover, the *EHR.CRM* will serve as the central hub that integrates data from devices, services, clinical information, and data for research.

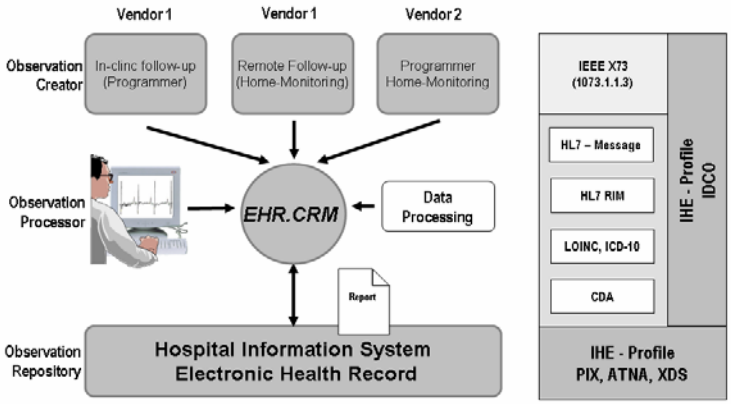

Fig. 1: IT infrastructure showing the *EHR.CRM* as the central component of the interoperability framework.

Discussion

CRM is an expanding area in health care today that combines developments in telemedicine, process optimisation, and integration. Moreover, CRM covers a highly interdisciplinary field involving participants on different care levels in different medical domains. Hence, coordination of workflows and processes is essential to make therapy management effective, safe, and to avoid unnecessary clinic visits.

Today, CRM is based on a very heterogeneous technological environment. Several vendors provide programming systems for in-clinic follow-up and home-monitoring systems for remote device interrogation. These systems operate more or less stand alone. On the other hand there are a lot of different hospital information systems which lack in flexibility for smooth data integration and CRM workflow support.

The proposed IT infrastructure may provide a sound solution for the integration of CRM data and workflows an into existing and future eHealth infrastructures. In such a solution, the *EHR.CRM* will act as subsystem of a distinct IT infrastructure such as an HIS or an EHR.

In the following opportunities and challenges for an eHealth-infrastructure in CRM are discussed from clinicians', CRD vendors', hospital IT personnel's, and researchers' point of view.

Clinicians: For clinicians working with CRD from different vendors, data and information management can be time-consuming and labor intensive. To make CRM efficient and safe, a single entry point for data management

to access information from routine care, telemedicine services, and clinical trials in needed (i.e. a "physicians' cockpit").

Vendors: In future integrated eHealth landscapes CRD vendors will be in charge to provide standardised interfaces for data exchange. However, to speed up the integration-process, to save on money, communication time, and headaches with hospital IT personnel a central integration point – such as the *CRM.EHR* – would be useful.

Hospital IT personnel: Hospital IT-systems often lack the flexibility and the possibility to exchange data with external services. Adoptions are time-consuming and costly. Although most CRD vendors already provide proprietary interfaces for their systems and services, the hospital IT people are not willing to implement specific interfaces for each vendor.

Researchers: Besides the evaluation of the medical outcome of new innovations in CRD technology, future research aspects will focus more and more on health-economic aspects in CRM. To render possible "CRM outcomes research" a combined, flexible IT-system that supports data consolidation from routine care and research at the same time is needed.

Conclusion

Driven by the needs of an advancing eHealth landscape in Europe there is a need for integrated care concepts in the CRM domain. The developed IT-infrastructure based on the *EHR.CRM* may provide a sound solution to meet the requirements and expectation of clinicians, vendors, hospital IT personnel, and researchers.

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Preliminary Stage of the 24/7 Web Telecardiologic Service Project Based on Artificial Intelligence and Fuzzy Logic Algorithms

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Telemedical service project including personal electrocardiographs net, central Web-server and cardiologic consultants provided with access to patient's date on server for 24/7 consulting is proposed. The main project advantages are:

1. Extremely low price for personal 6-channel ECG-device (potentially up to 100 USD per unit) which can be connected to any PC by wired or wireless interface.
2. Special software performs automatic express-estimation of registered ECG and gives recommendations regarding cardiovascular system current status and more in-depth analysis necessity.
3. Special server software performs in-depth analysis (any arrhythmia types, ECG complex form changing etc.) of the patient's ECGs uploaded to paid server. Software is capable to perform automatic recommendations regarding necessity of on-line or delayed consultation with personal doctor or on-line paid consultants accessible by server interface.
4. Server software provides on-line or delayed patient consulting by registered cardiologists. Project know-how are specialists selection system, their multilevel rating system based on wide professional quality estimation and 24/7 access to patient's ECGs and other data.

Some project parts are already realized successfully:

1. Personal ECG device is created.
2. Automatic analyzing software based on artificial intelligence and fuzzy logic algorithms is created and on study stage now.
3. Server software collaborator is selected.

Project developers are looking for European or Asian participant for partnership in project completion and marketing it in world telemedical market.

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Telecardiology and Tele-ECG Network in Ukraine – Achievements and Clinical Efficiency

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Trans-phone ECG transmission was invented by W. Einthoven in 1905. During 1970-1980 a lot of analogous devices were used for this kind of telemedicine, special expert centers had been created. In those times successful usage of "Volna" analogous devices and a few referral centers in Ukraine was reported.

Modern telemedicine network Telecard for digital trans-phone ECG transmissions and telecardiology consultations based on domestic tele-ECG equipment was established in Ukraine in 2004.

National Telecard network consist from: 52 Distant Diagnostic Centers (DDC) which equipped with 57 receivers, 270 sending stations at rural hospitals, 300 - in rural ambulances, first aid stations and cars.

Aims of Distant Diagnostic Centers

Distant Diagnostic Centers have to:

- Receive transmitted ECG;
- Perform timely, high quality teleconsultations (24/7);
- Offer dynamic telecontrol of patients in emergency situations;
- Help in decision making about transportation to referral center or direction of the special medical team to the patient;
- Take part in elearning.

Thus, multilevel digital telemedicine network focused at emergency cardiology care for rural and remote areas worked out.

National Telecard network include a lot of segments, each one consisting of 3 levels:

1) Rural ambulance or car,
2) Community/municipal referral and diagnostic center,
3) Regional referral and diagnostic center.

Every region of Ukraine, and there are a total of 26, has 1-3 such segments.

During 2005-2007 years 28433 ECG records were transmitted. Note, that during 2007 year growth of teleconsultations quantity was 23,6%.

Results

Summarized data about clinical situations when ECG-teleconsultations were used most often are as follows:

- Myocardial infarct or chronic ischemia – 11-63%,
- Different arrhythmias or conductivity disorders – 14-57%,
- Other cardio-vascular pathology – 3-14%.

In addition:

- Non-fatal malfunctions at ECG during transmissions occurred in 1-3% of cases;
- Re-transmission became necessary in 0,5% of cases.

After ECG transmission:

- In 60% of cases - teleconsultation was performed,
- Patient stay in I-II level hospital;
- In 40% - special medical team went to the patient side.

High clinical, management and financial efficiency of National Telecard Network was determined.

Conclusions

According our experience usage of trans-phone ECG transmission with further teleconsultation allows:

- To decrease duration between start of disease and III level care at 3-9 times;
- To increase quality and availability of prompt care in rural areas;
- To organize dynamic clinical control and telemonitoring;
- To perform system thrombolysis and other urgent medical procedures at “golden hour”.

Key words: telemedicine, tele-ECG, telecardiology, network, efficiency, digital

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Wireless Telecardiology System for Rural Areas: A Romanian Experience

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Abstract: **Heart diseases represent one of the most important causes of morbidity and mortality in Europe. This situation is more evident in new EU (European Union) countries like Romania. The necessity of a modern telemedicine system mainly for the patients in rural areas is important, in the prophylaxis of cardiovascular diseases and to reduce hospitalization. The health care system in Romania is characterized by some particular aspects: a centralization of the health care providers, even if we consider the relation urban vs. rural health care; focus of health care providers more in the cities then in the rural areas (despite the fact that the population in rural areas are ageing and the incidence of heart diseases is continuous increasing); migration of professionals to the urban area; the distance between rural areas and high level health care providers (hospitals); nowadays it is noticed a tendency of the population from urban areas to move to the so called residential areas of the cities nearby to the rural areas; finally the mentality and the habits of the population. The main aim of the system is to offer a high level health care to a basically old population with limited mobility capacities. That for we have implemented in a GP office a digital ECG (electrocardiogram) device (Nihon-Kohden 9132K) with 12 leads. The ECG device has the capacity to record data on paper or in digital format that permit the transmission of the ECG signal to a smart phone HP (Hewlett Packard) iPAQ 614/614c and through Bluetooth or VPN (Virtual Private Network) to a server located in the Cardiology Clinic of a Regional Hospital. The 24/7 mode of teleconsulting opens the perspective of an emergency network in rural areas with the possibility to record data at the patients site. The first experimental records and transmissions had a very impressive impact in the local community expressed by the significant increase of the ambulatory consulting in the GP's office and the positive feed-back of the doctors and patients in the same time. The study showed a great impact of this type of health care, with the possibility to record and transmits the data from the patient's site, despite the fact that the role of the doctors in primary care must be more increased by high level health care.**

Major diseases in the European Union (EU)-from cardiovascular disease to neurologic and psychiatric disorders-can take their toll in terms of lost days from work, hospital expenditures, and out-of-pocket costs to consumers. As the population in the EU ages and life spans increase, the incidence and prevalence of major diseases and disorders are expected to significantly impact the European healthcare industry.

Heart diseases represent one of the most important causes of morbidity and mortality in Europe. This situation is more evident in new EU countries like Romania. In Romania, cardiovascular diseases are the leading cause of death, they account for 61% of all deaths and 26.6% of the total disease burden, high blood pressure causes 32% of the total disease burden.

Family doctors act as gatekeepers for the health system. Patients need referral from them to gain access to outpatient clinics and hospitals. Primary care in rural areas is not satisfactory.

The constitution guarantees the right to health; the whole population has access to a basic package of services.

The necessity of a modern telemedicine system mainly for the patients in rural areas is important, in the prophylaxis of cardiovascular diseases and to reduce hospitalization. The health care system in Romania is characterized by some particular aspects: a centralization of the health care providers, even if we consider the relation urban vs. rural health care; focus of health care providers more in the cities then in the rural areas (despite the fact that the population in rural areas are ageing and the incidence of heart diseases is continuous increasing); migration of professionals to the urban area; the distance between rural areas and high level health care providers (hospitals); nowadays it is noticed a tendency of the population from urban areas to move to the so called residential areas of the cities nearby to the rural areas; finally the mentality and the habits of the population.

For all this reasons it is necessary to implement a modern telemedicine and tele-cardiology wireless system that has as goals the following aspects: the prevention of heart diseases, initiations of screening in the population to assess the risk factors for heart diseases, to improve the quality of health care at the GP's (General Practitioner) office, to reduce the waiting time for health care and to reduce the costs for hospitalization. To achieve this ambitious project we have implemented a wireless tele-cardiology system in a GP office in a rural area.

In order for a telemedicine system to be clinically useful, it must have several features including programmability, high-performance, flexibility, and upgradability. It must provide programmable handling and compression of video, audio, and images to support applications ranging from typical video teleconferencing to diagnostic-quality consultations. Programmable

handling of data will allow the system to improve and adapt to changing requirements from continued research in telemedicine.

The development of a telemedicine platform is proposed in this paper. Taking as a reference the user requirements and the client-server architecture, a model of communications that allows a bidirectional exchange of information is reported. Special attention is focused towards the design of communication protocols compatible with that model. The platform is based on a Microsoft Windows environment, and communications are implemented by using sockets (Fig. 1).

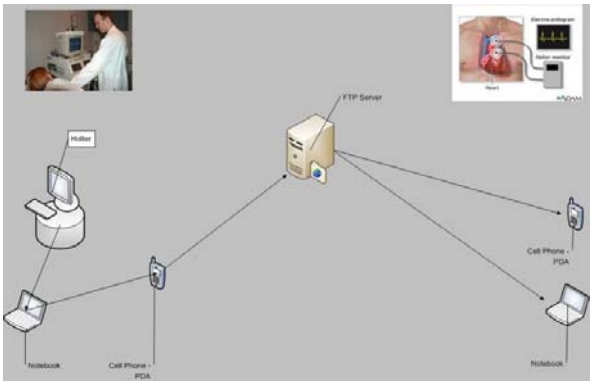

Figure 1. The arhitecture of the wireless telecardiology for rural areas

The main aim of the system is to offer a high level health care to a basically old population with limited mobility capacities. That for we have implemented in a GP office a digital ECG (electrocardiogram) device (Nihon-Kohden 9132K) with 12 leads. The ECG device has the capacity to record data on paper or in digital format that permit the transmission of the ECG signal to a smart phone HP (Hewlett Packard) iPAQ 614/614c and through Bluetooth or VPN (Virtual Private Network) to a server located in the Cardiology Clinic of a Regional Hospital. We use a wide band network (10 Mbps) for the transmission of data.

The system that we had used for these test transmissions consists from a digital ECG device or an ECG Holter monitoring system (i.e. Labtech), a mobile device and FTP server located at a hospital, respectively at a research center.

For a more clearly teleconsulting in the GP's office we have implemented a webcam to offer the possibility to communicate clinical data (history, clinical examination).

The data were transferred by File Transfer Protocol (FTP) via the Internet to the Emergency County Hospital Timisoara, Romania and to a FTP website located at the Polytechnic University of Timisoara (Fig. 2).

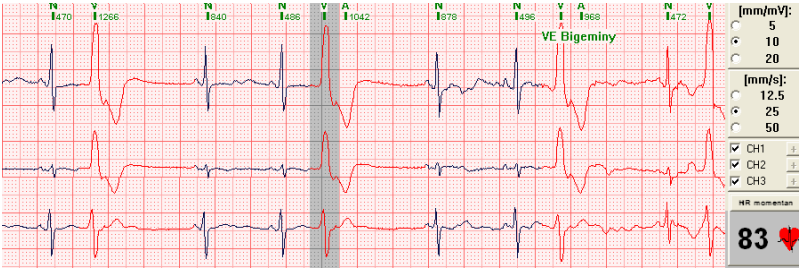

Figure 2. ECG signal sample, recorded from the Holter monitoring system.

The File Transfer Protocol (FTP) is a network protocol used to transfer data from one computer to another through a network such as the Internet. FTP is a file transfer protocol for exchanging and manipulating files over a TCP computer network. An FTP client may connect to an FTP server to manipulate files on that server.

By transferring ECG signal as jpeg images and by implementing an email based sharing of medical data between the general practitioners and the doctors from the hospital (specifically cardiologists) we had proved the value of simply wireless telemedicine system that has as benefit some aspects:

- Rapid access to a central health resources
- Receive specialty care while under direct care of family doctor
- Remain close to home where family provide support
- Reducing the hospitalization care

A low-cost workstation for real-time, interactive telemedicine for many applications is currently possible with existing hardware and software. Video-conferencing and image sharing are just initial examples of telemedicine applications.

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Session 7

Telemedicine in Clinical Trials

Presented by Medifacts International

Home Blood Pressure Monitoring – Insight into Telemedicine in Clinical Trials

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Telemonitoring and tele-healthcare are actively being implemented through health care providers for general patient care, specifically in patients with heart failure, diabetes and hypertension. The transition and implementation of telemedicine in clinical trials provides many benefits to the conduct of the study, but it is important to recognize limitations based upon available technology as well as key considerations for successful implementation of telemedicine in a clinical trial.

The use of Telemonitoring Self Measured Blood Pressure (T-SMBP), allows for remote collection of blood pressure (BP) data from a subjects home. The benefits of implementing T-SMBP include:

A) Electronic capture of BP data – remove transcription errors in diary;

B) Based on trial design, it may be possible to reduce the number of office visits required by the subject;

C) T-SMBP provides for real-time access of the subjects BP data via study web portal. This can include alert criteria process as well as real-time view of data trends and treatment effect.

This session will also review key considerations for successful implementation of T-SMBP within the clinical research environment. In addition, we will provide some case study examples.

This presentation represents the collaboration of the Medifacts' T-SMBP team including: Amy Gallagher, Keith Klischer, Todd Kisner, Priya Vasa, Chris Levinton, Andy Skotak, Raghu Chintala, Lavanya Yedluri, Andre La Follette and Ben Den Broeder (netMedical, et. al.).

Fig. 1 Medifacts

Medifacts' web address is http://www.medifacts.com (Fig. 1).

Key words: blood pressure, T-SMBP, hypertension, clinical research

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Jeff Heilbraun, MS Senior Director, Business Development Medifacts International attended Tufts University in Boston, Massachusetts were he completed his Bachelor of Science degree in Biology. During his studies at Tufts he focused on physiology. Following his studies at Tufts, he received his certification as an emergency medical technician.

Jeff continued his studies at The American University in Washington DC. He received a fellowship from The American University where he completed his Masters of Science in Health Promotion and Disease Management. Jeff's studies focused on exercise physiology and exercise testing. His Masters project resulted in a paper on the comparison of venous versus finger blood samples in evaluating cholesterol. Jeff continued to teach at The American University as an adjunct professor in the Health Promotion program.

Upon completion of his Masters de gree, Jeff joined the Medifacts team and over the last 16 years has supported activities in data management, operations and business development. He has been fortunate to be part of the global growth of the Medifacts International team and organization. Throughout his career at Medifacts, Jeff has maintained his focus on the science and physiology behind cardiac safety within pharmaceutical development, with a special interest in hemodynamics. Jeff has presented posters at the Drug Information Association (DIA) meeting, American Society of Hypertension (ASH), Canadian Clinical Pharmacology Association and recently at the Cardiac Safety Research Consortium (CSRC) where he is presently leading the development of a white paper on the blood pressure safety considerations for non-hypertension compounds.

Session 8

eHealth for Developing Countries and Low Resource Regions

Albania: Managing Referrals through a New Health Information System

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The article aims to describe the present situation and future options for the use of Health Information Systems as a referrals' management tool in the Albanian Health Care System. The Albanian Health Care System continues to be under a reform process. Before 1990, it was organized based on the Semashko model, with rigid centralization being one of its key features.

Despite many negative aspects of a centralized health system, in Albania it represented a rather efficient way for managing the patients' referral.

The desired referral system in the Albanian Health Care can be described as in the figure above. Anyway, due to the failure of the reform measures to focus properly on the patient referral system, it is currently chaotic with the patients presenting themselves at primary, secondary or tertiary level of care according to their free choice. In order to discourage the patients from presenting directly to the Tirana University Hospital Center, a fee of 2,000 LEK (~16.5 EURO) is charged to those patients who lack a referral form from their Primary Health Care (PHC) Physician.

The Ministry of Health (MOH) and the Health Insurance Institute (HII) opted to adopt an encounter-form-based Health Information System to track referrals from PHC physicians to the secondary level of care. The system was developed in the context of two USAID funded projects and was carefully piloted for several years. The PHC physicians and nurses report in regular basis their encounters with patients using a simple encounter form. The form is computerized at the MOH or HII regional level and the information is used (among others) to determine the proportion of referrals towards the secondary level of care. Based on the information contained in the encounter form, an examiner can also judge the appropriateness of the referral. Furthermore, HII stressed the need to reduce the proportion of referrals by making it part of their annual contract with the Autonomous Primary Health Care Centers. In order to obtain the Quality of Care related bonus (5% of the annual fund) an APHCC should reduce by 5% the number of referrals towards the secondary care specialists.

The Health Insurance Institute is attempting to further reform their Health Information System by introducing a health ID card either as a stand-alone document or as part of the national ID card. In addition, HII is planning to build a platform that will connect stepwise their Headquarters with the Regional Offices [1], Pharmaceutical Importers and Pharmacies [2] and Autonomous Primary Health Care Centers [3]. With this last development, the referrals towards secondary care specialists can be tracked and managed in real time, thus disciplining this important aspect of organization and provision of health care in Albania.

Key words: Health Information Systems, Health Reform, referral system, health ID

Current Status of e-Health in Peru

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Abstract: **The revolution in science and technology has caused deep changes in human development and its values, with positive and negative impacts on all spheres of society, particularly on human health. Latin America is faced with several development challenges, chief among them are public health epidemics, environmental degradation, vulnerability of rampant poverty, geopolitical climate, impediments towards expansion of education and social services, and limited trade competitiveness.**

Today the threat of infectious diseases like pneumonia, tuberculosis, diarrhoeal diseases, malaria, measles and HIV/AIDS have assumed global proportions and is threatening hard-won gains in health and life expectancy. The threat is hanging over the civilization like a Damocles Sword. Contagious diseases like AIDS are now the world's biggest killer of children and young adults.

In Peru it has been heartening to see the establishment of strategic alliances between public institutions and civil society organizations, through the various collaboration methods using ICTs. The community effect is reflected in the promotion of greater familiarization with the use of the Internet, and assisting medical team's involvement and access with the activities of the community.

One sees with capacity building activities through knowledge and experience sharing plus skills building of relevant healthcare personnel, the quality of proper and trusted healthcare for all those living in developing countries is reinforced. ICTs can be of much help and the axis of e-Health is the greater power acquiring the patient or user. Health information technology is transforming and will continue to transform health and healthcare in Latin America.

It is essential to build human networks, with the support of ICT, that motivate and harness, in dynamic and systematic form, the interaction between people, thereby strengthening the generation, dissemination and exchange of information and knowledge based on their professional, institutional and social objectives.

- The globalization and the global health are not unidirectional but to a large extent it involves policy processes and is quite heterogeneous.
- We must have the capacity to adapt to commit ourselves to recreate, and to even reject, what is not beneficial to the health of the population of the country.

Fig. 1. Education in e-health

Objective

- To build the capacity of service-providing organizations, particularly in rural and urban areas, facilitate best-practice sharing and collaborations using ICTs;
- To Improve the working conditions of sanitary personnel;
- The telecomunication infraestructure of health establishments specially those without telephone lines and services.
- To Provide health information services:
- Access to specialized health information and access to distance learning courses;
- Access to consultation with expert health personnel;
- Improvement of the epidemiologic surveillance system;
- Create contents and software development

The Particular Needs are:

- Language
- Culture
- Inability to pay to obtain access to internet
- Local economy and life schedules
- Geographic location
- Access to alternative providers who so far have not played almost any role.
- Yet, in developing countries today illnesses continuous to killing people at an alarming rate.
- No more than six deadly infectious diseases:
    - Pneumonia
    - Tuberculosis
    - Diarrhoeal diseases

- Malaria, measles and
- HIV/AIDS

Community Effect

- They have not been familiarized with the use of active internet.
- The medical team should became more involved and familiarized with activities of the community.
- The access to them is getting expensive specially in remote areas the Andean Highlands.

Fig. 2. Education in the community

Challenges:

- Knowledge and skills of participating organizations and individuals.
- Access to informational resources.
- Quality of service delivery.
- There is a significant combination of problems in Peru rural area: jungle, highlands multiple languages, poverty, poor health, very limited infrastructure.
- The indigenous population is the poorest, with 43% of the population.

Fig. 3. Challenges in e-Health

Opportunities:

- More responsibility from the government
- Safer communities
- Provided for the population:
  - Innovation
  - Research resources: human, institutional, financial, informational, aspects of equitable access to decision-

Fig. 4. Opportunities in the population

making and governance.
  - With new ICTs, the participants do not see each other physically, nor do they touch each other.

Results:

- It is indispensable to generate the basis for the establishment of strategic alliances between the governmental institutions and participant organizations of the civil society to the collaboration in concrete actions for general knowledge of the ICTs.

Proposal to Future:

- It is urgent to have public policy and aggressive actions, yet of fairness in the access of the ICTs and effective use.
- It is essential to try to conform human networks, with the support of the ICTs The interaction among population which would who fortify the new generation.
- We could provide access to health services for consumers in the urban and rural areas.

Fig. 5. Work Group

- Targeted to all the health personnel in rural areas of developing countries
- Appropriate low cost technologies
- We could support the delivery of health services when the parcipants are in different locations.
- Training in those communities in spanish language.

Collaboration

- We could collaborate with:
  - Our Needs;
  - Our experience.

Acknowledgments

I would like to kindly acknowledge the many representatives from government, the private sector, and the academia who contributed their time, expertise and/or knowledge to help us. Special thanks is made to the following persons: Eduardo Gotuzzo, Frine Samalvides, Paco Prieto, Oscar

Becerra, Karin Delgadillo, Walter Fust, Rinalia Abdul, Alexander Semeno, Jorge Sánchez, Fernando Jimenez, Jose Lacal.

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More than fifteen years of experience in Technologies of the Information and Communication (ICT). She is member of the Global Society of Knowledge (GKP), Member of Mondialogo, Member of HIFA2015. She's integrated the Multisectorial Commission at the moment for the Development of the Society of the Information in the Peru (CODESI). Author in differents articles national and international. Speaker National and International. Official Delegation of Peru: in the World-wide Summit of the Society of the Information made in Geneva 2003 and Tunez 2005.

Design and Evaluation of Economically Affordable Telemedicine Station

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Introduction

The development of a station of Telemedicine with characteristics of Usabilidad and economy will permit to foment the Telemedicine service in the country, the objective is to decide to the physician of a tool of work based on gives atmosphere multimedia the who allow you to carry out tasks of Teleconsulting, captures and storage of data of the patients of such way that facilitates to him your diagnostic labor. Actually, there are many institutes of investigation, have chosen for designing and development your own stations of work by considering your needs and applications between it have to the Group of digital accused of signals of the University of Valencia (Spain), the institute of pathology of the Udine university (Italy) and Institute Fraunhofer Computer Graphic of (Germany) between other.

Methodology

For collection of the information employed the technique of observation, the population of study was composite for the physicians they scheme in the urology educational institute (IDU), selected a sample of five medical to create the design committee. It did not take into account in principle neither the specialty of work nor the experience in the topic as of the direct observation and later hug the coast to the users identified the requests of the users to carry out the proposals of design.

Top down Methodology

The Top-Down methodology consisted in analyze each source of entry of telemedicine workstation. The first design prototype of the telemedicine station, can be visualize in the figure 1, where at left have the inputs, those which can be video signal, biomedical signal, medical images and the data of the patient. In the center has the station of Telemedicine, which must offer the facilities of: 1. Capture, storage and sending of data of the patient. 2. Communications 3. Visualization of video signal 4. Capture of images by means of a digital chamber. 5. Capture of the electrocardiography signal. At right, we have the output those which consist in the display of signals and medical images, the electronic register of the data of the patient, the

notebook of consultation and the communication of the user by means of the e-mail or the Internet path or videoconference.

Video selector. Adaptation of the medical instrumental to the videoconference equipment

For Telemedicine experiences we need to send videos and images principally and fortuitously sound; it disposes of videoconference cards of multiple very expensive canals. This work tries to get resolve the capture of video from different sources to an accessible price. The problem consisted in deciding as it achieves that as of a card of videoconference that possesses a single canal to video and audio input can multiplexing several input video in one channel, that it behaves as a card of video of high services but with value reduced. By means the adaptation of an external hardware achieved emulate a card of multiple entrances of video and sound; for a price of dollars seven hundred ($700) with similar services to a card of high services whose cost is of three thousand dollars ($3000).

The selector of video, consists in a electronic circuit that have video and audio multiplexer, this can be controlled by the parallel port from console, there are many signals of video and audio coming of medical peripheral equipments, in the center has the selector of video which takes this signal and multiplex in one signal that transmits the toward the videoconference card, and to the exit the display in the screen of signal of video that the user selects.

Figure 1.1 Principal GUI for Video Module

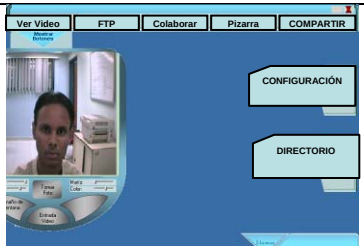

Figure 1.2 GUI “Video Module” task “See video”

Image module

This module permitted captures images from medical equipment and stored inside of HCE. These images can be analyzed employed visualization tools, the user must be the brightness, color and size of images. As a result has a gallery of organized images for patient and dates of capture. The next step is the identification of these images and writes a summary of your relevant characteristics for an educational application.

Communications module

The design was focused in the actions during a videoconference, using the Visual Development Kit library of classes achieved construct a module it offers to the user five options with those which can execute a communication with a remote site, moreover permits configuring parameters related with data and video, store data of calls users in a notebook, facility for the rapid marked when already has established a previous connection, establish a Multiconference and hang a conference.

HCE

The HCE was develops using the CDA standard version 1.0 for HL7, the structure of electronic clinical record was elaborated in XML format and the data terminology it takes of the medical bibliography. The output is a history clinic electronics that can be shared with other authorized users, using the client-server philosophy.

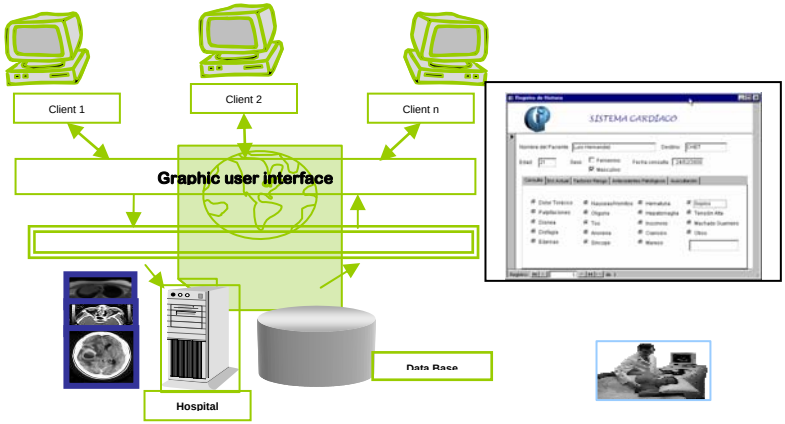

Figure 2 Scheme of Data Base we used *client-server philosophy* and present a format to cardiology first no invasive consulting.

Bottom up Methodology

The Bottom-up design, were made the case study type second medical opinion; and medical specialist-medical specialist, such as the medical board; based on this experiences found the use of images, signals, data, documents, and the introduction of Internet tools such as video conferencing, electronic mail, among others. Also were analyzed the characteristics of communications systems required for this experiences. Following they explain to him the stages of proposed evaluation.

Case study: Medical rural-specialist. Second medical opinion

In the ambulatory rural is a physician with the following academic profile, is recently graduate or frequently studding the last year; it possesses little practical experience. You are offered the option to carry out Teleconsulting with a specialist whom supports him. To achieve this stage the rural physician must have received a previous training over the basic techniques to gather information of the patient, from the clinical record to the signals and images. Additional must have in your rural dispensary medical equipments of diagnosis, those which must fulfill one's obligations to the needs of the community. Of this way this will be able to obtain all data and send it to the specialist physician that will be able to be located either in a hospital of the region, the state, the country or in any place of the world.

Medical specialist-Medical specialist

This experience consisted in made a videoconference session between two side, in one site is a medical with the patient and medical equipment whom need to present a medical case to partner, in the other side are locate three medical specialist this analyze the medical case and intercutting with the videoconference equipment to make actions as zoom a image, hearing a sound e.g.. In the figure you can see the experiences of teleconsulting, at left are locate the doctors, patient, medical equipment for urology and telemedicine work station, at right the doctor can see the image of study and can collaborate with your partner in the clinical evaluation of patient.

Figure 3 Experience of teleconsulting. Wok in this experience Dr. J. Cuervo, Dr. D. Ortiz and Dr. J. Rodríguez. This is an endoscope study to visualization the prostate, the signal video is send across the telemedicine workstation. Was used a peer to peer link to 512 Kbps.

Conclusions

According to the user's requirement, the minimum requests for the Telemedicine station are: Videoconference CODEC, Ecograph, Digital stethoscope, Videoscope and Digital cam. With these equipments guarantee applications of Telemedicine for the following specialties: Cardiology, Urology in the first not invasive consultations, psychiatry, Medicates general, Pediatrics and Radiology (images transmission).

After several interviews with the potential users, was defined the characteristics of the graphic user interface (GUI). Based over the user requirement the telemedicine workstation has the following characters:

1. HCE of the patient, which can store to him images and video; diagnosis medical and measurements of interest. 2. The process of communication must be very similar to those of a telephone call. 3. Availability for service to visualization medical images and videos. 4. Security. (Physics and logical).

Evaluation

The test format is the following, to the physician you are presented the equipment with the intention that the shape it without any type of help and can capture signals of interest. Will have to how are you evaluate the working with the equipment, that so comfortable is to carry out the examination and from your expert opinion that is quality of the obtained signal. The two first parameters to evaluate comfortableness and facility of use are intimately are very subjective, while that the quality is a parameter but measurable. To evaluate the quality of the signal received, the physicians will resist the carried out diagnoses with the proposed model and the traditional method. The evaluation of each equipment in itself is a particular investigation that you are had proposed to the area of studies of postgraduate of the department of sciences of health. In this stage it is able to make concrete an environment of work in the area of Telemedicine that is dedicated only to the validity of medical equipments.

There are two formal outlines for the evaluation of interfaces, the heuristic evaluation and the empiric evaluation. We worked with the empiric evaluation, was used the CANTASIA tool, this permits display and record in videos files the activity of the user using the interface, also will design a hall of evaluation in which is to be located at least two chambers in order to engrave the actions of the user in front of the interface and your reaction in the presence of the errors. Then all this information must be analyzed and presented to the user in order that these present your opinions. Once it has carried out the empiric evaluation, will go in to him the heuristic evaluation.

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eHealth Project for the Amazon Region

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Abstract: **Relying on the knowledge acquired from a previous mission to the southern border of the Amazon forest, the Microgravity Centre, the Nucleus of Research in Indigenous Culture and the School of Medicine of PUCRS organized this further project. The project aimed the development of software to manage and transmit patient data, and to provide multipoint access. A Delphi development kit, combined with a FTP server and a Mysql database, was used to build software able accomplish this task. As a result of this joint effort, a second mission to the region was made in which the developed software enabled the efficient interviewing of patients and collection and storing of full clinical backgrounds. The local health units benefited from this by having access to specialized remote medical opinion and by acquiring complete patient records of medical history.**

Introduction

The development of telecommunication technologies and the diffusion of eHealth applicability have made possible the implementation of a wide range of Telemedicine systems supporting clinical practices in different regions of the world [1-3]. Remote and less developed areas, characterized by difficult access and hazardous environments are those that can most benefit from remote consultations [2, 4]. This is due to the high costs involved in transporting specialized health teams and medical equipments between major cities and isolated villages, which is essential to provide adequate health care [4]. The assistance projects in the Brazilian Amazon Region are an example of the improvements in health service that can be provided by the use of Telemedicine in such areas [5].

Objectives

The main objectives were (1) to develop an efficient method of acquiring and delivering the medical information of patients in remote areas using

local Internet and (2) to assist urban and Indian populations with skin and mouth lesion complaints in the region of Ji-Parana City.

Methodology

The project had two distinct phases:

- Phase I: System development and Team Training
    - Technological tools
        - Data delivery system – *Store and Forward* technique
            - Mysql database modeling
            - FTP server setup
            - Software development in Delphi
            - Basic information input
            - Software test and adjustments
        - Illumination adapter for image acquisition (Figure 1)
            - Improvement of previous adapter
                - Better camera attachment
                - Stronger
                - Better light distribution
                - Easier to handle
    - Multidisciplinary eHealth team training
        - Data delivery software familiarization
        - Lectures regarding local Indian Culture
        - Presentation of last mission
- Phase II: eHealth Mission – Validation

From 5th to 23rd of January 2008, a multidisciplinary eHealth team composed of one professor and students from dentistry, pharmacy, engineering, nutrition, medicine and education from PUCRS travelled to Ji-parana city, Rondonia state, to assist the local community using the telemedicine tools developed (Figure 2). Inhabitants from the general population of the city and the Indians from the villages of Arara and Gaviao were interviewed. Those people showing signs of any skin or lip lesions had their medical information collected and images of their skin lesions were acquired.

The data was sent to specialists using the developed software (Figure 3) after all the interviews were finished. Following analysis, the specialist second opinion was delivered to the medic responsible for the health care of the patients.

Fig. 1. Illumination adapter

Fig. 2. Data collection workstation

Fig. 3. Developed software: Patient basic information input window

Results

A total of 167 patients (mean age of 45 years old SD ± 23.0) were seen by the eHealth team (Fig. 4). Some patients required more than one consultation, and thus a total of 176 consultations were accomplished. A second opinion was provided remotely by specialists in deontology and dermatology (Fig. 5.). Among them, 21.2% were inconclusive cases and the remote specialist asked for further medical information. The patients were from local Indian villages, from the health care unit Adolfo Rohl and from the Home for the Elderly, Aurelio Bernardes (Fig. 6.).

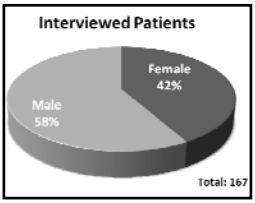

Fig. 4. Percentage of male and female interviewed patients

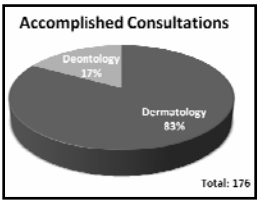

Fig. 5. Percentage of deontological and dermatological consultations

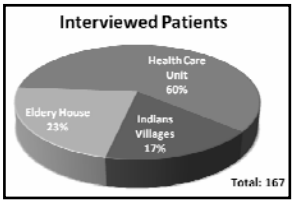

Fig. 6. Percentage of interviewed patients in each visited location

Discussion

Multidisciplinary eHealth team training was crucial to the success of the mission as it prepared the group to (1) deal with the local conditions of the Amazon region, (2) to better interact with the local Indian communities and (3) to solve equipment problems if necessary.

The use of software capable of managing all patient data was very important to avoid information loss or misplacement during data collection. The team was capable of working at multiple workstations connecting to the same database, allowing them to work as different departments of a single institution, where one would open new patient profiles adding basic information and another would check every lesion, adding its characteristics and images into the system.

The illumination adaptor proved to be an essential tool to ensure that light conditions for all images taken were equivalent. This procedure enabled the specialist to better compare and contrast skin color of patients' lesions, an important characteristic for dermatological diagnosis.

Conclusion

The Telemedicine tools and telecommunication system developed for this project proved to have a great applicability for the diagnosis of dermatological skin and mouth lesions. It was possible to remotely diagnose dermatological and mouth related lesions in a short period of time, at low cost and without the need to transport the patient to another location. It is believed that the eHealth assistance model applied in this project can be transferred to any location that has access to an Internet connection.

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eHealth Services Marketing in Developing Countries: A Conceptual Model for Understanding Behavioral Intention to Use eHealth Services in Developing Countries by Medical Professionals

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In order to expedite the introduction of eHealth services in developing countries, it is important to understand the behavioral intention to use such services by medical professionals.

The most significant research studies to date on the subject of eHealth adoption in the literature are: Chau & Hu [1] investigated the acceptance of telemedicine technology amongst 408 physicians by examining and comparing Davis' Technology Acceptance Model (TAM) [2] and The Theory of Planned Behavior [3], and ICT and OTs: A model of information and communication technology acceptance and utilization by occupational therapists, which used the The Unified Theory of Acceptance and Use of Technology (UTAUT) [4] model in the healthcare industry in Australia with occupational therapists[5].

However, these models were constructed and applied in developed countries. The intention of this adapted conceptual model is to build a research model that can be used for understanding medical professionals' behavioral intention of eHealth services in developing countries. Therefore, based on a qualitative study [6], literature review and expert interviews in the field of eHealth in developing countries, a conceptual model was developed as follows:

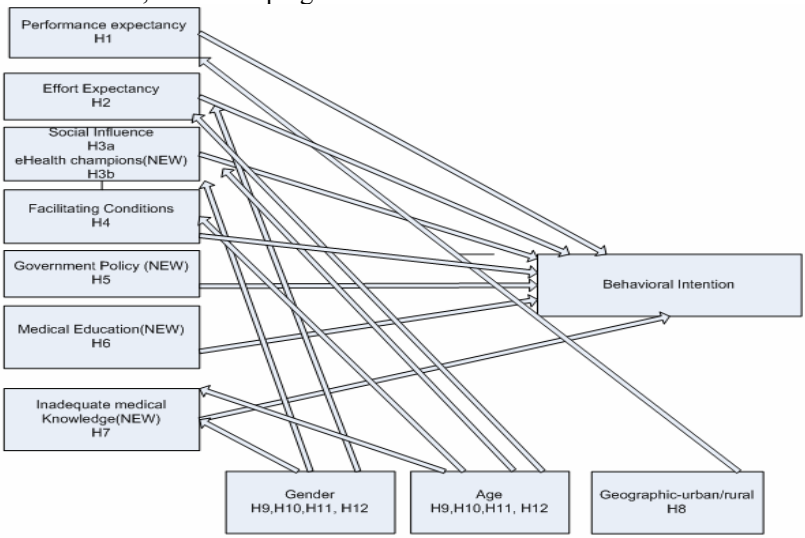
Research Model

The model incorporates twelve hypotheses: H1, H2, H3, and H4 are derived from the UTAUT model [1] and H5, H6, and H7 are new constructs specifically oriented towards developing countries and form the basis for strong premises as key factors in medical professionals' behavioural intentions to use eHealth services in developing countries.

The first hypothesis is the degree to which a person believes that using a particular system or service would enhance his or her job performance. In the literature, perceived usefulness is one of the most important adoption factors in ICT and specifically, in eHealth adoption. In [1], the authors'

examined information technology acceptance theories in the context of eHealth for individual physicians' technology acceptance in Hong Kong.

Therefore, due to the strong correlation of perceived usefulness (benefits) in healthcare as a key adoption factor, perceived usefulness will be tested in a new context, i.e. developing countries.



The following are two subsets to this hypothesis:

- Perceived improved accuracy in diagnostics is positively related to eHealth adoption. This hypothesis is again related to perceived usefulness and is applied specifically to eHealth in developing countries. The adaptation from UTAUT is the original contribution, i.e. eHealth specific and new context for developing countries.
- Perceived improved accuracy of treatments is positively related to eHealth adoption. This hypothesis is also related to increased productivity by doctors due to eHealth adoption. Increased productivity is an essential adoption factor in developing countries if doctors will be able to treat more patients and therefore, make more income. This should be specific to developing countries as income is a motivating factor in developing countries [7].

The second hypothesis is the degree to which an innovation is perceived as being difficult to use. This hypothesis uses the construct from the UTAUT model [4]. Effort Expectancy was not clearly proven as a key behavioral adoption factor in the Shaper and Pervan study in Australia [5]

or in Chau and Hu's study in Hong Kong [1]. However, this construct is relevant for developing countries as they have relatively low or no experience with ICT, and effort expectancy (ease of use) could be significant for behavioral intention to use eHealth services.

The third hypothesis is social influence which is a key construct in the UTAUT [1] model and is assumed to be also an important construct in developing countries. In developing countries, status and image are very important motivators as evidenced in the literature and through qualitative research [6] where medical experts are key role models. This is in line with the role of opinion leaders in Roger's diffusion of Innovation theory [8].

The third hypothesis includes the intention to use eHealth services by doctors in developing countries as being more significant when there are volunteers or champions within the country, or within their hospital, clinic, etc. who take a pro-active interest in promoting, using, and educating other medical professionals in the benefits of eHealth services. These individuals will be involved in eHealth projects, conferences, and usage of eHealth services. Countries which have these individuals will increase the intensity of behavioral intention of medical professionals in developing countries.

In developing countries, it is important to build facilitating conditions into the model even though two studies, User acceptance of Information Technology: Toward a Unified View [1] and Examining a model of Information Technology Acceptance by Individual Professionals: An exploratory study showed that facilitating conditions will not have a significant influence on behavioral intention when perceived ease of efforts are included in the model and to the autonomous nature of the individual users when they are physicians. However, this model will test facilitating conditions to see the significant influence on eHealth adoption in developing countries. Facilitating conditions will impact intention more significantly in developing countries than in developed countries, therefore technical training of eHealth services' tools and on-going support are important for eHealth adoption in developing countries.

The fifth hypothesis is related to government policy and support. Positive government support is a requisite to eHealth adoption in developing countries. This is also supported in the literature [9].

The World Health Organization (WHO) has issued a decree for all countries to develop an eHealth strategic implementation plan. This plan is critical and will influence the adoption of eHealth in developing countries [10]. Government Policy is cited as key in developing countries [1, 6].

The 6th hypothesis concerns the importance of eHealth education in medical schools and continuous medical education after school. If eHealth is included in the curriculum at medical schools, there is a positive

relationship to attitude and behavioral intention in everyday medical practice. Education is a key adoption factor in both the literature and in the qualitative research. Recent study in literature based on the Pakistani market built this into their model as an important factor in eHealth adoption [6].

The model also includes three moderators: gender, age, and geographic location (urban/rural) settings. These moderators are built into the model to see if behavioural intention changes or moderates based on gender, on the age of the medical professionals, and if medical professionals work in cities or in rural areas.

In concluding, this research model will be tested in several developing countries. The data will be used to correlate the relationships and strengths of the variables to determine the key behavioural intention factors for eHealth services in developing countries. These factors will be used in management practice to develop a professional marketing strategy and approach for eHealth services in developing countries based on the factors that will contribute to behavioral intention by medical staff. From a managerial viewpoint, the identification of these factors will allow the definition of broader marketing strategies.

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Electronic Medical Records – Challenges and Opportunities

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eHealth is a relatively recent term for healthcare practice which is supported by electronic processes and communication. The term is inconsistently used: some would argue it is interchangeable with health care informatics, while others use it in the narrower sense of healthcare practice using the Internet. The term can encompass a range of services that are at the edge of medicine/healthcare and information technology. Among these services is the Electronic Medical Records (EMR).

'So what is 'an electronic medical record'?' Briefly an electronic medical record is a medical record in digital format. EMR enables easy communication of patient data between different healthcare professionals (specialists, care team, pharmacy).

One of the largest projects for a national EMR is the National Health Service (NHS) in the United Kingdom whose goal is to have 60,000,000 patients with a centralized electronic medical record by 2010.

Although undeniable useful, EMR services are not yet widely spread and its adoption by healthcare professionals is increasing slowly. The latest data from the National Ambulatory Medical Care Survey (NAMCS) indicate that one-quarter of office-based physicians report using fully or partially electronic medical record systems (EMR) in 2005, a 31% increase from the 18.2 percent reported in the 2001 survey. However, the survey also states that just 9.3% of these physicians actually have a "complete EMR system", with all four basic functions deemed minimally necessary for a full EMR: computerized orders for prescriptions, computerized orders for tests, reporting of test results, and physician notes.

Barriers to adopting an EMR system are complex issues of trust, complicated or unsuitable usability and accessibility and in general, older record incorporation, privacy, technology limitations, preservation, as well as the lack of a national standard for interoperability among competing software options (Kralewski *et al*. 2005).

This paper addresses current, reasonably established, issues behind the slow rate of adoption of an Electronic Medical Record system. It identifies challenges for using the EMR and its impacts. Benefits for adoption and its experiences are examined, and finally, current practice and promising areas for development are reflected.

Keywords: ehealth, Electronic Medical Record, older record incorporation, interoperability.

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Experience of Uzbekistan Emergency Medical System in Implementation of Telemedicine

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Abstract: This paper presents the experience of telemedicine promotion in emergency service and view on the future development.

Introduction

Based on decree of the President of Uzbekistan # UP 2107 from 10.11.98., totally free of charge emergency medical system (EMS) is created. There are one main referral hospital – Republican Research Center of Emergency Medicine (RRCEM), 12 affiliates in each district center and 173 sub affiliates in regions and towns of Uzbekistan Republic. The EMS of Uzbekistan has pyramid shape, subordinated and connected between each other. All directors of district emergency centers are under supervision of general director of the EMS [1].

Totally, there are 3660 beds in all district affiliates and 4279 in sub-affiliates with different average of beds number such as 140 in Surkhandarya affiliate and 680 in Tashkent Central Hospital, 124 in sub-affiliates of Navoi district and 570 beds in Fergana district sub-affiliates. In comparison with total beds of health system of Uzbekistan, EMS has only about 10% out of total number of hospital beds in the country [1].In the middle range, surgical division represents 61%, therapeutic division 29%, pediatric division 10% of facilities' beds in affiliates and 38%, 32%, 30% respectively in sub-affiliates. Out of 3660 beds in district affiliates, 344 (9.4%) are only for reanimation (Intensive care) [1].Regarding medical personnel working for emergency care, totally there are 7560 doctors (17%), 19 736 nurses (45%), 16761 others (38%) (cleaners, drivers, etc; comments: there are no paramedical personnel in the EMS of Uzbekistan) in the whole EMS of Uzbekistan. Middle ratio of nurses/doctors is 2.6[1].After organization of Uzbekistan EMS mortality rate in certain medical conditions such as acute appendicitis, GI bleeding, perforated ulcers were reduced from 0.06%, 6.7%, and 2.7% in 1997 until .04%, 4.2%, and 1.8% in 2007 respectively. At the moment the government of

Uzbekistan takes care about provision and installation of modern medical equipment in all health facilities of the EMS. However, even existence of modern medical equipment at the branches of the RRCEM there is a gap in medical skills in different hospitals of the EMS. Therefore, there are many calls from the regions with just "confirmation of medical condition" purpose. Almost 30 % of all local sites visit have no medical actions, just general medical observation and confirmation of present health status. Other 30% related to additions to the general treatment scheme. Next 30% related to patient transportation and about 3% required surgical intervention on the site.

Telemedicine infrastructure in RRCEM

If we look at changes in the quality of Internet access and communication services provided were tracked by the major indicators such as bandwidth capacity of external channels of access and total capacity of modem pools, then we can find that as of October 2006, total capacity of modem pools of Internet service providers amounted to 14,900.

Recognizing the importance and possibilities of integrating telecommunications in medicine, fundamental directions of telemedicine development in Uzbekistan were outlined as follows: (1) create a country-wide telemedicine network; (2) create a system of tele-diagnostic services; (3) create an emergency telemedicine system; (4) create a system of continuous healthcare monitoring; and (5) create a system of continuous tele-education for health care professionals.

As stressed in a very recent report of WHO"ICT are changing health care delivery and at the core of effective, responsive health systems [1]. These technologies are vital in enabling rapid response to global threats to health."[2].Efficient e-Health services have already demonstrated their value [3]. Most of the telemedicine projects are designed to allow the exchange of information between groups of healthcare professionals, in developed and/or developing countries. However, the set-up of multipoint dynamic telemedicine networks where several teams could share patient data while respecting patient privacy requires the further strengthening of collaboration between healthcare professionals even within developing countries [4]. This requires moving away from the present central web server approach towards the creation of a federation of databases.

In 2001 NATO and the U.S. Department of Defense (DoD) Partnership for Peace (PfP) Information Management System (PIMS) program initiated the project, entitled Military Medical Readiness Project (MMRP). This project involved four Uzbek clinical facilities: two military and two public hospitals. The U.S. Army's Central Command (CENTCOM) provided

funding to this project that included the delivery and installation of computer workstations, digital cameras, and a web-based telemedicine store-and-forward system (AXON) for patient entry and case management, and conduct telemedicine training and implementation. Analyses done under the EuroAid project in 2004 showed that telemedicine services based on a Website environment is urgent needed and requested locally and nationally. A remote diagnosis for patients located in both the project-regions, Nukus and Karshi was provided. Developed Health Telecommunication System (HTS) provided the most basic telemedical features: sending and receiving administrative data in the electronic form; getting remote medical consultations and advices from the RRCEM in particular cases, providing the regional branches of RRCEM with an IT access. A Website based system provides powerful informational facilities and includes databases with different characteristics and functions. The already existing cooperation with Swinfen Charitable Trust in London, UK, should be strengthened. Inside of the granting program of the Ministry of Health of Uzbekistan telemedicine has been started to be develop inside of the EMS of Uzbekistan. As pilot project telemedical centers in Samarkand, Fergana, Nukus and Karshi branch of RRCEM were opened and telemedical system were taught and distributed. From 2-3 telemedical consultations per month from each affiliate total number at the end of 2007 increased up to 12-16 consultations from each affiliate. At the moment about 38% of all consultations provided via internet. Sending images, videos and text materials with sometime phone call discussion can substitute medical consultation on the site. At the moment RRCEM supporting by the Ministry of Health of Uzbekistan Republic has been developing project by implementation of e-Health such as electronic medical records which will be incorporated with the system of telemedical consultation.

Lessons to be learned and prospective

Emergency doctors' general troubles based on results of PIMS and HTS systems operating are: we haven't time for waiting during 3-5 days for answer for our cases; we need in training and multipoint dialog. It has become obvious that co-existence of regional organization and global information exchange is a key factor for successful deployment in resource-constrained areas, including Uzbekistan. For a large scale implementation within health care systems such networks must be technically and organizationally independent. There is a huge potential for inter-linking such different networks: grid of networks allowing transparent exchange and inter-connectivity at all levels [5]. Grid technology is an

emerging in field of computer sciences addressing several issues in distributed computing and providing concepts and frameworks for the technical integration of network [6].Keeping in mind two basic publications of Jan Foster one can consider that the perspective of telemedicine development in areas of theory and practice will be based on three blowers: data mining, grid and multiagent systems [7].Really, what we have in telemedicine? Data: it is the basic resource exchanged in telemedicine, being the basis for almost every activity. Expertise: every time an opinion is requested, exchange of specific expertise occurs. Processing: specific data processing is sometimes possible only in some site, usually because it needs either particular expertise or particular hardware/software configurations not available everywhere. Processing activities which can exploit telemedicine tools are image processing, data mining.

Nevertheless integration of different telemedicine networks into a grid is not depending on technical standards alone-organizational, social, financial, etc aspects must be equally addressed. This will be one of the challenging areas for further research in telemedicine which will be of high impact also for its application in developing countries.

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Prof. Bokhodir Magrupov is a deputy general director of the Republican Research Center of Emergency Medicine by human resources and education. He is chief of scientific direction of the hospital by implementation of ICT including telemedicine. Under his administration at present using funds of the Ministry of Health telemedicine has been developing and e-health applications such as electronic patient records gradually installing at the EMS of the country.

ICT and the Developing World Health System

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The scope of this abstract is to identify and understand how the health care system in the developing world can benefits from ICT and improved health services delivery. Telehealth application has great potentials to improve health services delivery in the developing world. However, developing countries are far from having exploited this promise. In Cameroon, telehealth application is still under the evaluation stage; This is due not only to financial, technological and infrastructure challenges, as the term "digital divide" suggests, but also because the real needs of the users are over looked . To alleviate and address these problems, increasing investment in developing countries in Integrated Healthcare Communication Systems (IHCS) is required. This is necessary to provide a seamless platform on which telehealth solutions can be effectively integrated and deployed. Without such a platform, the development of telehealth will be curtailed and applications will be more difficult to deploy. Telehealth is part of the overall healthcare ICT (Information Communications Technology) solutions that enables healthcare to be pushed out to the edge, for local delivery, and to be more evenly, efficiently and effectively distributed. Many factors should be considered before implementing eHealth projects in developing countries including: How can we understand the readiness of a developing country to effectively implement technology solutions within its health care system. 2.What are the technical challenges in order to use ICTs to provide accurate and timely health information to the developing world 3. What are the major challenges to establishing sustainable models (financial, administrative, training, etc.) of health services provision using ICTs in developing countries? Then Can ICT be used appropriately to train health professionals. From a development perspective, ICTs are key instruments towards meeting the Millennium Development Goals (MDGs) related to health. In this respect, the increasing adoption of ICT in health care services of developing countries, by both public and private sectors, has been a welcome trend. Developing countries suffer from an extremely high incidence of virulent diseases, which comprises not only the prevalent contagious and communicable diseases, but also an increasing number of chronic diseases related to changes in lifestyle and consumption patterns. According to the World Bank figures, expenditure on health in developed countries is 11 percent of their GDP, as

compared to just 6 percent on an average for developing countries. Given this depressing scenario, it is no surprise that the developing countries are woefully off-target in meeting the MDGs pertaining to reduction in child and maternal mortality and in control of major communicable diseases like malaria and HIV/AIDS. In this context, ICT can play a crucial role. ICTs would play an important role in improving the performance of health care system in developing countries, especially in enabling equitable access to health services delivery, besides networking, coordinating research and knowledge management within the global health system.

Keywords: ICT, developing world ,telehealth ,networking

The Strategies to Cope with Challenges towards Natural and Un-Natural Disasters in Pakistan

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Abstract: **Natural or un-natural disasters are a big challenge for humanity and have remained a cause of severe casualties. Casualties can be minimized either through the use of pre-monitoring systems or using the intervention of managed and instantaneous rescue services. Although, it is difficult to get instant information about the disaster, but the challenges of the aftermath can be dealt by training the personnel in the field of medical sciences, satellite technologies and engineering for ready rescue. Many attempts have been made in this direction however; more research is required to make use of innovative technologies in order to meet the challenges of instant recovery. In this paper, a model has been presented to explain the strategies that how, such natural/un-natural disasters can be dealt with, in the preview of recent mishaps to encounter distress, trauma and aftermath of the disaster in Pakistan.**

Keywords: biomedical engineering, disaster management, e-Health, strategies and satellite communication

Introduction

Human beings, animals and birds are gifted with natural instincts to feel the danger of disaster or mishap, but within a very small span of time. A disaster happens so quickly that it becomes difficult to make a rescue for large number of casualties. From the ages, people are well versed with facing the challenges of disasters like, volcanic eruptions, floods and earthquakes, but in past, they were connected to the religious calamities by the creator. A research in the direction of innovative technologies like Satellite Communication, Geo-Information System (GIS), Remote Sensing.

Thus by pre-monitoring devices one can find the clues for a particular disasters in advance.

In general, disaster can be categorized as Natural and Un-natural. The natural disasters for examples are, lightening, volcanic eruptions, earth quakes, heavy rains, floods and viruses like, bird flu. On the other hand, un-natural disasters are human created like, bomb blasts in thickly populated areas, community fighting or clashes, war between countries and many others, such disasters are creating challenges for the humanity.

Furthermore, in 1995, Gene Philip has given two tier based telecommunication disaster architecture model [1]. Where, at top level-transportation, communication, public works and engineering, fire fighting, health, medical services, food and energy are shown. On the other hand at lower level, three components namely; emergency support system, disaster field office and private industry are discussed. As shown in fig.1, the communication shortfalls are also discussed in this paper and are used as the basis in the model for disaster recovery in the country.

The command and control for disaster response is discussed in [2], now it is in practice and in near future may be used through cyber care for instant rescue by utilizing the four components as discussed in this paper. These four components are military, strategy, operations and technology. The other three primary challenges are uncertainty, complexity and variability depends on the environment and situation of the disaster.

The disaster has many aspects; one of the disasters can be viewed as risk disaster, which has direct or indirect effect on business. For example, inflation and community fighting's have great effect on business for local and foreign investors. So, this is also human made un-natural disaster, which has effects on human behavior, similar to psychological effects in trauma in case of natural disaster [3]. According to [4], which suggest disaster due to landslides, cyclones, and other disasters through Geo Information Technology (GIT). Since floods are type of cyclic disaster which repeat every year. Since command and control through cyber care can be utilized in this direction also. This component may also be included in disaster strategies model in the future. In [5], five components of disaster pre-monitoring system have been focused such as, disaster model bank link, disaster monitoring network link, disaster transmission channel, disaster analysis and management link, decision making and command link.

The basis of this paper is to analyze the present position of disaster in Pakistan and predict technically to achieve the pre-disaster measures. In the proposal it has been emphasized that the Global Information System (GIS) be adopted for early warning system only. Although, in Pakistan, classical way of earth quakes recording is already present by metrological control

department, using seismic devices at Peshawar and Quetta. At country level the disaster monitoring or surveillance is checked by Space and Upper Atmosphere Research Commission (SUPARCO).

As, the earth quakes that hit Pakistan in the last years, has shattered the whole country in general, but has created very adverse effect on the life of the people of those particular area. A care should be taken to make arrangements to control these earth quake disasters. The other dangers of disaster are coastal areas, which are vulnerable to tsunami type of disaster at any time, can happen. In order to avoid causalities, measures should be taken to save the thickly populated areas of Pakistan to face challenges of cyclones and undersea earth quick problems. The disasters caused by rainy seasons are monitored by remote sensing methods [6] for agriculture purpose. Thus, the satellite monitoring systems for checking of crops provide warning for agriculturalist, to manage facing the forthcoming floods and weather disasters.

Disaster Management through Satellite Communication

The earth quake that hit Pakistan in the years 2005 and recently in 2008, government has made many attempts for instant rescue and has made future planning to face mishaps. In these disasters, the French scientist immediately after the incident probed through fiber communication system to search the people dumped under the debris. This technique was helpful and many injured people were being rescued and immediate treatment was given along with medical support from the same source.

Similarly, Frederic Patricelli et al, [7] in their recent work indicate that Geostationary Earth Orbiters (GEO) and Low Earth Orbiters (LEO) satellites can be helpful in logistic supply through wideband area networks. For better results transponders or cellular networks in major cities Pakistan can provide to take suitable measures instantly. A company like, Global Village Foundation (GVF), is a non-profitable organization that can be helpful for countries like Pakistan by using satellite communication, for pre-monitoring and immediate rescue actions to be taken in the case of disaster. This foundation can be helpful in case of floods, crop destructions attacked by microbes and also pesticides can be controlled.

MODEL for disaster recovery

Looking at the scenario and geographical aspects of Pakistan, we can categorize disasters in three parts as, first, top hilly area, second, midlands and third, coastal areas. In case of natural disaster earthquakes are frequent danger to the Northern parts or top hilly areas of the Pakistan. Whereas, in midlands floods and crops are facing natural calamities. In the coastal area,

is an Arabian Sea, so the cyclones are the major cause of the disaster? However, un-natural disaster can happen anywhere at any time. In present situation International and National organizations are collectively making the attempts to face the challenges of disaster in Pakistan in the future. Fortunately, SUPARCO is a source of satellite information through satellite and can play an effective role to control the disasters.

Consequently, SUPARCO can have setup of organizations like, National Disaster Management and Control Cell (NDMCC) for monitoring the disaster through out the country. Unfortunely, southern part of the country is facing un-natural disasters in the form of business risks, inflation, community clashes and un-hygienic supply of food and water is causing numerous numbers of diseases and viruses. This can be control by tele-healthcare network system and business sector of Pakistan.

The strategies for controlling the disasters in the near future may be implemented in the underlying three collectively steps namely: Cyber Care and Control, Global Information Technology and Local Strategies.

Cyber Care and Control

It has already been discussed that, GEO and LEO satellites can help through the company like GVF, which can be beneficial in the future.

Geo Information Technology

It is the way of monitoring flood, agriculture and un-natural disasters for better possible solutions with the help of remote sensing devices and mobile

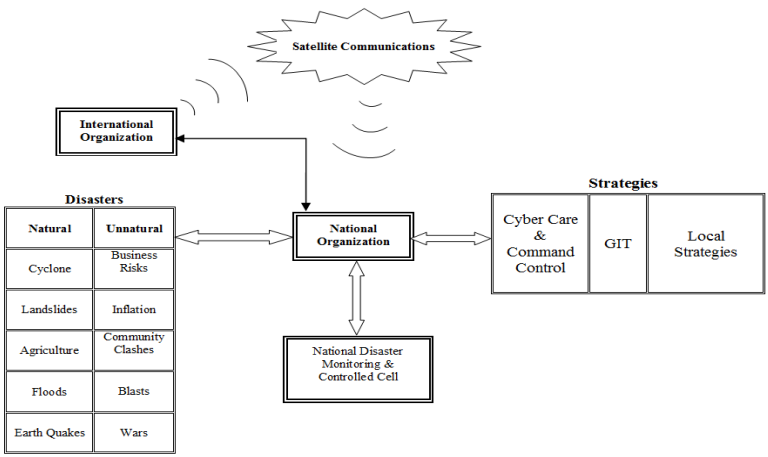

Fig.1. Model for Disaster Recovery in the country

and network communication system. Also, TV and Radio station can be used to make aware landlords and peasants to make necessary measures in advance to avoid disaster.

Local Strategies

Local police, army and Government can observe closely to control and monitor in order to reduce the risk of any disaster occur with the collaboration of the National Disaster Management and Control Cell.

Conclusion and future recommendations

It has been observed that the disaster mostly reveals psychological, social, economical and food problems. For this purpose experts are contacted through satellite communication using network infrastructure and information technology along with tele-healthcare system. With the collaborative efforts and experiences, we have learnt a lot to face the challenges. In this research paper, a consolidate model has been introduced, particularly for Pakistan and can be applied to any other country. In case of un-natural disaster, video monitoring system could be launched to identify the terrorists. In this context, the rescue efforts can be made immediately using military and paramilitary recruits. It has been known that disaster is a problem that can be handled by joint venture program between the countries to share efforts, to help instant monitoring and remedy solution for any kind of disaster. The fields of IT identified in the area of disaster as, bioengineering, e-healthcare, network infrastructure etc. To up-date the knowledge, the international organization, conferences, workshops and exchange programs could be helpful. It has been emphasized in this research that in future there is always need of training for the focal staff to meet the challenges of disaster.

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Teleconsultation in Absence of High- Speed Internet: The Case of the Developing Countries

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Abstract: **With the development of information and communication technologies (ICT), it is now possible for a doctor to consult a patient remotely. In this paper, we propose a way to plan and implement e-health and teleconsultation with the typical kind of resources one can find in the developing countries.**

Introduction

The development of information and communication technologies allows certain medical practices that were simply impossible in the past. Nowadays, it is possible for a doctor to consult a patient remotely. This new practice of medicine makes it possible to those who, for one reason or another, cannot meet a doctor or a specialist physically, to profit from his services, even remotely.

Most applications and research focus, on the one hand, on knowledge sharing and collaboration among practitioners and, on the other, on remote interventions online. Unfortunately, for the moment, all this is not possible in developing countries. Indeed, the Internet connections are still too slow and the hospital structures are relatively badly equipped. It is thus necessary to conceive a teleconsultation adapted to the difficulties of developing countries.

Teleconsultation

Teleconsultation [2] is the evaluation of a patient or data concerning a patient, without direct physical interaction but via a telecommunication system. As shown on Fig. 1, a synchronous teleconsultation (point 2) is carried out on line or by videoconference while an asynchronous teleconsultation is carried out by a website (points 1 and 5) or by a store and forward messaging system (points 1, 3 and 4).

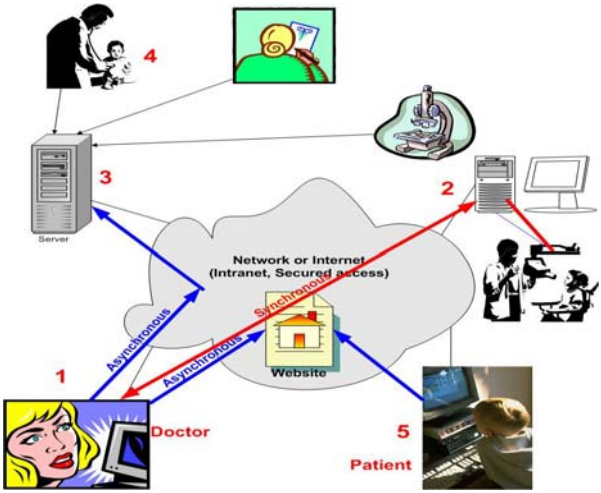

Fig.1: Teleconsultation

Requirements

A synchronous teleconsultation requires a simultaneous connection of the patient and the doctor on the network. The network must satisfy some bandwidth requirement [8] so that, all occurs as if the patient were physically beside the doctor. For an asynchronous teleconsultation, each one checks or transmits information when he can. One can thus work better with a slow Internet.

The Internet connections currently used in several areas of developing countries (e.g., at 64 Kbps) do not make it possible to consider a synchronous teleconsultation. Often, for lack of competence or equipment on the spot, it is not even possible to request a teleconferencing (Fig. 1, 1, 3 and 4) about a patient.

Interests for the developing countries

Using ICT, residents of the developing countries can reach doctors and specialists they could not join otherwise. They can save money and time compared to a special travel for consultation. Sometimes, displacement is not essential or even possible! For the moment, in certain agglomerations or provinces, one can find cybercafés and others ICT materials, but not a dermatologist, for example. Then, why not use the ICT to try to join a qualified doctor?

Teleconsultations in the developing countries

As the experiment of [4] shows, an asynchronous teleconsultation is possible in developing countries. One can use e-mails like in [1] and [5], an open web system like in [4] or a secured web system like in [6]. All these systems can function in spite of the current Internet bandwidth. The remaining problem is to manage the electronic medical record (EMR) efficiently. Indeed, it will be difficult for the doctor to put each correspondence manually in the suitable EMR.

To solve this problem, a solution would be, as we propose in [3], to have an online EMR system. The doctor should have a full access and he could give to the patient, the permissions necessary to consult (messages from doctor, etc.) or send (his evolution, etc.) some information. It would be like in the e-bank where the banker authorizes the customer to reach on his account but restricts certain operations. In this manner, all the exchanges remain in the medical file and there is no extra work for the doctor. This last, could even request the opinion of a distant specialist as in [7], by giving him the access necessary to the EMR. The medical file would be, concretely, a database accessible on the web. This access must be secured (e.g., login and password).

With such a strategy, the resident of a developing country could go in a cybercafé, surf on the website of the e-health provider and request a teleconsultation. If one excludes from the nonessential images and videos, one can manage to function with the Internet speed available. The doctor can always recommend a physical meeting, in the event of need.

The e-health provider should specify on his website, the way to pay the invoices. These payments could be done on advance in the form of provision with the opening of file or a posteriori with the reception of the invoice. When the banking service is non-existent, one can use the money transfer agencies.

Discussion

Instead of using special software as in [7], we recommend the use of a simple web navigator. The website must be relatively light to adapt to the Internet connections of the developing countries. Without payment of the consultations as in [4], one can quickly have several patients. Unfortunately, that will not be interesting for the doctors [6]. The cybercafés are not the ideals places for a teleconsultation but, while taking into account the level of current equipment of the developing countries, these places can render a precious service.

Conclusion

In spite of very low speed of the Internet connections of the developing countries, while adopting a good strategy of management of online EMR, one can consult the patients remotely. To be effective and viable, it is necessary to envisage a right remuneration for the doctors of the teleconsultation. The website must be lightest possible and require only a simple web navigator. Existing cybercafés and other ICT infrastructures can be used to facilitate the exchanges between the patient and the remote doctor.

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Turkish National Telemedicine Project

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Turkey is a large country located between Europe and Asia with a rooted history and a population of 67 million people living on an area of app. 780.000 sq km. Almost half of the population live in big cities while the other half live in rural areas. Nearly all well-equipped hospitals are located in big cities, the same situation is also true for medical specialists, (doctors, nurses etc.) as well.

Turkey is divided in to 7 geographical regions. Since the climate and social conditions are less attractive in Eastern and South Eastern parts of Turkey, the population is lower. Parallel to population differences, there also exists a difference in the distribution of specialists, hospitals and well equipped medical centers between these regions due to these socio-economic and geographical aspects..

Turkey, still a developing country, is a prime candidate to immensely benefit from telemedicine services based on her geography, demographic makeup, as well as distribution of health care facilities and medical services.

Istanbul University is the only institution in Turkey that has started meaningful work and application of telemedicine. ISTEM (Istanbul University Continuing Medical Education and Research Center) currently carries out telemedicine work at the University.

By doing this, ISTEM will help enhance further the Turkish National Telemedicine Project (TNTP) which is a major new contributor to Turkey's national health policy and it will continue its participation in the international telemedicine platforms.

Turkish National Telemedicine Project (TNTP)

Purpose

To establish a National Telemedicine Study Group under the leadership of ISTEM, (Istanbul University Continuing Medical Education and Research Center). This group's main objective will be to launch, enlighten, and define telemedicine concept nationwide. Initiate wider realization of telemedicine nationally and ensure that enormous benefits of telemedicine reach every

corner of the country. At the same time achieve wider cooperation with foreign organizations and participate in international projects to keep abreast of global medical and technological advancements.

Structure of TNTP

ISTEM is responsible for initiating, developing and administering the Turkish National Telemedicine Project.

Infrastructure and equipment:

ISTEM uses terrestrial connections and satellite links for telecommunications and utilizes Internet, ADSL, Radio Link, ISDN, Satellite and UlakNet (Turkish National Inter University Academic Network)

Currently Istanbul University has a fram-relay connection to Harran University in Urfa approximately 2000 kilometers southeast of Istanbul. With a point-to-point connection, interactive courses are offered to students at Harran University.

On the other hand, ISTEM is the Turkish representative and founding member of EMISPHER (Euro–Mediterranean Internet-Satellite Platform for Health, Medical Education and Research) and NetAdded (New Technologies to Avoid digital Division in e-divided areas), projects that were sponsored mostly by the European Commission. Due to this relationship, now there are two parabolic satellite antenna set up on the roof of ISTEM building. By utilizing the satellite capacity of "EUTELSAT" and "Telemedicine Technologies" which are two technical partners of EMISPHER and NetAdded, Mediterranean basin countries are now able carry out telemedicine related work among themselves as well as their European partners. In the future TNTP will be able to use the ISTEM antenna for similar telemedicine related work and education.

Past, present and future of telemedicine project of Istanbul University

Istanbul University is the oldest and most deeply rooted educational institution in Turkey. It has pioneered many innovations in numerous fields over the years. Now, Istanbul University has keen interest in what the latest information and communication technology has brought to us: **Telemedicine**.

Istanbul University has been vanguard of medicine and medical education during the past years, not only by using cutting edge of technology but also by helping the evolution of medicine in terms equipment and techniques.

In 1992, two medical faculties of Istanbul University established the Audio Visual Medical Education and Research Center (ODVIM) to provide more up to date medical education. In 1996 ODVIM started "Distant

Education" and "Telemedicine" implementation. In 1997, the name and structure was changed to ISTEM - Istanbul University Continuing Medical Education and Research Center. Between 1997 and 2000 using radio link and ISDN connection, ISTEM commenced distant medical education, though limited in scope. ISTEM center progressively started to gain experience and recognition in telemedicine.

On April 3, 2000 ISTEM organized the First National Telemedicine Symposium that was the foundation of TNTP. This symposium brought together Ministers of Health, Education & Transportation along with top officials of universities and medical faculties as well as high ranking representatives of Turkish Telecom, Tubitak and other communication officials to present their views and opinions on TNTP.

Ever since 2001, eleven Medical Faculties in different regions of Turkey have been making telemedicine conferences over ISDN 384 Kb/s line connection at ISTEM. Additionally, from time to time, we have meetings/conferences with numerous medical centers in France, Belgium, Germany, Austria, Italy, Sweden, Israel, USA and also many African, Middle Eastern and Asian countries. We plan to increase telemedicine activities in the future and make them more effective.

We plan to use the existing Ulak Net communication network that links 47 medical faculties. This broad band IP based network appears to be more advantages than ISDN connection.

Existing Ulak Net System is operated by Tubitak, a government agency, therefore all operating costs and expenses are covered as part of their annual budget.

Our future plan is also to link non-university medical centers, medical clinics even individual practices with medical centers around the world via satellite, internet and terrestrial lines so that they will share their medical experiences with their peers in the medical field and keep themselves up to date with developments and advancements in medicine.

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1986 Contractual Foreign Professor at Université Paris VI
1988- Present Professor of Surgery, İstanbul Medical School, Director of "Turkish National telemedicine Project"; Director of ISTEM(Istanbul University, Continuing Medical Education Center).

Session 9

Citizens Services for Borderless Healthcare in the European Union: Practical Solutions

Presented by TEN4Health

Ten4health – Trans-European Healthcare Support Network for Europe's Mobile Citizens

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Abstract: **The TEN4Health service aims to improve access of mobile citizens to healthcare provision in other Member States, based on a secure web service and its integration into developing European eHealth networks. Its key components include: pertinent online information for citizens in their language at the point and time of treatment abroad, instantaneous online verification of insurance status, online billing and reimbursement procedures across Member State borders and assurance of interoperability. The TEN4Health service package thereby fundamentally contributes to a better acceptance of the European Health Insurance Card (EHIC) and prepares for its eCard version.**

Project challenges

Travelling abroad for pleasure, education, or work has become a natural part of life for many European citizens. All across Europe, more than 400 million visits to other countries were estimated for 2006 alone. Mobility of people is increasing, products and services can be bought in another Member State when the need arises, but obtaining healthcare outside their residence country is still problematic for many Europeans despite of the legal framework for healthcare provision across Member States having been set up already in 1971 by the EU and its Member States with the so-called E-forms.

In 2004 this procedure was improved through the introduction of the European Health Insurance Card (EHIC), which should allow every citizen who is insured through the public health system equal access to healthcare in another Member State when in need.

However, knowledge about this is not widely spread, and the administrative processes accompanying cross-Member State provision of healthcare have not developed at the same pace as leisure travel and labour mobility.

Service characteristics

To alleviate this situation, the TEN4Health service package contributes towards improved healthcare provision for mobile European Union citizens. Initiated by leading public health insurance providers, it assures access of citizens to healthcare in participating Member States' hospitals, based on a secure web service and its integration into developing European eHealth infrastructure networks. The package's key components include:

- Online information portals on local rules, co-payments and other aspects of healthcare for citizens in their respective language at the point and time of treatment abroad
- instantaneous online verification of insurance status for healthcare providers and assurance of cost coverage
- efficient support for fast electronic post-processing at the national level
- eBilling and electronic reimbursement procedures across Member State borders, with special attention to interoperability.

Project results

How the service works

The above services have been implemented in different formats at different sites in several countries and are fully operational as part of the day-to-day business of the hospitals and health insurance companies concerned. In all sites the services are operated in a similar way.

Typically the participating insurance companies sign contracts with partner hospitals abroad, initially in regions frequented by their clients when travelling for leisure. When clients, in unplanned need of treatment, go to a participating hospital, they only show their national health insurance token/EHIC. They receive information in their mother tongue, via the web-portal or a call-centre, about the conditions of treatment, their rights and obligations in the country of treatment, including regulations on co-payments. After verifying their insurance status online, they receive treatment like local residents.

The person at the administration desk of the hospital enters the national insurance card number or the unique EHIC ID number onto the system. This creates an electronic administrative record for the particular case of treatment. The validation of insurance status, either from the actual insurer,

or the hosting insurer in the country of treatment, is returned instantaneously. All further administrative information exchange, including reimbursement, are based on the electronic administrative record created and use the same web-based technical infrastructure. Staff at the hospital can enter and receive data either directly via a web-portal, or via the country-specific administration interface they use for local patients. The latter can be a web-interface, like VECOZO in the Netherlands, a hospital intranet or a hospital information system (HIS).

Benefits of service use

The benefits of using the TEN4Health services are manifold for all stakeholders involved. These can best be illustrated when comparing the processes, workflows, roles and activities of the different actors in today's process of obtaining healthcare abroad including the insurance status verification, billing and reimbursement activities to those using the TEN4Health service. As can be seen from the following figure illustrating the present situation of a citizen using the EHIC, the process involves 9 transactions and 5 entities with different roles at different stages in the entirely paper-based process. From the evaluation of these processes we know that such process can take up to several years to be accomplished and completed.

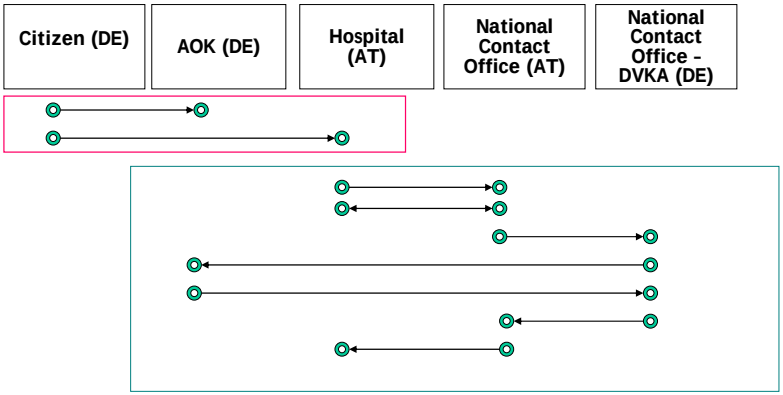
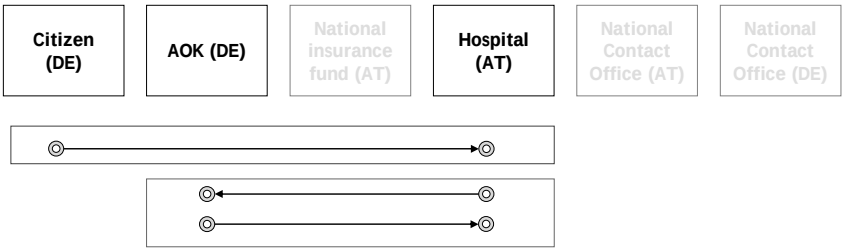


Fig. 1 Health service provision process abroad today using the EHIC (example: Austria)

TEN4Health now offers two models for and improved healthcare provision abroad including all the steps ranging from online insurance status verification to eBilling and reimbursement. In the "direct model", based on contractual arrangements between a patient's health insurer and the treating

hospital abroad the number of transactions is down to 4 and only 3 entities are involved with all transactions being carried out online.

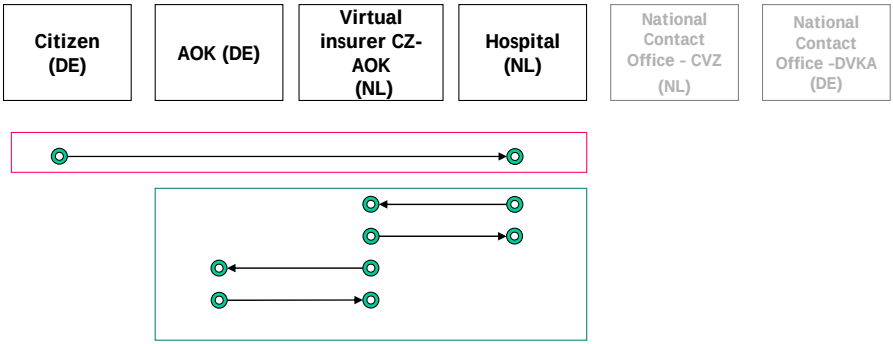
TEN4Health health service provision process: Model 1 (“direct” mode):



From the evaluation carried out in TEN4Health we know that in these cases the overall transaction duration is down to less than two months on average and in terms of effort and cost involved probably only a fraction of what these were previously.

The second model offered is the “indirect” model which is in operation in the Netherlands. In this model the tariff control is not carried out by the German health insurance organisation (AOK Rheinland / Hamburg) but by an intermediary. In the Netherlands this intermediary is the Dutch health insurance organisation CZ Actief in Gezondheid with whom this has been agreed on. The procedure is depicted in the following figure.

TEN4Health health service provision process: Model 2 (“indirect” mode):



Pilot and validation sites

The TEN4Health service is being validated at 11 hospitals directly participating in the consortium, and several other indirectly participating hospital sites across six Member States – Austria, Belgium, the Czech Republic, Germany, Italy, and the Netherlands.

European services standard for cross-border healthcare provision

The TEN4Health services can either be operated as web portal or web-services solution. For the latter a WSDL for an XML messaging has been developed and agreed upon with NetC@rds, another European project developing IT-based services for cross-border healthcare provision. Agreement on a common European web service specification supporting standardised messaging to link hospitals and other health care providers with health insurance organisations and with national healthcare IT infrastructure has been achieved in early 2009. The common web services are specified in WSDL and messaging is XML-based. The development of the services and this agreement are seen as a major step towards full interoperability in web-services provision throughout European health care. The new services help ensure that any European citizen requiring healthcare in another European country can be served easily, that health care providers can reliably determine that a patient is covered by health insurance and rapidly receive reimbursement. For health insurance organisations offering these services it is seen as a market discriminator, positively distinguishing them from competitors in the growing and increasingly competitive European health insurance market.

With this agreement we are paving the way for a European standard supporting the necessary communication and data exchange processes for cross-border healthcare in Europe.

AOK Rheinland / Hamburg, a large German health insurance company with around 3 million customers, and Techniker Krankenkasse (TK) have already developed and operate a web portal providing the TEN4Health and similar services for their joint 10 million customers. The service is operational in hospitals in Austria, Belgium, the Netherlands and in process of introduction in Italy and the Czech Republic. Now that this agreement is in place the AOK/TK service is being modified to fully conform to the new European WSDL and XML messaging standard.

With these online services TEN4Health has managed to develop and successfully operate citizen services for borderless healthcare in and across countries of the European Union to the benefit of the patients, the hospitals, and the insurance organisations.

For the participating hospitals the service has resulted in a substantial streamlining of all administrative processes and in a significant increase in payment speed to hospitals, down from one to two years in Austria or up to five years in Italy to less than two months.

Many other health insurance companies are showing an interest in also offering this service and five further German insurance companies have already joined our initiative, extending the customer base to 16 million. TEN4Health is on a successful route to providing real cross-border healthcare services to customers and supporting the health care providers in the different countries in service provision and the associated online reimbursement and billing processes.

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Benefits of TEN4Health Service Operation for Patients, Hospitals and Health Insurance Companies – The Business Case

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empirica GmbH, Bonn, Germany

This presentation will show some results from the final TEN4Health business plan which presents the idea underlying the TEN4Health service in its strategic context and the expected business case as well as the benefits to every stakeholder, citizens, hospitals and third party payers. The costs and revenues to be expected from the introduction of the TEN4Health service have been analysed from the point of view of the health insurance organisation as the main driver of the service and one typical participating hospital. The main revenues for AOK stem from increased client loyalty and reduced efforts for processing of bills. Hospitals benefit from faster reimbursement, reduced costs in the accounting department and profit margins on the treatment costs for foreign patients. Given the increasingly competitive healthcare environment in all European Member States, the TEN4Health service is an interesting means for insurance companies and hospitals to differentiate themselves from competition improve loyalty and retain their clients.

Cross-Border Health Services for Tourists in a Skiing Resort

Herbert Mayer
Krankenhaus Zell am See, Austria

A second operational example of a hospital providing the TEN4Health GCE service to tourists in Austria comes from Zell am See. The hospital is located in a skiing resort which is heavily visited by Germans. The service has been implemented with its full functionality ranging from an online insurance status verification of foreign patients to online reimbursement and eBilling directly with the health insurance organisation abroad. It is currently being operated as web-portal solution making use of the AOK EuropaPortal and has in the meantime used for a substantial number of German patients with ever increasing numbers.

Health Services for Tourists - Experience From an Austrian Hospital

Karin Schlüter, Asima Kadiric
Landeskrankenhaus Villach, Austria

The Villach regional hospital provides primary/ secondary/ tertiary care for the area of Central and Upper Carinthia and it is located in the border region to Slovenia and Italy. Furthermore Carinthia is a touristic region attracting people all over the year. This situation brings with it the need for intercultural and linguistic competencies, cooperation across borders as well as high quality standards. The Villach regional hospital has thus developed instruments to deal with (a) being located in a border region and (b) working in a touristic region, which will be the focus of the presentation. It is the first hospital in Europe to operate the TEN4Health GCE web services solution fully integrated with its hospital information system and the full functionality ranging from an online insurance status verification of foreign patients to online reimbursement and eBilling directly with the health insurance organisation abroad.

TEN4Health IT-Based Cross-Border Service Solutions in Hospitals in Prague and Karlovy Vary Via a Web Portal

Milan Ruzicka
IZIP, Prague, Czech Republic

Recently the TEN4Health GCE service has been implemented in two Czech hospitals. The hospitals are located in Prague and in Karlovy Vary. The service is currently being operated as web-portal solution making use of the AOK EuropaPortal and has been implemented with its online insurance status verification functionality to verify the insurance status of foreign patients from Germany. Online reimbursement and eBilling with the health insurance organisation abroad will be implemented as a next step.

TEN4Health – IT-based Citizen Services for Borderless Healthcare: from web portal to web-service solutions

Heike Au[1], Werner B. Korte[2]
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AOK has started to implement and operate cross-border health services now for a long time already. The service to be validated as part of the TEN4Health project and to be presented at the workshop offers an all-round package of administrative information flow to improve access to healthcare provision across Member States by travelling citizens:

a. Information for insured citizens on their rights and obligations when accessing healthcare in a certain Member State (both on the World Wide Web and at the point of care) via a multi-lingual web portal

b. Instant electronic identification and verification of patient's insurance status with their respective home health insurance for healthcare providers

c. Improvement of the flow of administrative information between health system institutions

d. Electronification of exchange of administrative information regarding reimbursement across Member States borders.

The service is provided by and for health insurance companies either as a web portal solution or a web service solution fully integrated in the hospital information systems of health service providers. It is currently operational and being spread in a growing number of hospitals across several European countries including the Netherlands, Belgium, Austria, Italy and the Czech Republic. For more information: www.ten4health.eu

The EHIC Portal "AOK EUROPA" – A Web Portal Solution Offered by German Hospitals for Foreigners from All over the World

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The EHIC Portal – AOK Europa is addressed to foreign visitors asking for health treatment in Germany. This service replaces the post-processing of EHIC treatment within German Rhineland region in that it initialises the administrative process at AOK via a web-based interface already with the start of treatment at the hospital. This service is operated by almost 200 German hospitals and has achieved very high usage figures and levels of satisfaction among these health care providers since it eases and speeds up processes significantly.

Session 10

Deploying eEHIC Services for Borderless Care in Europe

Organized by the European eTEN project NETC@RDS

NETC@RDS for E-EHIC: Deploying E-EHIC Services for Borderless Care in Europe

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Abstract: **The NETC@RDS project is achieving initial deployment of an online service for the announced electronic European Health Insurance Card (eEHIC) in 15 EFTA/EU countries. The service has already been successfully tested in 85 pilots across 10 EU Member States. The project is sponsored by the European Commission, e-TEN Programme. This initial deployment project phase will extend the existing implementations and add new countries to enable health care access for European citizens who provide evidence of entitlement in any of the planned service points across the 15 participating European countries. This can be via an eye readable EHIC, or a national health insurance electronic card, or via certain National e-ID chip card issued by the responsible government authorities of the participating partners. An online verification provides assurance to support acceptance procedures for both health insurances and health care providers.**

Introduction and background

During the European Council in Barcelona (2003), the European Union (EU) Member States and the European Free Trade Association (EFTA) countries decided paper entitlement forms for trans-European mobile citizens to receive health care during a temporary stay in any of the EU/EFTA Countries will be progressively removed and replaced by the European Health Insurance Card (EHIC) after 1st June 2004. To this end, decisions nr 189, 190, 191 stipulating which and how paper forms will be replaced by the EHIC were issued by the EU.

Currently the EHIC is a single-side eye-readable plastic, or even paper-card with only some administrative visual information on it. It can be either a standalone card (alike the French or Slovenian EHIC) or it can be laid on

the rear side of the national-regional health insurance card (e.g. alike German or Austrian national cards or some Italian regional cards).

Since September 2002 and according to the recommendations of the European Commission, the NETC@RDS consortium has been working out and putting to the test practical solutions for the e-EHIC in pilot regions of 10 EU Member States (Austria, Czech Republic, France, Finland, Germany, Greece, Hungary, Italy, Slovakia, Slovenia).

During the NETC@RDS project validation phase the European Commission encouraged partners to report experience to the Administrative Commission on Social Security for Migrant Workers (CASSTM) and interact with its members as much as possible. The Commission also recommended every effort should be made to involve all the Member States and other EFTA countries in the development of future common solutions. In this respect, a formal cooperation between the CASSTM Technical Commission (TC) Ad Hoc Group eEHIC and the NETC@RDS partners has been closely established by early year 2006. During the current project phase (June 2007 – May 2010), the consortium has been extended to 26 organisations from 15 EU/EFTA countries including the 10 Member States already participating in the project plus participants from Liechtenstein, the Netherlands, Norway, Romania and Poland.

As a next milestone the introduction of an electronic eEHIC is foreseen for the medium run. The CASSTM/TC Ad hoc Group eEHIC is currently working out requirements and specifications for the eEHIC. Further, a CEN/ISSS Workshop e-EHIC sponsored by the DG Employment has been initiated by April 2007. By April 2009, it will publish a CEN Workshop Agreement (CWA) which will identify and propose to the Technical Commission all the specifications necessary for deploying the e-EHIC system.

Objectives

The NETC@RDS project is aimed at (i) providing reliable and interoperable solutions for the EHIC electronification; (ii) enhancing interstate data exchange while using secure IT network software applications incorporating professional and personal smart cards with PKI and Digital Signature; (iii) contributing to mobility and skills convergent policy while improving health care access for mobile citizens; (iv) achieving initial deployment of an on-line service for the eEHIC.

The key measure is that any European citizen travelling in the participating regions, with their card and in need of non-planned medical treatment can benefit from the NETC@RDS service. The most important target users are the insured European mobile citizens who could be

supported by the European wide awareness and adoption of NETC@RDS services whenever they need to access unplanned health services in other participating countries.

The primary operators of the NETC@RDS services are health care providers in hospitals and ambulatory health care offices. Administrative staff in these medical units already frequently encounters persons coming from abroad and presenting their EHIC. The value-added benefit of using NETC@RDS is that it can read the EHIC electronically. This enables manual and paper based administrative processes to be reduced and has the added benefit of providing an accurate electronic EHIC data set for post processing.

The secondary target users are health insurance and cross border cost clearance organizations, which have signed the internal NETC@RDS General Agreement, and are involved in the reimbursement process. Electronic data capture and automated checking mechanisms provides a much better base for clarification of inconsistencies, acquisition of statistical data, and improvement of the pan-European reimbursement process.

The project initial deployment project phase is now rolling-out operational services in all the targeted sites, including ones tested in the previous validation phases, and add new sites in other Member States locations to enable non-planned health care for European citizens who provide evidence of entitlement.

Deployed services

The NETC@RDS service for eEHIC serves three distinct processes: (i) automated data capture for identification based on a common set of data elements, (ii) non-on-line verification of entitlement rights via national portals, and (iii) minimal data provision which can contribute to subsequent back-office interstate billing.

The specific content of the NETC@RDS service is predicated on the patient EHIC data and verification data in the national health insurance databases. The specification of this data is provided by the European regulatory bodies. The common area of interest is in mutual use and recognition of the pan-European standardised eEHIC as a means of validating entitlement to unplanned health care. In addition two other cases are included: optical recognition of existing EHIC cards, and data capture of an eEHIC identification data set, incorporated in a national electronic identification (e-ID) from specific Member States of the participating partners.

The NETC@RDS project utilises state of the art technologies, directly suited to the requirements of the service in the following areas: web interfaces, end-to-end security over network of national service portals, data repositories and access point workstations, data protection, individual authentication and provision for back-end integration and auditing services.

Each portal can be connected to one registry or multiple national/regional registries in order to provide an online checking service. The overall system architecture is that developed and proven during the market validation phase of the project.

The specific technology components are: (i) a secured portal of services for each Country; (ii) an optional repository connected to the national portal; (iii) a client workstation; (iv) secured connections between those elements over the internet.

Conclusions

The central positioning of the project is to serve as an experimental test bed for the electronification of the EHIC and its results are now proposed for consideration for European regulatory bodies. In this frame, communication with the EU/EFTA working bodies (i.e. CASSTM/TC Task Force Ad hoc Group eEHIC, CEN CWA eEHIC) is regular and driving to a relevant cooperation at European and national level. In addition, more perspectives will raise in the light of the decision of the NETC@RDS partners to include the developed services in the EESSI (Electronic Exchange of Social Security Information) framework, aimed at ensuring that Member States exchange data electronically once adopted the new simplified European Regulations coordinating social security, which require the transmission of data between institutions to be carried out by electronic means under a common secure network.

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Session 11

International Telemedicine and eHealth Initiatives and Developments

Presented by the International Society for Telemedicine & eHealth (ISfTeH)

An Update of Austrian Telemedicine and eHealth Activities

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The aim of this presentation is to give an update about the different interim results of the ARGE ELGA, the workgroup AK7 (Telemedicine) of the eHI (eHealth initiative) of the Ministry of Health, some results and new guidelines from some medical specialist groups like the radiologist and a selection of some telemedicine projects in Austria. For the Austrian and international investigators of the Austrian telemedicine activities it's still quite hard to find out what going on in these areas.

This presentation is again an attempt of a common overview of these Austrian telemedicine and eHealth organizations and activities with focus on strategies and guidelines for common use in that field in the Austrian healthcare-system without the claim of completeness. The medical-core-processes for the patient and the medical teams will be more in the middle-point of the investigations. We attempt to visualize the actual status of the official organizations and guidelines of the Austrian ministry of health, the Austrian Medical Chamber, Austrian Insurance Companies, Austrian Medical and Non-Medical Universities and Austrian healthcare-providers (e.g. the ARGE-ELGA, the EHealth initiative of the Austrian ministry of health, the interministerial platform for telemedicine, the research division for eHealth and telemedicine of the UMIT and others).

Published official studies from these institutions and guidelines will be presented and existing web-links for further information will be presented.

In the conclusion a selection of different Austrian committees and societies in the field of telemedicine and eHealth will be presented with the invitation for further collaborations with the Austrian Scientific Society for Telemedicine and eHealth like the successful start of the D-A-CH-cooperation with the German and Swiss-Telemedicine and eHealth Societies last year.

Keywords: Telemedicine and ehealth activities in Austria, common overview, medical-core-processes, Austrian activities in the near past

Association of Ukrainian Telemedicine and eHealth Development - Report of 2008 Activity

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Association for Ukrainian Telemedicine and eHealth Development (AfUTeHD) is non-profit public organisation with principles of democracy, free-will, equal rights, autonomy and publicity for all members. Main aim of AfUTeHD - integartion of scientific and practicle potential of all members for an effective development and introduction of professional activity in fields of telemedicine, eHelath, medical informatics and cybernetics, also - protection of social, professional, lawful etc interests of members. AfUTeHD was founded 09.11.2006., since 01.01.2007 – National Member of International Society for Telemedicine and eHealth. AfUTeHD also associate member of European Association of Healthcare IT Managers. In this paper and presentation we are going to propose report about annual activity.

Editions

1.1.During 2008 year AfUTeHD has prepared and published special guidelines (methodological recommendations) for physicians, medical staff, managers, decision-makers, tutors etc: “Organisation of Telemedicine Care in Medical Establishments”. This issue was approved by Ministry of Health Service of Ukraine. Thus, first time in Ukraine lawful document about practice of telemedicine was developed and officially approved. This is most exciting achievment of AfUTeHD in 2008 year.

Fig. 1

1.2. Three issues of “Ukrainian Journal of Telemedicine and Medical Telematics” were published (Fig. 1) (in paper and electronic versions). Journal was indexed by Copernicus®.

Clinical telemedicine

During 2008 year a lot of telemedicine consultations were spent. Our main approaches in this field – combination of different technologies (IP-based, H.32x-video based, trans-phone based) in dependence of level of care, infrastructure availability and real clinical needs and aims.

Events

During 2008 year AfUTeHD had orginased 2 conferences (supported by ISfTeH):

3.1. IV International Conference "Telemedicine – Experience@Prospects" took place in Donetsk (Ukraine) 25-27 March 2008. There were about 170 participants from 17 regions of Ukraine, Russia (5 places), Belgium, USA, Romania and South Korea. Scientific sessions had included 62 oral and 19 poster presentations, also exhibition (9 companies) and media-corner (40 different editions, journals etc) were available for participants.

3.2. II International Conference "Telemedicine: Myths and Reality" took place in Lviv (Ukraine) 23-24 October 2008. There were about 100 participants from Ukraine, Poland, Russia, USA. At second day was the special event – Ukraine-Germany Partnering Day in telemedicine and ehealth projects. During conference Tele-Bridge (videoconference) with Advances in eHealth and Telemedicine International Conference (Warsaw, Poland) was established.

The official web-site is - http://www.telemed.org.ua/ARUTEOZ/eng/aruteoz.html. Fig. 2. The web is bi-lingual.

Fig. 2

Key words: Telemedicine, Ukraine, Professional Society, eHealth

About the Authors

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MOIRA Project

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MOIRA is a screening mammography project: protocol diagnostic not invasive by new functional instrumentations for Patient forward for his age and genetic risk. The objectives:

- To develop diagnostics protocol by new method: integration and procedures about cancerous tumour,
- To confirm new model of monitoring for woman patient efficacy in prevention and useful for health system in brief and long term.

The protocol will develop new technologies not invasive in clinical step by integration morphology analysis of traditional techniques by functional typology for studying the area of tumour intensive method. The Patients (20-45) years old and typology of thick breast and by genetic risk.

At the first the integrated technologies will involve the ultrasound scan, Resonance Magnetic (RM) dedicated, technology optical imaging, the transmissible scan by holography technology. It will be also the traditional mammography.

The management network it will be a web portal integrated by Clinical Virtual File (CVF), structured as an oncology virtual ambulatory. It will guaranteed the telematics continuity of process as international standard procedures.

The MOIRA will analyze diagnostic appropriate and will give indications about the cost of protocol.

The Project will be finished in two years and will develop 7 Work Packages:

- WP1: Analysis and plan;
- WP2: Control of protocol and methods;
- WP3: Diagnostic protocols multi method;
- WP4: Design of indicators;
- WP5: Web technologies of protocol support;
- WP6: Pilot-plant;
- WP7: Valuation of outcome

Partners: Institute National of Tumour (INT) of Milan, PI Western Europe, SW Team, Polytechnic of Milan.

Keywords: Breast, Prevention, Screening, Tumour.

About the Author

V. La Bella - Biomedical Engineer, General manager in Diagnostic Imaging multi-national companies; Experience in R&D for Health Care Information Technology. Successfully presented and Granted 2 Italian National Projects in Teleradiology and Telemedicine in Emergency

Teleconsult – One Telemedical Solution in Bulgaria

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Abstract: **A new arena of healthcare is emerging, because physicians, hospitals, financial health planners and administrators are coming together in a single highly integrated and coordinated virtual health organization.**
The mission of Telemedicine is to provide medical services independent of geographical distances between the involved sites. Through Telemedicine patients can get access to medical expertise that may not be available at the patients' site. Experience over the last decade has shown that the goals of Telemedicine are not automatically reached by the introduction and use of particular new technologies per se, but rather require the implementation of *integral services and specialized information systems*.
Software Teleconsult aims to provide logistic and telemedical services between two distant hospitals on the territory of Bulgaria. By definition TIS is an information system necessary for the implementation of telemedicine services.
Our development is a product with three layer architecture – expert's, operator's and administrator's modules. Each of the profiles has specific functions and characteristics, discussed and experimentally introduced to the users.
This paper is focused on presenting the system itself, as well the implementation experience and different module parameters.

Introduction

Telemedicine, using new advances in telecommunications and sensor electronics, improves health care service availability in remote or difficult to operate environments. The transfers of electronic medical files allow medical practitioners to engage in diagnostic activities without being in the same physical location as the patient.

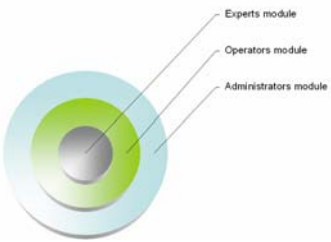

Fig.1. Three layer structure

For example, some telemedicine systems allow doctors to remotely view a patient using video cameras, still pictures, or other suitable imaging devices. A successful telemedicine program requires management dedicated to successful implementation and operation of the program. Generally, management is required at a number of levels to assure effective operation of the program.

Materials and methods

The current software is organized as it follows:

- Main software desktop solution, divided according to the operational level into three main parts (Fig.1.) – three different management modules that are developed according to the requirements and necessary functions for each participant in the telemedical process.
- Audio and video streaming through specialized software.
- Video communication through newly developed application with individual virtual rooms, locked and password protected meetings.

With this integral solution is performed the ability to verify whether a receiving physician is present, whether the receiving system can receive the transmitted files, whether the receiving system has received all prior files, and to otherwise ensure continuity of the medical record. Each patient is identified only with age, sex and physical conditions, in order to keep the patients privacy and confidentiality.

Fig.2 Entrance screen

Expert's module is designed and conformable to the specific telemedical consultation characteristics – each variant of consultation: required, consulted, not checked and with request for more information, is differentiate with its own color. The system checks every 30 seconds about

newly arrived requests for consultations, and ensures sound and visual signalization to attract the expert's attention.

The operator's module (Fig.2.) is the main coordinator in the system, where the Operator (Fig.3.) manages the expeditiousness of the process of giving consultation, and in case delay of 24 hours, the system allows redirecting the form according to the available specialists. In case of few requirements for the same specific condition consultations arrive at the same moment, the system distributes through the available specialists in the corresponding specialty.

He also has the rights to edit, save and delete the following participants: Medical experts; Hospitals; Municipalities; Graphics and Prices.

The Administrator performs functional connection between users and software developers, which is realized with system mailbox. He has the authorization to make any kind of statistics for anybody at any time (Fig.4.).

Administrator's panel is developed in order to assure the correct performance of the processes, committing full access to every single user parameter that the system registers: name, activity, host, ip address, day, month, year, hour, minutes and seconds. The system allows filtering of any of the above mentioned parameters, Word & Excel export of the references, chronology control, and graphical representations in bars. Statistical basis is organized in 69 different sections. In order to prove the usability and benefits from telemedical investments, there are two statistics about percentage of application for a medical expert and for a hospital.

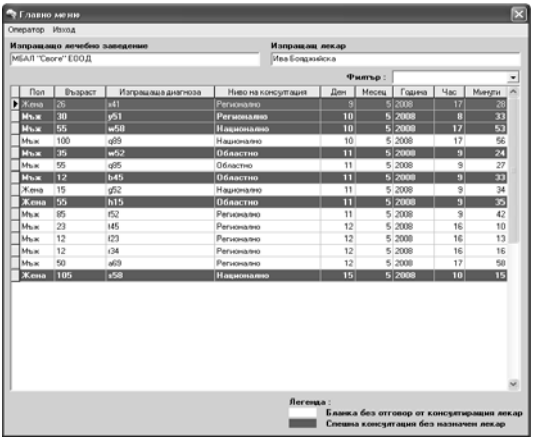

Fig. 3 Operators navigation screen

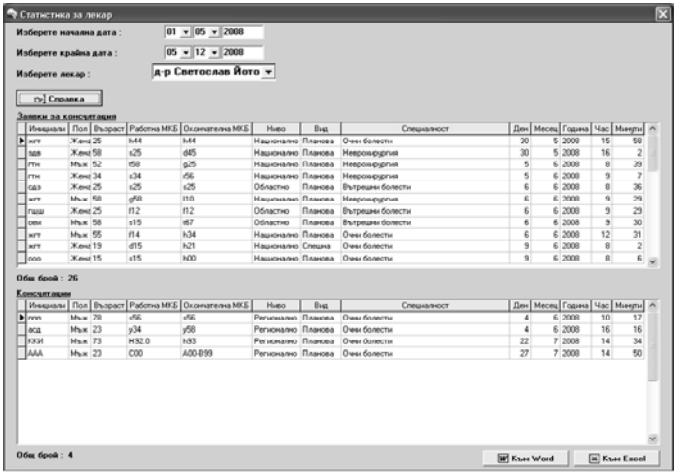

Fig.4. Doctors request and answers statistic for a period

Conclusion

With this project we plan to investigate and explore each factor that have an influence over the solution, to explore the healthcare system in Bulgaria in the necessary depth thus to eliminate possible shortages. Planned teleconsultations in the standard software form, in accompaniment with videoconference dialog with parallel transmission of specific medical data and images, represent a highly effective diagnostic tool. Telemedical consultations bring about less mistakes and better care through reducing information misunderstandings.

The users' opinion up to the current moment of 9 months exploitation is with high approval and satisfaction.

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Telehealth and eHealth – Moving Out of the Silos

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Abstract: **Telehealth is a service delivery component within the larger eHealth domain and has applicability across the whole continuum of health care delivery. It is becoming as integral to the service delivery of health care and health education as the phone, FAX and the Internet have become in the business environment. Electronic Health Records (EHR) have become high priorities for all federal, provincial and territorial health systems.**

Using the example of a woman located in a remote northern Canadian community who is diagnosed with diabetes this paper seeks to demonstrate how the various modalities used in eHealth could, in the future, combine to provide her with timely access to quality care without the cost and inconvenience of having to travel to a major center. Wherever possible, real Canadian examples are cited to support this example. This paper endeavours to project into the future in order to demonstrate the value of integrating of Telehealth and EHRs into mainstream health care delivery.

Introduction

Canada Health Infoway [1] is a not-for-profit organization that collaborates with the provinces and territories, health care providers and technology solution providers to accelerate the use of electronic health records (EHRs) in Canada. Infoway has put forward an infostructure architecture that allows wide sharing of information. That architecture can be adopted to integrate many of the modalities by which telehealth is delivered

The vision is that better care will result from timely access to electronic health records where patients' information is available at the point of care. Whether the organization will achieve its original goal of having 50% of all Canadians covered by a pan-Canadian EHR by the end of 2009 is debatable. Nevertheless with funding having already been approved for 276 projects across the country by December 31st, 2008 there is little doubt that considerable progress is certainly being made.

To date the majority of EHR and telehealth projects and programs have operated in relative isolation. The full benefits of the Infoway investments will not have been realized unless these two components of eHealth

combine to provide seamless delivery of healthcare in an integrated eHealth environment.

Hypothetical Case Study

Screening

As an example we cite the hypothetical case of a 43 year old aboriginal woman, Jane Doe, living in a remote northern Canadian community who is screened for retinopathy by a mobile clinic that submits the images via store and forward technology (S-F) to a central reading site. Radiology images are increasingly being reviewed off-site but the SLICK program [2] in Alberta sends retinopathy images from a mobile clinic to the opthalmology department in Edmonton for review. By integration with the EHR a record can be maintained of those individuals requiring screening and the results of that screening activity can be forwarded to other health care workers for subsequent follow-up.

Diagnosis and Treatment Plan

In Jane's case she is diagnosed with suspected diabetes so the nurse at her local health centre arranges for follow-up using video conferencing facilities which confirms a diagnosis of early onset of diabetes. The future scenario would provide online access to a patients' EHR and assist the team of care providers in creating a care plan, capturing the images and reports, publishing them to the EHR, and integrating these data with patients' longitudinal health record. Furthermore, these systems also enable care providers to further assess patients' conditions using video-conferencing and make the data captured and stored in the S-F mode readily accessible.

Using a team approach an endocrinologist and nutritionist are able to assist the local nurse to advise Jane and to place her on a monitoring system using home telehealth.

Home Telehealth

Jane has a telephone at her house so she is able to have a home monitoring system installed [3]. This system reminds her to weigh herself and to conduct a glucose monitoring test on a daily basis. The data are then transmitted to a central server, where health care professionals can monitor and generate detailed reports showing any change in Jane's condition. Pertinent data are also automatically copied into Jane's EHR.

Jane wishes to remain independent and finds this chronic disease management program suits her well since it provides her with confidence in handling her diabetic condition at home. The system of the future ensures that the record of her routine tests at home is included in her EHR.

Education

In her desire to remain independent Jane is also keen to learn more about her disease and indicates to the local health unit that she would be interested in attending any teaching sessions scheduled to be presented from the University using the Telehealth video-conferencing system at the health unit. Given that Jane's name appears in the central database she, and other diabetic patients in the community, are notified of such an event and meet at the health unit to find themselves on-line with ten other communities to learn more about their disease and how it may be handled.

This experience also provides Jane with an opportunity to meet with others suffering from diabetes such that they form their own community support group.

While these educational sessions may use the higher quality equipment found in health centres and other public locations they may also be "published" over the Internet. This mode of distribution takes the form of web streaming so that individuals may access the session from their own home and at their convenience via the Internet. As just one example of such learning material a doctors' surgery in Wales, UK has developed a series of video podcasts, one of which describes how to do blood sugar testing [4].

Teletriage

Jane has managed to keep good control over her glucose and insulin levels, and with their new-found knowledge her family has been able to assist her in this regard. Unfortunately she suffers a set back; she develops the flu and because she can't keep any food down, her insulin levels rise rapidly. Fortunately, by virtue of the fact that her daughter-in-law has learned about the risks associated with diabetes from a video podcast of the session that she attended, she recognizes the seriousness of the situation and calls the provincial 24/7 Nurse Help line [5]. By having access to the patient's EHR the nurse is able to assist Jane's daughter-in-law and to call for an ambulance.

Emergency Intervention

In reality, only in a few cases do ambulance services in Canada have the capability of transmitting medically important data that can impact the treatment of the patient en route to the hospital. In Levis Quebec the Hôtel-Dieu de Lévis and Unité de coordination clinique des services préhospitaliers d'urgence (UCCSPU) have ambulances that are radio equipped to send ECGs and cardiac monitor signals to the hospital for interpretation and treatment advice. In Nova Scotia paramedics use an electronic patient care reporting system to record the patient's condition

while in transit. This system is not interfaced to the hospitals but the potential for such an interface exists [6].

The nature of Jane's set back is such that she must be transported to the Regional hospital two hours away in order to treat her flu and for her blood sugar levels to be stabilized. The paramedics, having a wireless connection to the ER at the Regional hospital, are able to transmit Jane's vital signs and receive advice as to the treatment they might render during the ambulance trip. Upon arrival at Jane's house the paramedics quickly assess the situation, as Jane is still disoriented the paramedics establish an intravenous drip and attach a cardiac monitor. Using a glucose meter they are able to test Jane's glucose level. It is extremely low, so the paramedics according to their protocol for hypoglycaemia administer glucose via the IV drip.

Jane's level of consciousness improves and the paramedics put her in the ambulance and begin the long 2 hour trip to the regional hospital. The paramedics record their finding, treatment and Jane's response on a tablet computer and transmit the information from the ambulance via a wireless network to the regional hospital.

Conclusion

The scenario of a hypothetical patient has been used to demonstrate the need to EHR and telehealth to come out of their two solitudes in order to improve the overall efficiency and improved quality of care that can result from an integrated system. Much detail has been omitted for the sake of brevity and examples abound among the many projects in which Infoway has invested that convergence within the eHealth environment can be overwhelmingly beneficial.

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Trevor Cradduck has been involved in telehealth in Canada since 1995 including 3 years as Director of Telehealth for the Province of Alberta. He is presently the President of the Canadian Society of Telehealth.

His previous career was as a medical physicist working in nuclear medicine and he is Prof Emeritus from the Dept of Radiology and Nuclear Medicine at the University of Western Ontario, London, Ontario.

Telemedicine as a Tool for Equitable Health Service Delivery, the South African Experience

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South Africa has a world class health system in major cities comparable to the best in the world but as soon as you move a 100kms out of the cities we have major challenges with access to specialist services. This is partly due the inequalities of the past history.

One of the major challenges that need to be addressed is the accessibility and availability of healthcare and specialized medical services in rural areas in South Africa. The continent is currently experiencing a human resource crisis in the health sector, and the major crisis of the spiralling of communicable diseases such as HIV/AIDS, Malaria and Tuberculosis. Telemedicine as a tool has a great potential of innovatively addressing these issues.

Telemedicine is a potential solution to address some of the challenges within healthcare in a developing country like South Africa. This article looks at the experiences of developing and implementing a telemedicine projects in developing countries. The presentation will look at four different projects implemented in South Africa and their impact on the health service delivery. A flagship project in Limpopo province whereby wireless network covering an area of 444km linking 4 hospitals has proved to be a successful model for rural connectivity. The user satisfaction and private public partnership model will be interrogated.

The learning objectives

1. The challenges of implementing Telemedicine in developing countries
2. The needs assessment imperative in designing solutions
3. The need for cost effective Telemedicine solutions
4. The opportunities in creating sustainable private public partnerships in Healthcare.

Telepathology in Georgia – Advantages and Disadvantages

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Telepathology is the practice of pathology at a distance, based on the transmission through telecommunication means of still or stationary images from pathology specimens for their corresponding interpretation and diagnosis. Included in these transmissions is information about the patient, clinical history, identification numbers, laboratory data, statistics, etc. The central aims of telepathology are (1) the possibility to get a second opinion concerning a pathological-anatomical diagnosis from an expert outside of the normal pathologist's working team, and (2) to deliver primary diagnostics to patients who are treated in hospitals without resident pathologists. All diagnosis in pathology are based on images. In principle a telepathology system should include four basic modules operating independently (i) a module for generating the images (capturing or microscope control); (ii) a module for filing images or other information on the server (filing); (iii) a module for functioning of the expert ("expert module"), and (iv) a module (optional) for remotely controlling the microscope, or another "manipulator" (microscope control).

While telepathology has enormous potential for remote diagnosis, education and obtaining a second opinion, especially in support of isolated pathologists and non-specialty pathologists, telepathology, in general, has been limitedly used for the following reasons.

1. It is an expensive and time consuming process.
2. The limited field of view of telepathology images, unlike glass slides directly viewed on a microscope, often makes pathologists feel uncomfortable.
3. There is no widely accepted method to measure the image quality and accuracy of image parameters such as color.

Georgia is not lagging far behind in the field of telepathology. The first telepathology consultation was done in 2003. Since then a number of distance consultations were implemented. In this article advantages and disadvantages of implementation of telepathology in Georgia are presented.

Keywords: Telepathology, Telemedicine, eHealth, Image

The Role of eHealth in the Global Recession

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The Global Recession is forcing governments to review their spending plans, including budgets for National Health care provision.

Inevitably developing countries are likely to suffer most.

The role of eHealth both to access and to deliver healthcare services (supported by eHealth platforms) has never been more urgent, such that healthcare knowledge and skills can be shared more equitably across the globe, drawing from countries that still have them in relative abundance, and making them available to countries where resources are woefully insufficient.

With the reducing cost of telecommunications and information technology, and the more ubiquitous use of mobile phones as an interface where health care services can be both accessed and delivered, the time has come for a massive transformation of health care services, and visible sharing of resources by countries held together by a common language, and/or culture or history.

Examples such as the proposed Commonwealth eHealth initiative demonstrates how this might be achieved with real benefit to the 1.8 billion citizens that make up the 53 countries of the Commonwealth Community.

The Rockefeller Foundation's Global eHealth Initiative, and the Bellagio recommendations, bring focus to the potential benefits of eHealth, and in particular the drafting of a global convention on eHealth, will make possible the permission of transborder medical services, within a regulated framework.

These areas will be presented for discussion.

About the Author

Professor Ricky Richardson, is an acknowledged authority on eHealth and Telemedicine.

He is Vice President of the ISfTeH, and Visiting Professor in eHealth at Imperial College, London. He is also active clinically, as a consultant Paediatrician, serving patients at Great Ormond Street Hospital for Children, The Child and Family Practice London and Princess Margaret Hospital in Windsor. He advises Governments and major NGO's on implementing

eHealth strategies as a means to affect Health System Transformation.

His main focus presently is advising groups of countries, such that they can share health resources. Examples include The Commonwealth (53 countries) and the Portuguese Speaking World (9 countries)

The Videoconferencing in the Daily Activity of Saratov Railway Clinic Telemedicine Centre: The Experience and the Hopes

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Abstract: **This article contains the experience of using telecommunication in medical activity using by Tandberg Corporate videoconferencing in Saratov Railway Clinic Telemedicine Centre during 3 years.**

Keywords: Saratov Railway Clinic Telemedicine center, teleconsultation, tele-education, international clinical trials

Introduction

Saratov Railway Clinic (SRC) is a leading medical unit in the Volga Region Railway company. This multi-type hospital has patient capacity of 534 beds and employs the leading health professionals of the field.

The Volga Region railway covers more than 250 thousands km^2 with the population of more than 6 millions people. The needs of data exchange and medical consulting on such a vast area give a stimulus to the development of tele-medical technologies in the hospital.

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

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

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

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

1. Tele-education and professional tele-discussions;
2. Tele-consultations via the Internet and video-conferencing;
3. Monitoring patients at home and preventive checking on the cardiology staff;
4. Participation in Russian and international scientific projects;

5. The *Telemedicine and Neural Nets Symbiosis* project;
6. The *Virtual Clinic* project;

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

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

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

Fig. 1 Second opinion

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

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

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

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

With considerable clinical experience of our own, supplemented with telemedicine experience of our foreign colleagues, we are interested in the prospect of more close symbiosis of the telemedicine and neuronal network and especially on organization and management of medical data bank.

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

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

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

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

Fig. 2 Professional tele-education

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

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Three Years of eHealth Activities in Nigeria: The Issues and Way Forward

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Abstract: **This paper attempts to look at efforts to develop telemedicine and eHealth activities in Nigeria in the last three years, existing projects and the issues in the widespread deployment of telemedicine and eHealth solutions in the country and how it can be solve. The government of Nigeria is committed to the use of information communication technology to deliver health services as identified in the New Economic Empowerment Development Strategy (NEEDS) document where eHealth is launched as a component of eGovernment. Telemedicine budget is now included in the national health budget. There is several government agencies involve in the developments of ongoing projects but the projects are not coordinated well and could lead to duplication of processes and wastage of resources. The Society for Telemedicine and eHealth in Nigeria will continue her advocacy on the need to have a national coordinating mechanism for telemedicine and eHealth activities in the country.**

Keywords: eHealth Activities in Nigeria, the Issues, Way forward

Introduction

Efforts to develop telemedicine and eHealth in Nigeria by various interested individuals, groups started since 1994. The Department of Planning, Research & Statistics of the ministry of health made efforts to develop documents for eHealth development and deployment in 1996 but the project did not evolve. There are telemedicine activities in some of the public and private health institutions like Lagoon Hospitals Lagos, Pan African Telemedicine Project at the Universities of Lagos and Ibadan teaching hospitals have demonstrated in their practice the use of telemedicine to provide teleconsultations.

The first national stakeholders meeting was organized by Society for Telemedicine & eHealth in Nigeria a national member of the International Society for telemedicine & eHealth, Geneva Switzerland in collaboration with National eGovernment Strategies LTD on developing sustainable

telemedicine and eHealth programme for Nigeria; premier telemedicine workshop held 2005 and the first Pan African conference on telemedicine and eHealth held 2006, first and second Nigerian / Pan African conference on telemedicine and eHealth held 2007 and 2008 respectively recommended to the Federal Government of Nigeria the need to develop eHealth in Nigeria and to have a national coordinating mechanism to carry out this task.

Government Support for eHealth

Under the Health Sector Reform Programme (HSRP), The Federal Ministry of Health (FMOH), with the support of the National Council on Health (NCH), has committed to undertake a sustained process of fundamental change in policy, regulation, financing, provision of health services, re-organization, management and institutional arrangements, that is led by Government, and designed to improve the performance of the health system to attain a better health status for the Nigerian population (FMOH 2005).

One of the components of the Health Sector Performance issues addressed by the HSRP is improving the stewardship role of government by deploying information and communications technologies (ICTs).

The new National Health Policy has been formulated within the context of:

- the Health Strategy of the New Partnership for Africa's Development (NEPAD), a pledge by African leaders based on a common vision and a firm conviction that they have a pressing duty to eradicate poverty and place their countries individually and collectively on a path of sustainable growth and development;
- the Millennium Development Goals (MDGs) to which Nigeria, like other countries, has committed to achieve;
- the New Economic Empowerment and Development Strategy II (NEEDS) which is aimed at re-orienting the values of Nigerians, reforming government and institutions, growing the role of the private sector, and enshrining a social charter on human development with the people of Nigeria;
- the development of a comprehensive health sector reform programme as an integral part of the NEEDS II document. (FMOH 2005)

The government of Nigeria is committed to the use of information communication technology to deliver health services as identified in the New Economic Empowerment Development Strategy (NEEDS) document

where eHealth is launched as a component of eGovernment. Telemedicine budget is now included in the national health budget.

Telemedicine Projects in existence

The first pilot project was initiated by the National eGovernment Strategies LTD 2006 by providing teleconsultation in cardiology with the use of videoconferencing equipment and digitized electrocardiography machine to the Abuja rural communities. The second Pilot project was initiated by National Space Research and Development Agency (NASRDA), Abuja 2007(is a commendable project that will serve as resources if evaluated for wider implementation of eHealth in Nigeria) in collaboration with the federal ministry of health through provision of services by the tertiary institutions. Some of the sites are not running as of the time of writing this paper but faced with the challenge of sustainability beyond the pilot phase. A mobile health unit was set up and expected to shuffle round 8 states for a period of 2 months. These states include teaching hospitals in University of Ibadan and Maiduguri, Federal Medical Centers in Owerri, Gombe and Birnin Kebbi, Owo to mention few centers. We have the India Pan African Telemedicine project at the Universities of Lagos and Ibadan Teaching hospitals to help provide trans-border teleconsultation and training of health workforce. There is the Intel telemedicine project between Federal Medical Center Bida and National Hospital Abuja. There are no data yet from most of these centers on evaluation of their telemedicine activities with respect to the cost effectiveness of the services and how to scale them up.

The Issues

In the last three years Society for Telemedicine and eHealth in Nigeria have engaged the federal government and the ministry of health to constitute a national eHealth Committee or Council as stipulated by resolutions of the World Health organization and International Telecommunications Union to serve as the national coordinating mechanism to develop an eHealth strategy, plan and programme for Nigeria. In October 2006 there was a meeting of the Society with former President Chief Olusegun Obasanjo, the minister of health and the ministry with head of other key agencies to discuss on developing eHealth in Nigeria. It was agreed that the committee will be constituted and Nigeria will have a national budget for eHealth in 2007.

The Society was informed about the creation of the national telemedicine programme under the department of Hospital services in the ministry of Health mid 2007 but no programme is available for all stakeholders to know

which areas of activities is the focus for deployment of eHealth tools and services till date. Currently:

- There is no national eHealth Committee or Council in place to coordinate eHealth activities in Nigeria.
- There is no national eHealth needs assessment, national eHealth Strategy, Plan, Policy and legislation to guide wider implementation.
- The current national telemedicine programme needs a secretariat that is staffed and trained with capacity to implement its activities.
- Nigeria was one of the countries that participated in the first Global survey on eHealth conducted 2005 by the Global Observatory unit on eHealth (GOe) World Health Organization and we have not improved in the last three years in the areas indicated for improvement (WHO 2006).

The Way Forward

It is time to enact changes in the health care sector in Nigeria through the use of information communications technology to improve quality and extension of health care services to the rural communities for the development of the nation. Public health monitoring, disease surveillance, research and quality monitoring require data that depends on the wide spread adoption of eHealth tools & services.

Below are the immediate steps to be taken by the Federal Government of Nigeria through the Federal Ministry of Health:

- Establish a national eHealth programme/ secretariat to provide a national and political framework of guide lines for wider implementation of eHealth in Nigeria.
- Ensure that eHealth is integrated into the national health budget
- The Federal Government should provide the political support and fund for the programme
- The Federal Government should constitute National eHealth Committee or Council to the National eHealth Programme

There is several government agencies involve in the developments of existing pilot projects but the projects are not coordinated well and could lead to duplication of processes and wastage of resources. The Society for Telemedicine and eHealth in Nigeria will continue her advocacy on the need to have a national coordinating mechanism for telemedicine and eHealth activities in the country.

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Towards a Specific eHealth Data Tool "CARTOGRAPHY TELEHEALTH"

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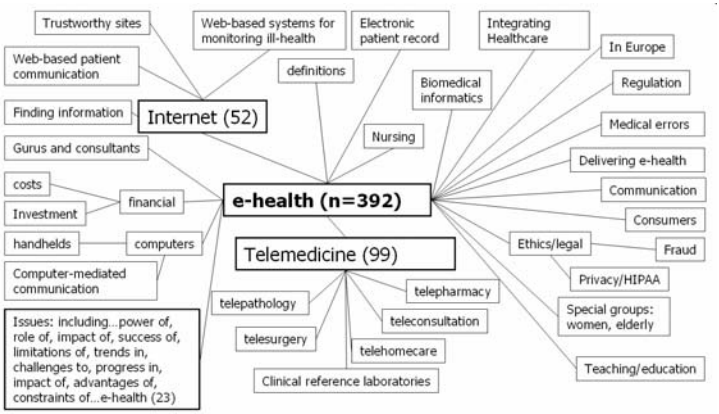
Abstract : **In the scope to have the better knowledge of telemedicine/e-Health data possible, all researches today go to the statement that no clear and specific telemedicine/e-Health data bank really exists . People who want to know how this domain is going on has to search on several and different non specific ways. The large global data banks as Medline or Current contents don't have definitively a special keywords tracks to help people in their retrieves. Of course, a lot of societies or organisations working around telemedicine try to propose their own repertoire of projects, applications, articles and communications. But no one has a sufficient cover to catch the all "State of the Art". This is the case for ATA, NTA or better, Med-e-Tel which initiated some years ago a papers 'index about the presentations performed during the Med-e-Tel meetings. CATEL, the unique multidisciplinary French structure for telemedicine and e-Health, has been approached to be a core coordinator to establish the larger telemedicine and e-Health "cartography" named Cartography Telehealth, to list all the actions, articles, projects and application all over the world. The presentation will be a summary of the CATEL methodology to achieve this mission and also the concrete report of the first approach with the detail of conditions to become a user.**

For all the people involved on the telemedicine /*e*-health tracks, it is rather difficult to have access to a true and the more exhaustive possible data bank. Of course, it exits a lot of newspapers to report projects, programs, applications and equipment dedicated to telemedicine and *e*-health. Normally, at the end of each article, it is common to have a list of references, just to help the readers to have more specific information on the subject. This is already a good step but a very limited and questionable step .This is exactly the



same from the numerous events about telemedicine and *e*-health which take place each year worldwide. Today there are not less than 52 definitions around *e*-health with a lot of different words signification according the countries. This was the reason why it was initiated a tender in the scope to boost a methodology in order to built the larger data bank about telemedicine and *e*-health, in France but also all over the world. A code name was given to this very ambitious action: Cartography Telehealth. The goal of Cartography Telehealth is to built first, and then to upgrade, a kind of telemedicine and *e*-health "cartography". That's means to propose, as a view map, the more exhaustive repertoire about researches, projects, programs, applications on the care and health fields in order to help concerned people to be able to know, at any time, the "state of the art" of telemedicine and *e*-health progresses. CATEL was minding, thinking and deciding to conduct and to realise this "cartography". Some words about CATEL. This is a French, non profit association, devoted to telemedicine and *e*-health dissemination, recognition and application. It was created 11 years ago by a small group of people in French Brittany. From the beginning CATEL was structured as a multidiscipline group with an active participation of institutional, researchers, university, electronic and informatics, engineers, health professionals, industrials and patients association. Traditionally, CATEL has three jobs:

- Areas' exchange organisation
- Knowledge watch and transfer
- Sponsoring and support for innovative projects

Today, CATEL has 500 members and more than 8.500 web contacts. Each year, CATEL organises at least 4 forums (each forum is dedicated to one specific telemedicine-*e*/health topic with recommendations as

conclusion ready to be published) and the big multi Visio conferences called *Journée Internationale de la Télésanté* (*e*-Health international day) where 10 to 12 different visio sites are in connection all the day, some on the French territory, some others worldwide as Quebec, Mali, Senegal, Switzerland, all linked by the use of the French language.

CATEL has its own website: www.portailtelesante. It is the editor of a monthly letter and also, in case of emergency, the "flash". There is also a member service where each member can use the CATEL network to find information or answer to a burning question.

CATEL is really today the unique French telemedicine and *e*-health platform where all the people concerned could find, discuss, exchange the true and validated information about the domain. This position was recognised by the fact that, on 2006, CATEL was accepted as the French national member by the ISfTeH (International Society for Telemedicine and *e*-Health) and became board member end 2007, opening by a kind of privileged observatory of the telemedicine and *e*-health evolution worldwide.

The **strategic objective of Cartography Telehealth** is to guide all its specific developments in the *e*-health domain efforts in accordance with the potentialities and the actions going on in this global sector.

The **operational objectives** of **Cartography Telehealth** are the following ones:

- To provide a global and actualised overview about *e*-health by building a knowledge base with description of *e*-health actors, projects and proposal, their characteristics, their relationships.
- To propose a categorisation and a list of factors to allow to describe all the actors and their projects and to establish a link-bridge together.
- To identify all the already disposable cartographies on a internet data base or other server and to evaluate them.
- To be easy to use and to be reviewed by non informatics people, according the very dynamic evolution of this domain.

What could be the mission of CATEL in Cartography Telehealth?

It consists in two phases:

- Phase 1: to establish a "cartography" about all the *e*-health actors
- Phase 2: to built and to propose an original digital *e*-health data base

Phase 1: the global "cartography" has to be checked through sub-"cartographies":

- Actors' cartography
- Projects' cartography
- offers' cartography
- previous data bases' cartography

Phase 2: the new original global digital data base

- from the results and collection from the Phase 1
- allowing information research and synthesis on the *e*-health domain
- offering an easy upgrade by non informatics people
- bringing a quick overview by professional sectors: technological, commercial and others
- easy to be consulted by web technologies
- using soft tools as Microsoft Office Pro or others for which licences would be provided.

How CATEL should do this mission?

By chance, CATEL with its pluri-discipline members is able to federate a large panel of specialists to bring each a part of the strategic plan. Amongst those specialists there are:

- French regional telemedicine associations as, for instance, Astrh@ (*Rhone-Alpes region*)
- Competitively poles (*Pôles de compétitivité*), new entities for specific activities
- Research laboratories involved in the domain
- Some universities and engineers high schools
- The CATEL international commission
- A society with its high competence and experience about software

A win-win partnership to answer as best as possible to the "cartography" request

The CATEL proposal is based on an ergonomic web solution, easy to handle and to upgrade,

- A virtual and unique desk for all files
- Centralisation on an unique dossier for all actions
- An easy ongoing follow for the files
- Administrative and operational guidance for files (observatory module /control panel)

To reach the Cartography Telehealth goal, CATEL has scheduling the following steps, after the preliminary meetings with all the actors:

A – Cartography Telehealth initialisation:

- Area definition
- Validation of the functional means
- Description of the data
- Grid of priorisation and qualification
- To organise the partnership
- Pilotage committee

B -To collect and to qualify the data

- Identification of the existing data bases
- Qualification and integration of those data bases
- Research for complementary information
- Qualification of the information
- Redaction on the case studies
- Confirmation
- Prospecting

C -Modelling of the Cartography Telehealth data base

- Definition of the relational scheme
- Definition of the concrete form for the cartography

D - To built and to configure the data base

- Analysis
- Configuration

E - To open en to evaluate the Beta data base version

F – Propositions to extended steps

- Possible evolution
- Valorisation

The final goal might be to have a pragmatic *e*-Health data base, using the previous selective data bases and wide information to constitute a unique tool for all the people concerned by the telemedicine and *e*-health evolution in the next future.

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Session 12

Promoting Telemedicine/eHealth Practice: ISfTeH Student Videoconference Session

Presented by the International Society for Telemedicine & eHealth (ISfTeH) - Student Working Group

ECG Teletransmission – Present and Future Possibilities

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Abstract: **Electrocardiography (ECG) is the basic diagnostic method of acute coronary syndrome (ACS) and arrhythmias. For patients with myocardial infarction (MI) especially the first 90 minutes from symptoms appearance is critical. In Warsaw 2 cardiology units receive ECG teletransmission from ambulances and refer high risk patients directly to invasive cardiology unit, reducing the time to reperfusion and improving patients' outcomes. In long term medical care ECG telemonitoring is useful among patients with coronary artery disease, arrhythmias, implantable cardioverter-defibrillator (ICD) and in home-rehabilitation program.**

ECG teletransmission in acute coronary syndrome

Introduction

Acute coronary syndrome (ACS) is usually accompanied by characteristic changes in electrocardiography (ECG). Myocardial infarction (MI) is a myocardial cell death due to prolonged ischemia.

According to the European Society of Cardiology (ESC) guidelines time from symptoms appearance to myocardium reperfusion is an important risk factor. Especially the first 90 minutes are critical [1].

Clinical implications

ECG teletransmission from ambulance to cardiologist via gsm with a short phone interview results in high risk patients referral directly to invasive cardiology unit. In Warsaw two cardiology units are able to receive and react to prehospital ECG teletransmission provided by one of over 50 Lifepack 12 defibrillators in Mazovia District day and night. In April 2006 there were 244 Lifepack 12 defibrillators in Poland transmitting ECG from ambulance to 15 invasive cardiology unit and 316 defibrillators ready to transmit (Fig. 1.).

Studies confirm that ECG teletransmission reduces time from emergency unit arrival to invasive intervention, "door-to-balloon" time – from patient

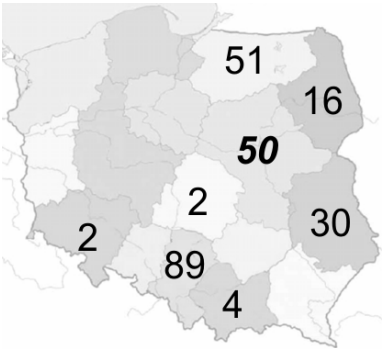

Fig. 1. Lifepack 12 defibrillators transmitting ECG in Poland (status in April 2006)

arrival to hospital to intervention [2-5] and has a positive prognostic implications in a group of patients with ACS[1]. It also reduces number of patients unnecessary referred to invasive cardiology unit.

In Mazovia District Karcz and Rużyłło[5] were analyzing efficacy of prehospital ECG teletransmission. Median time from ambulance arrival to patients' arrival to invasive cardiology unit was 89 minutes. Average teleconsultation before referral to urgent intervention took about 15 minutes.

ECG telemonitoring in long term medical care

Indications and methods

ECG telemonitoring is useful in long term medical care in group of patients with coronary artery disease (CAD), after myocardial infarction (MI), with arrhythmias and with implantable cardioverter-defibrillator (ICD). Patient at home is equipped with ECG recorder or ECG is recorded by ICD. ECG can be monitored when symptoms occur - patient turns the device on and calls head office. During a call ECG is transmitted via phone. Then cardiologist on duty evaluates symptoms, ECG and patient's medical history and decides whether hospitalization is required. The other method is a constant observation – every day data are stored on the device and at one moment sent to the medical service or are sent simultaneously with registration.

Study	Door-to-balloon time	**Reduction rate**	**Region**
Adams et al.	50 min	0,505	North Carolina, USA
Dhruva et al.	80 min	0,452	New Jersey, USA
Sejersten et al.	34 min	0,65	Copenhagen, Denmark

Tab. 1. Door-to-balloon time reduction using prehospital ECG teletransmission. Results of selected studies

Results

Long term observation reduces the risk of undetected episodes of myocardium hypoxia or arrhythmia. Among patients with ICD it is possible to control heart rhythm, leads and battery condition (Fig. 2.), even expect or prevent hospitalization (Fig. 3.). In the group of patients after MI performing home rehabilitation ECG monitoring allows to control progress and rehabilitation safety [6].

The future of cardiology

In the future, similarly to ECG, teletransmission of sounds (electronic stethoscope), images (computer tomography, magnetic resonance imaging) and video (echocardiography) will allow to develop teleconsultations and teleeducation in cardiology.

	Since last periodic Messager
HEART RATE	
Mean ventricular heart rate [bom]	76
ATRIAL RHYTHM	
Intrinsic rhythm (As) [%]	90
Number of mode switching	>=52
Duration of mode switching [%]	74
VENTRICULAR RHYTHM	
Intrinsic rhythm (Vs) [%]	55
Ventricular rate at mode switching [bpm]	< 120
No. Of ven. Runs (4 … 8 consec. VES)	0
No. Of ven. Episodes (>8 consec. VES)	0
Duration of longest ven. Episode [min]	< 0.5
AV CONDUCTION	
AV synchromy [%]	84
With intrinsic rhythm (As -Vs) [%]	42
With atrial stimulation (Ap -Vs) [%]	0
With ventricular stimulation (As - Vp) [%]	45
With dual-chamber stimulation (Ap - Vp) [%]	13
SYSTEM INTEGRITY	
Atrial lead check	OK
Ventricular lead check	OK
Mean P-wave ampl./prog. Sensitivity	< 50% safety margin
Mean R-wave ampl./prog. Sensitivity	>= 100% safety margin
Battery status	OK

Conclusions

ECG teletransmission improves management of acute conditions - ACS. ECG telemonitoring, providing day and night observation, improves long term medical outcomes and reduces risk of hospitalization. Both increase medical care efficiency and rationalize costs.

Fig.2. Example ICD report.

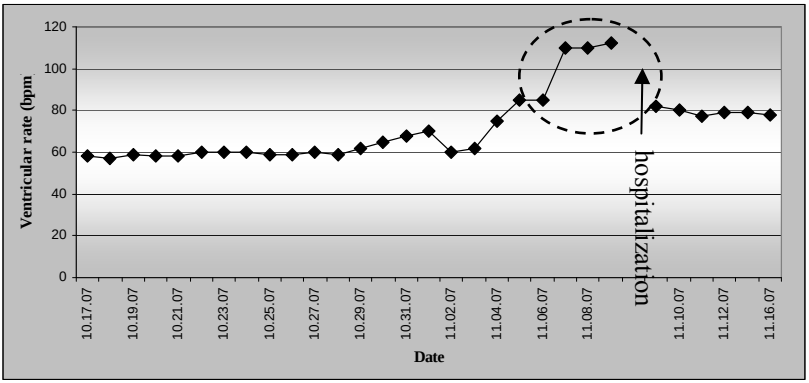

Fig. 3. Long-term heart rhythm registered by implantable device and rhythm acceleration before hospitalization.

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Establishment of a Multicentric Telecardiology Project in Rio Grande do Sul State/Brazil: A Report about Academic Participation

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Abstract: **A multicentric project of telecardiology started in 2008, in the state of Rio Grande do Sul (RS), under the coordination of the e-Health Centre of the Institute of Cardiology of RS (IC-FUC RS), in a partnership with the State Secretary of Health. A multidisciplinary team, including IC-FUC professionals and students, was in charge of organizing and delivering - during 6 months - a training program for both 2 cardiological centres and 11 remote health care institutions.**

Introduction

Worldwide establishment of new telemedicine and e-health applications brings the potential of overcoming traditional barriers in health care delivery, with a potential impact when implemented in developing countries. Telecardiology is one of the most important areas of telemedicine, as heart diseases [1], mainly coronary heart disease, are the most common cause of death in many countries [2]. It has been strongly highlighted that the education of a new generation of professionals will play a crucial role in the adoption and wide implementation of e-Health services. It can, in fact, guarantee the sustainability of new technological initiatives, allowing estimating a successful deliver of better health care services in the near future [3].

The State of Rio Grande do Sul/Brazil (RS) has 496 cities. Most of them are small and have a lack of health care professionals, being critically underserved in medical specialties. In RS, a multicentric project of telecardiology started in 2008, under the coordination of the e-Health Centre of the Institute of Cardiology of RS (IC-FUC) in a partnership with the Cardiology Hospital of Rio Grande and including the participation of 11 small and remote cities/villages and 1 regional hospital. For the implementation of this project, a 6 month training program was prepared by the e-Health Centre, which included the participation of IC-FUC professionals and both undergraduate and postgraduate students.

Objectives

The project aims: 1. To work as a pilot project for the establishment of a large network for acute cardiovascular assistance throughout the RS State, Brazil; 2. To offer, for the students, a practical experience with the standards of health care practice in both small hospitals and outpatient care units of remote cities; 3. To allow undergraduate and post-graduate students to get skills in the field of telemedicine and e-health applications.

Methods

The health care infrastructure of the project includes:

1. Two cardiological referral centres:

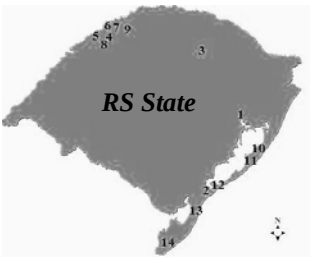
- Institute of Cardiology of Rio Grande do Sul, located in Porto Alegre (capital), as a reference for the cities of the north-west region;

-Cardiology Hospital of Rio Grande, located in the city of Rio Grande, responsible for the south-east region.

2. Eleven health care institutions (hospitals and outpatient units):

- 6 located in the north-west region and 5 in the south-east region.

The medical assistance of severe cases that need advanced cardiac care will be performed in the Cardiology Hospital of Rio Grande for patients from south-east region. Patients from the north-west region will be removed to the Hospital SãoVicente de Paulo, in the city of Passo Fundo.



01. **Porto Alegre (Central)**
02. **Rio Grande (Central)**
03-09. **North-West Region**
10-14. **South-East Region**

Fig. 1. Map of RS State and Telecardiology related regions/cities.

The project offers: 1. Immediate digital ECG signal acquisition, Internet teletransmission from remote areas and specialized ECG diagnosis from 2 referral centres; 2. Internet based live second cardiological opinion; 3. Thrombolytic therapy for ST-elevation Myocardial Infarction, to be infused at the remote point of care and; 4. Ambulance transport of critically ill patients.

Training team selection: the coordinators of the e-Health Centre were in charge of organizing a training program. The first step was the

establishment of a multidisciplinar training team, that included a selection of 3 students, from both undergraduate and post-graduate programs.

Results

The Project was implemented during the second semester of 2008. The first steps were the implementation of a high speed Internet network (512 Kbps-1 Megabit/s) and the installation and tests of the equipments. Also, during 2 months, a training program for the students was organized, aiming to prepare them for the training task. In this period, the team organized guidelines and teaching material to be used in the field.

Training in the field: the training program for the professionals took place during 4 months, on every other 15 days, and consisted of:

- 2 joint regional meetings - in north-west and south-east regions -, aiming to transmit both telemedicine & e-Health concepts and an overview about the Multicentric Telecardiology Project of RS. Figure 2 illustrates 1 session at the auditorium of the health regional office, in Santa Rosa City.
- During 4 months a series of technical training sessions were delivered for the professionals of both the remote teams and the referral centres. It included 6 team trips to each remote region. A total of 121 professionals were trained in all institutions: 67 in the north-west and 54 in the south-east region. Figure 3 shows an example of a training session in a remote institution in north-west region of RS.

Fig. 2. Regional Meeting in Santa Rosa

Fig. 3. Training Session in S. J. Inhacorá

Conclusions

The Multicentric Telecardiology Project in RS/Brazil, is under establishment as a part of a joint public e-health program, with the participation of 2 public cardiological centres, 11 remote health care institutions, 1 regional hospital and the State Secretary of Health. Recent studies have demonstrated that planning public health assistance and transport strategies can reduce the time spent to offer proper care for cardiovascular urgencies and emergencies [4,5]. This project has the

potential to play a key role in health care delivery, improving cardiac assistance in underserved areas of the state.

The participation of undergraduate and postgraduate students in the training process resulted in an opportunity to visit and to see, during 6 months, the reality of medical practice in small and remote communities of Brazil. Assuming an educational task during the training period was a very innovative experience for the students, allowing them to get experiences in the fields of acute cardiac diseases, public health services, IT infrastructure and implementation of e-health services for emergency cardiac care throughout the state. The results of these efforts, to be documented during the operational phase of the project, are expected to match the objectives.

Acknowledgments

The authors greatly acknowledge to the eHealth Centre of IC/FUC for the innovative opportunity and to the remote health teams for their commitment during the implementation period. Also acknowledge the ISfTeH for organizing the Student's Videoconference Session.

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HON – Hungarian Oncology Network

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The essential goal of The Health Society Complex Program is to raise the health status of the Hungarian population, and to increase the life expectancy at birth to reach the EU-27 average at 2013. For the achievement of this goal, the structural transformation and the infrastructural development of the providing system of cardiovascular and malignant diseases is inevitable. In the year 2005, Hungary 33500 person died of tumours. [1] This data shows that in Europe, Hungary has the highest mortality of malignant diseases. [2]

The East-European countries', above all Hungary's bad mortality numbers are caused by the unhealthy lifestyle for example: smoking, high alcohol consumption, environment-contamination and by the geographical inequity of medical service, especially in oncology. The reduction of the Hungarian mortality rate can be solved by prevention and early diagnosis of tumours, more advanced diagnostic methods and application of effective therapy procedures.

The *Hungarian National Cancer Control Programme* (HNCCP) was announced in February, 2006 as a government program to reduce the mortality of malignant diseases, adjusted to WHO-guidelines and expectations of the European Council. The HNCCP analyzes the insufficiency of the oncology provision, and composes recommendations for increasing the efficiency of the providing system and informatics developments. The project's main goal was to create an information technology system connecting the providers (establishments), taking part in the oncologists' further vocational training, providing the telemedicine in the diagnostic process and the caring of oncological patients.

IT implementation

One of the main goals of The Hungarian Oncology Network (HON) system [3] is to equalize and harmonize the level of the regionally organized oncological centres' medical attendance to increase the patients' chance of recovery and to make the up-to-date care available.

Prevention and treatment of malignant diseases is exceptionally complex and complicated, so it needs the exact cooperation of medical experts and the availability of medical equipments. We need a very good structure for

the integrated operation to assure this activity. This structure needs also an advanced system-organization and quality assurance. For the prevention and up-to-date care of tumours it's indispensable for the patients to find the best information (source) for them and to take advantage of the needed medical attendance without delay.

For the achievement of these purposes the HON Portal must ensure the hierarchical/structured overview and filtering/searching options, about the services of the oncological centres and medical attendance opportunities. The search for the services of medical attendance could be executed in context sensitive mode, what means, that the result of search is displayed according to the logged in person's regional classing and the position of the oncological institute.

Within our work – in the scope of cooperation between the Semmelweis University and the National Institute of Oncology – we endeavoured to test the established portal-structure and content, and as skilled medical-IT users we put forward concrete motions for an amendment, and if they were accepted they were built in the portal's content and structure.

Education

One of the *Hungarian National Cancer Control Programme*'s goals is: training in European standards, continual medical education for the specialists in the oncological attendance. The international observations shows, that the action against the malignant diseases was effective only where the performed program was long-term and professionally established and where the education and its organization was high-level. Nowadays in Hungary the oncology attendance has a lack of experts. One of the most important condition of the fight against the tumours effectively is that the treatment performing doctors in the various oncological institutes have a unified, up to par attitude and skill of the present day. These things make them capable of the performance of the high-level preventive, diagnostic, curative and palliative anticancer activity.

The program's essential goal is to form a multidisciplinary education-program that beyond the clinical knowledge of early diagnosis of tumours and complex therapy contains basic research knowledge of prevention and formation of tumours.

Target audience of education:

1. family doctors
2. residents in oncology
3. oncologists

Within our researching-developing work we adapted the examiner program of the Semmelweis University used in the health-IT education/training into the postgraduate oncologist trainings based on the credit system.

Telemedicine for tumour diagnostics

Nowadays the health system requires more and more money from public fund, the health-insurance companies, and even from the citizens. There were so many ideas for solving this problem of cost-containment: to manage the system from less money but with the same effectiveness of service. In the health system, the knowledge and technology already achieved a level where a greater technological development can be implemented.

What kinds of technical conditions do we need for using telemedicine?

The bases of applying telemedicine are the high quality videoconference-systems, to which the special medical devices can be attached and if needed, many other types of peripheral devices can also be added.

The basic elements of the systems are for example the multilateral conference-servers, video units (e.g. video printers, converters, beamers), audio units (e.g. audio mixers, interpreter devices), cameras (e.g. mobile) or even central peripheral-drivers which ones let us use special distance teaching, telemedical, monitoring devices.

Making the videoconference connections had always great attention during our student research-development program. To make this presentation is also a task of the students of the University. These experiences of the development will be delivered to the HON project, where they are needed.

What kind of advantages or disadvantages does the telemedicine system have?

Advantages:

- Interoperable patient-administrating systems can be installed, which can make easier to decide for example the priority in transplanting and operating waiting-lists.
- Different experts' opinions could be easily and quickly asked, even from abroad.
- The postgraduate education of health professionals would be more effective.
- The new medicines, technologies, accepted professional norms, and the new guidelines will be known more quickly.

Some disadvantages:

- Some people are afraid that the patient-doctor relationships will become less personal, some others are afraid of the new types of medical malpractices, and that they will become more frequent without the newest technology.
- Many think that implementing this telemedicine system will be too expensive, and the State has not enough money for it.

However, we think that despite all these real threats, the telemedicine is such a good new opportunity, with much more advantages than disadvantages, so at least in some parts of the health system, it should be implemented, and if it is working properly, the implementation in other parts should be considered.

Acknowledgment

András Jávor, Dr.; György Surján, Dr.

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The Student eHealth League of PUCRS (LITESA)

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Abstract: **The establishment of Telemedicine projects at PUCRS motivated students to search for further information regarding eHealth technologies, programs and project experiences. In December 2007, with the support of professors from the university, a multidisciplinary student group was created known as the Student eHealth League of PUCRS (LITESA). From the very beginning of its activities, LITESA has attempted to broaden eHealth knowledge among undergraduate students from different areas, organizing activities between members within the local group, as well as with national and international student groups. This has familiarized students with Telemedicine technologies and assistance programs, encouraging them to participate in research and healthcare projects. As a result, students have acquired a better understanding of technological advances in the areas of Telemedicine and eHealth, thus being better prepared to use them in their careers.**

Introduction

eHealth educational programs, Telemedicine assistance technologies and graphic design tools have changed the way universities and their students, researchers and patients interact [1-3], enabling them to reach higher levels of communication [2-3]. As a result, distance has ceased to be the main barrier for health assistance and education in remote areas [4], allowing knowledge to be widely exchanged and improving patient assistance [5]. There is no doubt that in the future there will be a greater need for better educated medical and health informatics specialists who are more aware of new information and communication technologies, as the applicability and use of these tools in the health care field increases. Therefore, having students share educational experiences at multiple universities is widely regarded as an essential and integral part of the learning process [6]. In consideration of this, professors and eHealth professionals of PUCRS have encouraged students to organize and create student research groups. One

such multidisciplinary group is The Student eHealth League of PUCRS (LITESA), created in December 2007.

Objectives

The aim of the establishment of LITESA was to encourage an environment where the development, promotion and diffusion of knowledge and technologies in eHealth could take place, contributing to academic and professional development of students of PUCRS and partner Universities, and leading to an improvement of existent health assistance models.

Methodology

Students met once a week to discuss previous telemedical education activities, evaluating their positive and negative points, and to organize new eHealth events in order to build a timetable. This was made available to all student members via Google's group e-mail delivery and Google Calendar service. All activities were scheduled considering the student's availability.

To the development of activities, eHealth tools were used to enable virtual participation. The Skype software, an open source video-conference system, the Scotty video-conference equipment and the Adobe Connect Pro web conferencing web-system allowed professors, students and health professionals to perform PowerPoint presentations nationally or internationally.

Results

The following projects and activities were developed with the assistance, management and organization of LITESA between January and December 2008: live surgery transmissions via an analogical audio/video system from the operating theatre to the classroom, with simultaneous transmission via Skype software to the eHealth Student Group of Kaunas University of Medicine (eHSGK), Lithuania; video-conferences of case discussions via Skype software and Scotty video-conference system with the eHSGK (Figure 1), students and professors of the Aachen University, Germany, including simultaneous video-conferences with students and professors from Warsaw University of Medicine, Aachen University and the eHSGK (Figure 2); workshops about eHealth tools and telemedicine projects via Adobe Acrobat Connect Pro system with the Brazilian eHealth Student League; international conference via Skype with the eHSGK (Figure 3), which resulted in the presentation of scientific projects; successful assistance missions to the Amazon region of Brazil (Figure 4); eHealth presentations to students of PUCRS University for the promotion of

telemedicine concepts; poster presentation in the Regional Medical Education Congress. Students of LITESA also took part in training activities in web-conferencing tools using the Adobe Acrobat Connect Pro system and scientific presentations about eHealth applicability.

During this period a total of 31 student activities and 1 poster presentation took place, allowing the students involved to learn about, discuss, exchange and present different subjects regarding eHealth technologies and applications, whilst gaining the experience of collaborating at a national and international level.

Figure 1: Case discussions with Telemedicine Centre of Kaunas University of Medicine, Lithuania, via Skype software

Figure 2: Multipoint activity between PUCRS, Aachen University, Kaunas University of Medicine, Lithuania, and Warsaw University of Medicine, Poland.

Figure 3: International conference between undergraduate students from PUCRS and Kaunas University of Medicine.

Figure 4: PUCRS Amazon Mission – January 2008

Conclusion

LITESA has contributed to the diffusion of eHealth knowledge at PUCRS, allowing students to better understand concepts, technological tools and different telemedicine applications. The multidisciplinarity of the group has proved to be a key factor for the success of the work. Moreover, the activities developed have fostered closer international relations between students from different areas of the world and encouraged thinking at a

more global level which could prove to be an invaluable experience for students in their future careers.

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Towards Quality of Service-Awareness of Mobile Healthcare Services

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Abstract: **Inevitably healthcare goes mobile – providing m-health applications to users anywhere-anytime, and relying their delivery on the best-effort Quality of Service (QoS) of the underlying wireless networks. We examine a technical and business viability of *QoS-information system* (QoSIS), which, based on Mobile Web 2.0 paradigm, predicts the QoS provided by networks available in a given m-health user location-time thus enabling this user an informed network choice.**

Introduction

The effective use of any mobile healthcare i.e. m-health application like tele-monitoring or tele-treatment, strongly depends on the Quality of Service (QoS) provided by the wireless networks it uses. However, this QoS is often unknown. Public or private wireless network providers, for example Mobile Network Operators (MNOs), do not disclose any 'real-world' QoS information. For marketing purposes, they advertise only the best networks nominal data-rate values. Besides, according to the 4G vision, in a near future various networks provided by different MNOs over wireless technologies like 2.5/3/3.5G or WiFi/WiMAX, will be ubiquitously available for m-health users. Also, a seamless handover between these networks will support the users' mobility [1]. In the ideal scenario, these users have a priori knowledge on the QoS provided by different networks, based on which they can make an informed choice of which network they want to use for their applications [2].

Towards this end, we propose *QoS-Information System* (QoSIS), which, based on Mobile Web 2.0 paradigm, distributes to m-health users predictions about the QoS provided by different networks in a given location-time [3]. The predictions are used to choose the network provider and technology and to adapt application to the network's provided QoS, thus enabling an improvement of the user experience, and decreasing a probability of endangering of the m-health application user's life.

QoS-Information System (QoSIS)

QoSIS (Fig. 1) is a system that collects from m-health users the (anonymized) QoS data about the QoS provided by networks. The collected historical data is stored and processed in databases, with the principal dimensions: location, time, wireless network provider and technology used. The QoSIS uses a QoS-prediction engine, which, based on data-mining techniques, builds a heuristic to derive QoS predictions from historical data.

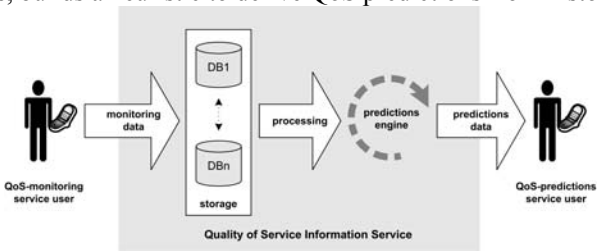

Fig. 1. QoSIS high-level system architecture

QoSIS distributes the derived QoS predictions back to m-health users. These predictions are location-time specific predictions of the QoS achieved by a user of m-health application, when a given provider (e.g. Orange) and technology (e.g. 3G) is used. Along the Mobile Web 2.0 paradigm, the m-health users are data producers-consumers, i.e., "prosumers" [4].

QoS-predictions Service Case Study

We assess a technical feasibility of QoS predictions engine in a case study based on a mobile health telemonitoring application provided by the MobiHealth system [5, 6]. A QoS measure of importance is an application-level delay, i.e. a delay at which vital signs data being acquired from a mobile patient are available in his healthcare center. We collected historical data from a Chronic Obstructive Pulmonary Disease patient living in Geneva city, using his application acquiring his pulse rate, oxygen saturation, plethysmogram and alarm button activity continuously (freq. of 128 Hz), in different locations-times along consecutive days of his daily activities in December 2007. The overall application data rate sent was ~1.2-1.5 kbps. The patient used Sunrise-GPRS and UniGe-WiFi networks. The application-level delay has been categorized in five classes: <0, 750), <750, 1500), <1500, 2250), <2250, 3000), <3000,∞) The simplest delay prediction method is an 'educated guess'; predicting delay's median class, i.e. class 4, with an accuracy of 51.88%. We aim to predict delay for the eighth day of the m-health application usage based on seven days of

historical data. Table I presents speed, accuracy and complexity of the predictions.

Table I. M-health application data delay predictions: speed, accuracy and model complexity

Technique/Algorithm [7]	**speed (s)**	**Acc (%)**	**Model complexity**
Hybrid: classification via regression, using M5P trees	414	55.95	5 trees, avg. 100 branches/tree, 3-46 functions/tree leafs
Trees: J48	1.26	55.47	485 branches, 319 leafs
Lazy: kStar	0.03	55.39	
Rules: PART	13.21	55.31	302 rules
Bayes: Bayesian Network	0.31	54.87	6 nodes, 5 relations
Funct.: Multilayer Perceptron	2445	54.28	1 hidden layer
Function: SMO	953	53.10	

None of the techniques achieved accuracy significantly higher than the 'educated guess'. That may mean that our data is too random or that we lack some important predictive variable in our historical data.

For the given set of techniques, there is a trade-off between predictions speed and accuracy and model complexity. The most accurate is a hybrid model containing trees and linear functions in tree leafs; however it is slow and complex and therefore can have a tendency to over-fit future prediction cases. J48 tree is simpler, faster and having a less complex model.

Lazy algorithms do not build any model on the data, but search a space of historical data to find the cases similar to ones, the predictions is made for. Bayesian Network derives basic probability relationships between delay and all other variables (location, time, etc.). Non-linear functions (Multilayer Perceptron NN, SMO) take long time for building (complex) models, yet they do not exhibit an advantage in predictions accuracy.

QoSIS.net Business Viability

QoSIS.net is a company based on QoSIS. We assess its business feasibility along the MCM-business model framework [8]. The healthcare domain puts specific requirements on QoSIS.net related to the criticality of the m-health applications used by patients, yet we show that QoSIS.net can be also operational in other applications domains, e.g. entertainment [9].

The main QoSIS.net *product* is a QoS-prediction service - a *mobile service*, which delivery relies on wireless networks. QoSIS.net *customers* are m-health application providers (like MobiHealth BV [6] in a B2B segment) and their users. There are *costs* incurred for QoSIS.net: a) for services setup and maintenance and b) marketing costs for new customers' acquisition. Costs incurred for the QoSIS.net customers' relate to a) an ownership of mobile device with location-determination e.g. GPS module

and b) the QoS-prediction service usage, i.e., data communication, storage and processing 'costs'. The *revenues* for QoSIS.net relate to the QoS-prediction service usage; customers pay monthly or per a prediction fee. A *competition* amongst QoSIS.net customers requires it to be a trustworthy enterprise. As privacy sensitive location-time information is acquired from m-health users by QoSIS.net, the users need to sign an informed consent.

Conclusive Remarks

In this paper we examine a technical and business viability of QoSIS, predicting the QoS provided by networks available in a given m-health user location-time thus enabling this user an informed choice of the network to be used. The predictions are possible to be derived; yet, there is a trade-off between models complexity and predictions speed and accuracy. At the moment we conduct analysis for other historical data (e.g. two, three weeks) and other predictions methods. The QoSIS business feasibility shows that using the QoS-predictions service is beneficial in terms of revenues increase for QoSIS.net and m-health application providers, and in terms of mobile users experience improvement. QoSIS.net critical success factor relates to an attraction of minimal number of customers, providing historical data as a base for deriving of accurate predictions. Our solution reaches beyond the current QoS-frameworks based on network-resources reservation and user's "locking-in" into network mechanisms. The novelty is that we employ Mobile Web 2.0 paradigm; m-health applications users are data producers-consumers. QoSIS.net empowers them to choose the network to use, yet, it does not require any change in the existing network infrastructures.

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Session 13

eHealth Informatics

Adaptive Healthcare Applications using Agent and Workflow Technologies

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Abstract: **This paper presents a prototype system that aims at supporting healthcare professionals at their everyday tasks. The system has been developed on the grounds of a service-oriented architecture where healthcare process automation is realized by means of dynamic, patient-related workflows.**

Introduction

Current challenges in Healthcare Information Systems (HIS) include providing healthcare professionals with efficient tools to support them in their everyday tasks [1][2]. In this way, their productivity will be increased and the quality of patient care will be improved. For example, a workflow supporting a daily ward round in a hospital may guide healthcare professionals through this process and, subsequently, freeing them valuable time to focus on patient's care. However, it cannot provide an adequate solution since a quite intricate workflow is required for every possible scenario to be predicted. To this end, patient-related workflows, realized as dynamic workflows, where flow of tasks or sub-processes depends on patient under examination and is determined at runtime, must be utilized. Current Business Process Management (BPM) environments are not designed to support constantly changing workflows.

This paper presents a pervasive healthcare system architecture that facilitates seamless and pervasive access to integrated healthcare services by means of wireless and intelligent technologies. The proposed system architecture utilizes web services technology for resolving data integration issues and radio frequency identification (RFID) technology for user identification while agent and workflow technologies are used for the implementation of dynamic healthcare processes' composition. The proposed system architecture incorporates a context-aware authorization mechanism to conveniently and effectively regulate user access to patient information while providing confidence that security policies are faithfully and consistently enforced.

Agent and Workflow Technology for Supporting Dynamic Healthcare Process Composition

Healthcare applications often have life-or-death dimensions as a patient's life can hinge on the instant availability and accuracy of information retrieved during cross-organizational healthcare processes execution. Thus, one important consideration is how to implement those process activities that support healthcare professionals and frontline staff at the point of care [4]. These processes should be tailored to each individual patient and meet the most stringent requirements of high performance, reliability, robustness, scalability, high flexibility and fault tolerance. The conjunction of agent and workflow technologies provides the ability to form and execute such dynamic healthcare processes.

WADE, which is the main evolution of Java Agent Development Environment (JADE) [5], is a software platform suitable for the development of mission critical applications by exploiting agent and workflow technologies [3]. In particular, it facilitates the development of interoperable multi-agent systems where agents undertake the management of dynamic healthcare processes which are defined according to the workflow metaphor. In WADE each workflow is expressed as a Java class with a well defined structure, thus combining the advantages of workflow technology with the power and flexibility of an actual programming language like Java. Each time a new workflow is formed, it can be deployed at runtime thus making it immediately available to healthcare professionals.

System Architecture

Fig. 1 illustrates a high-level view of the system architecture, which is described by a three-tier model, comprising the PDA client, the server site of the DGH and the health district information systems.

The first tier essentially refers to the PDA carried by a physician on a ward round. A RFID reader is adapted to the PDA which reads the passive RFID tags placed on wristbands worn by patients. The PDA contains both RFID software, which is responsible for collecting raw RFID data, filtering them and submitting them to the RFID middleware installed on a server at the DGH site, and an HTTP(S)-based client, which is the PDA’s web browser and provides user interaction with the system.

The second tier is the server site of the DGH and consists of the following components:

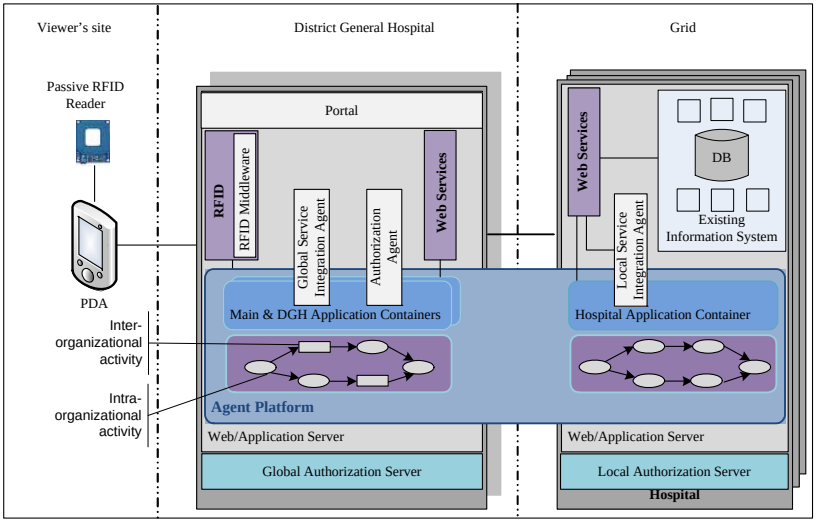

Figure 1. System Architecture

- Web Services: They address the issues related to interoperability of the database management systems residing at each healthcare setting within a health district.
- Agent Platform: It is the software used for the development and deployment of the agents that perform the composition of dynamic healthcare processes. There are two kinds of agents managing these processes: the Global Service Integration Agent (GSIA) and the Local Service Integration Agent (LSIA). The former is held at the DGH peripheral container while the latter at the peripheral containers of the various healthcare settings. Both agents have been designed to include a light workflow engine that executes workflow-based processes. In particular, when a patient's RFID tag is captured, this is communicated to the GSIA which in turn forms the patient-related workflow starting form an existing workflow that serves as a template. As soon as the workflow is formed, it is deployed and can be executed by the authorized healthcare professional. LSIA is responsible for the management of sub-processes that may be included in the aforementioned workflow. These are formed and executed at the relevant healthcare setting of the health district.
- RFID Middleware: It is the product that mediates between the RFID software installed on the PDA and the software applications using the information captured by the RFID reader. This middleware applies

formatting or logic to tag data captured by the RFID reader in order to convert it to a form that can be processed by any software application.

- Portal: It provides a web-based front end to the system. It consists of a portlet container that hosts and manages the portlets delivering the system functionality.
- Web/Application Server: It provides the hosting environment to the aforementioned components.

The third tier comprises of remote data resources where patient information is stored. These are heterogeneous and reside in geographically distributed and organizationally disparate healthcare providers within a health district. Patient information is accessible by means of web services.

With regard to security, at the DGH a global security server controls process execution and web service invocations. At each healthcare organization, a local security server controls access to locally stored data at the database servers during web services execution. All the security servers are based on an authorization model that has been implemented in XML Access Control Markup Language (XACML) [6].

Conclusions

Provision of the highest quality of healthcare delivery can be achieved if healthcare professionals can be guided in a complete, integrated and exhaustive way through all the required tasks during a ward round. To this end, the proposed system architecture provides healthcare professionals with a powerful tool that assists them in their everyday tasks by means of dynamic healthcare processes. In these, the flow of tasks is adjusted at runtime in accordance to the context of the patient under examination.

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A European Patient Summary Infrastructure

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Abstract: **The healthcare infrastructures are naturally distributed and heterogeneous in terms of information management, document structures, protocols and language bindings. In this paper, we address the European Patient Summary challenge with a semantic space middleware that we term Triple Space. Triple Space facilitates the sharing of patient records by avoiding many of the eminent interoperability problems and potentially incompatible privacy and data protection laws via semantic technologies.**

Introduction

The healthcare organizational structure in all countries is naturally distributed, being a geographical spread of centers at different levels of complexity: from the general hospitals down to individual physicians. The ultimate objective of such a structure is to build a network of complementary centers (hospitals, laboratories, ambulatories, coordination centers, etc.) spread over the territory, to meet effectively the social needs in the area.

The lack of homogeneity in current healthcare information systems (both in terms of technological progress and of different implementation choices) leads to data integration problems when having to cross the boundaries of the single information system. When the aim of the integration is to aid the decision process of a doctor, a full integration of all the medical records related to a patient is very hard to implement and can be more than needed. Integrating a smaller set of information better meets the requirements of a means of providing a meaningful subset of the patient's clinical history, also called Patient Summary, independently from the sources of the information.

The implementation of Patient Summary infrastructures is currently carried on by single countries, and it is a long and money-consuming process. A single country can fully impose its own will to its healthcare providers when dealing with standards and reference platforms, but trying to provide a solution at a European-wide scale implies solving a

multilaterality problem mainly in the fields of reference standards and privacy regulations.

As each country is developing its own country-wide healthcare information system using a certain set of standards, providing a multinational solution by forcing all the EU countries to adopt a single standard for messaging and medical vocabularies is certainly unrealistic. Moreover, in an EU-wide context the issue of privacy protection becomes much more complex, as each country associates a different meaning to the concept of privacy, and that meaning is then put into the regulations of the country itself. While country-wide healthcare information systems can assume a single privacy law used by all the healthcare providers, a multinational system must take into account the existence of different and possibly incompatible regulations about accessing clinical data.

The Triple Space Infrastructure

Triple Space (TS) as communication and coordination infrastructure is derived in its basic ideas from the concept of tuplespaces or blackboards, as they are known from parallel computing and artificial intelligence [1]. The main purpose of TS is thus to provide a platform (information space) in which autonomous clients can share information via the publication and retrieval of persistent knowledge artifacts. This brings along four major characteristics of the links between data providers, and consumers:

- **time autonomy –** providers and consumers do not need to establish timely connections;
- **location autonomy –** once published the data becomes independent of the provider;
- **reference autonomy –** providers and consumers are independent of each other (anonymous access to information); and
- **schema autonomy –** the data internal data schemas are independent of the native schemas of either producers or consumers..

The global information space of the TS platform is organized in a tree of disjoint spaces that as a whole establish a network of virtual information sources, an overlay on top of the physical network of the legacy information systems of various data providers (healthcare providers in this particular case). This allows particular groups of healthcare providers and authorities to create their own space and to collaborate via their chosen space with their chosen security policies and access control. Every space provides thus a specialized cooperation platform for a given group of actors.

The data shared in the TS are represented by three fielded RDF triples that provide a means to connect the shared data to ontologies, and hence to give meaning (semantics) to the published information. The use of semantic

formalisms enables the application of further semantic technologies like data mediation, inference, or consistency checking. In that sense TS delivers increased interoperability, and protocol, respectively language neutrality that is required to realize a European patient Summary infrastructure.

Triple Space as Solution for the European Patient Summary

The primary requirement of the PS scenario at an European-wide level (EPS) is the integration with existing healthcare information systems, which are designed to exchange patient data through existing eHealth standards, including HL7 Clinical Document Architecture (CDA), OpenEHR, and ASTM Continuity of Care Record (CCR). The EPS solution using the TS adopts a properly configured semantic grounding component, which is able to translate HL7 CDA, CCR and OpenEHR messages in their corresponding RDF versions. In order to perform this step, formal models (in the form of ontologies) and mappings that capture both the structure of the messages and their meaning have been developed.

The TS configured for the EPS scenario is virtually one big space within the global Triple Space infrastructure. It is subdivided into many subspaces following the natural structure of health authorities in Europe. There are several nations with national authorities which in turn are subdivided into regions and cities. Thus, the EPS is represented by a tree of triplespaces with the root representing all of Europe, and the leaves delivering the individual citizens' patient summaries. Every summary is further divided into three subspaces: two for the parts of the PS related to administrative data and clinical data, protected according to public regulations, and a third subspace protected by patient's specific access policies. Each space has a security policy which controls the permissions on the various possible operations wrt. the group that the user belongs to. The policy of a space also specifies how the policies of its subspaces are to be evaluated (e.g. if the decision taken by the parent policy prevails over the one of the subspace, or if a deny decision during the evaluation has to prevail over an allow decision). Depending on the rules of the authority owning the PS, data of each PS can be either stored on a single TS kernel or on multiple kernels. The first option follows the example of how the PS is handled by the Personal Demographics Service (PDS) of the National Health Service [2] (United Kingdom), which is the central database for the Patient Summaries of all the English citizens. Even if care records follow the principle of data ownership, the summary data is required to be submitted to the PDS. In our case, we allow such behaviour if we force all data providers who want to add PS data to write them in one of the three spaces defined before, and then we keep these three spaces of a single PS on a single kernel.

We can also allow a healthcare provider to keep the ownership of his data, as in the Dutch AORTA system [3] (in The Netherlands privacy laws don't allow centralized collections of healthcare data), by just allowing him to create on his kernel subspaces of the three subspaces of the PS. When accessing the data, the TS infrastructure takes care of retrieving data from all the kernels where the PS is hosted.

Conclusions

The European Patient Summary is a major component of a European-wide healthcare delivery system and a challenging endeavour in terms of interoperability and scalability. While the former can be addressed by means of well-established semantic technologies like ontologies and data mediation tools, the latter still suffers from a lack of semantics-aware middleware solutions that scale to the size of the European population. Triple Space is middleware solution that is tailored at the sharing and coordination of semantic artefacts in the large, and is thus a promising proposal for a platform that enables cooperative activities on top of semantically annotated patient records. In this paper we presented our Triple Space-based approach towards an EPS system, and introduced some technical characteristics in terms of platform implementation, information system bindings and interoperability.

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Artificial Inteligence in the Analysis and Diagnosis Of Breast Cancer

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Mammary cancer represents a major health problem on world plane; thus, its diagnosing as precocious and accurate as possible (in the sense of status condition) represents a field of convergence of the efforts of scientific research, and of the current clinical practice as well, which also involves specialists of various fields.

In a study, published in 2001 by the Computer Science Department, Frankfurt a. M., the German researcher R.W. Brause has analyzed comparatively (from statistical point of view) the oncologic diagnostic in the following cases:

- the best human diagnostic (medic with a very long experience): true in 79.7% cases;
- the best diagnostic of an expert medic using performing information techniques (databases of 600 patients, IA techniques): true in 91.1 % cases.

The conclusion has drawn the fact that the human expert cannot analyze *ad-hoc* complete data without (a wide range of) errors, being necessary the utilization of the information technique for reduction of their number.

Hence, the aim of this paper is to describe a *Diagnose Aided System* (DAS) developed in order to organize medical information and help the physician to detect the breast cancer symptoms (i.e. clinical information, disease details, image processing, etc). *DAS* is developed based on Artificial Intelligence (AI) techniques (fuzzy concepts). Moreover, *DAS* is set up based on two pillars: improvement of mammography / echography images and human knowledge transfer for image analysis and diagnostic decision.

Keywords: breast cancer, diagnose aided system, fuzzy technique, image processing

Challenges of Setting up Hospital Management Information System (HMIS) in Pakistan: Pakistan Institute of Medical Sciences (PIMS) - a Unique Success Story

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Pakistan Institute of Medical Sciences computerization background

Pakistan Institute of Medical Sciences (PIMS) initiated the process of computerization in 1993 with the Department of Pathology. It was a small yet significant step based purely on departmental initiative and effort. The main focus was on improving patient care by improving the management aspect of the Department. A private software house developed the software in FoxPro and provided training and maintenance free of cost. The hardware and Local area network was provided through private donations.

In 2005 Ministry of Information Technology (MoIT) and Ministry of Health (MOH) based on the positive results approved a two year project of about one million US$ for purchase of hardware, networking, training and setting up of an HMIS dept Presently 450 active nodes and 14 integrated modules covering all aspects of patient care are in use. 13 master trainers trained the hospital staff. Initially the staff was hesitant and reluctant and had a “fear” of computers. However, once the system stabilized and the staff realized the benefits including less effort, better output and better working environment and moral they readily discarded the manual system. Manually 2400 patients were registered per day at the central registration this activity was decentralized to the 18 departments. This is just one of the many process re-engineering activity takes place since computerization was introduced. The challenge in Pakistan now is to harness the technology effectively and quickly in order to provide better healthcare cost effectively. The HMIS effort in PIMS has opened the doors for e-health and telemedicine. Telemedicine and e-health are both based on ICT. Thus an understanding of how to implement these technologies on the ground is critical. PIMS experience over the past 15 years provides the knowledge base on which successful ICT initiatives can be based in the health sector.

Financial Challenge

PIMS is the first tertiary care public sector hospital to be computerized in Pakistan. The process of acquiring funding in the public sector starts with the preparation of Project Document (PC-1), which has to be approved by a Committee where all stakeholders are present. The PIMS PC-1 is used as a starting point by other hospitals. The funds have to be reflected in the Government's budgets. The Government generally provides grants for one time activity of a development nature and expects the institution to bear the recurring costs. Thus all e-health and telemedicine projects have to follow a similar path for obtaining funds.

Software Challenge

Most computerization projects fail because of the lack of availability of properly tested and debugged software. In the public sector maintenance of hardware, software and ownership of the source code is another area which inhibits computerization. Government and public institutions require the source code from the vendor which leads into security issues from the vendor's perspective who has invested a lot in his product. A clear policy on software acquisition protecting both the vendor and the procuring agency is prerequisite for further development of the market. Development of software is an ongoing process and outsourcing vs. in-house software development debate has been ongoing in the computer industry. The health sector especially hospitals have to determine their line of action in this regard. eHealth and telemedicine will also face similar issues.

Hardware Challenge

Hardware as compared to the software is relatively easier to manage. Successful implementation is to a large extent determined by resources. Maintenance contracts and recurring costs are sometimes much more than the original costs of the equipment. An IT system will break down when hardware fails. In developing countries availability of funds for maintenance are very limited and the procurement lead time is long. This leads to frequent breakdowns, and increases end user frustrations. Proper implementation of contract and provision of technical support by the vendor is unsatisfactory causing problems in running the system. eHealth and telemedicine initiatives to be successful need to ensure proper hardware backup support around the clock.

Training Challenge

Training is an ongoing process as a hospital is a dynamic environment. In developing countries the support staffs that have to perform the main

functions are not computer literate. This was the case in Pathology Department In the initial years both the manual and computer system had to be operated in parallel. In Pakistan computerization is seen as a parallel activity to the manual system. It is considered as a post data entry system and focuses on employing computer operators to do the data entry. In PIMS a different approach was followed. The staff which performs an activity manually now does it on the computer. This saves money and improves accuracy as the data is live. The training issues are; the staff turnover is high, incentives for learning computer skill is not available, there is a lack of familiarity with the use of basic computer programs and typing speed is slow leading to decreased efficiency. At PIMS staff training is through on job training and computer lab training. Training is a slow process. eHealth initiatives need to consider the training component seriously.

Management Challenge

In public sector coordination is a huge issue when a multitude of organizations are involved. The interaction between PIMS, MOH and MoIT is quite complex. The approvals and correspondence with the MoIT which provides the funds is routed through MOH. All stake holders have to be satisfied for proper functioning. This problem was dealt at PIMS by appointing a PIMS coordinator.

Given the success of the HMIS the MoIT and MoH has shown a keen interest in replicating this model in all the federal Govt. Hospitals. However users want to develop their own software and thus reinvent the wheel. There is thus a need to have standardization otherwise exchange of data between software would become very complicated. At present no federal agency is performing this task. Knowledge of HL7 is almost non-existent in Pakistan. Standardization would be critical for future E-health and telemedicine initiatives as it involves exchanging electronic exchange of patient records. Communication/interfacing of software with equipment and between hospitals in the city, provinces and in the country would be critical. Vendor’s are not in a position to provide solutions for standardization. Pakistan has very few fully automated hospitals. Some successful computerization models exist in the private sector where the software has been procured from abroad or an in-house development team has been employed. Computerization in a private hospital is easier as the rules and regulation are flexible, authority for hiring and firing of staff is clear, and there are output based incentives for staff. Management has total commitment to improve efficiency, financial management, transparency and patient care. On the other hand computerization in public sector is slow with the main reason for slow progress being lack of commitment and

ownership, unnecessary bureaucratic hurdles and no incentive for bringing change.

Telemedicine Challenge

Telemedicine, eHealth and hospital computerization are all interlinked. A concept paper for establishing a Tele Medicine Center at PIMS has been developed in collaboration with Ministry of Science and Technology (S&T) and PIMS. It is a novel idea as expertise from two different Govt. Ministries is being utilized to provide tertiary care health facility to rural areas. S& T will provide technical support and maintenance of telemedicine equipment, bandwidth etc. PIMS will provide telemedicine duty roster for the doctors from various specialties. Doctors will be performing this duty as part of their routine daily work. In addition to the software and hardware issues ensuring availability of doctors on time, availability of reliable electricity at rural centers, ensuring maintenance of equipment at the rural centers and providing incentive for doctors are some of the other challenges to be overcome.

Accreditation and Standardization of Hospitals

GOP through MOH is very keen to develop National Hospital standards leading to accreditation. One of the perquisites of such accreditation is the documentation and availability of reliable and retrievable data. HMIS is the answer to this problem especially in hospitals and other health facilities.

The way forward

The upcoming challenges to be overcome relate to creating awareness for e-health, telemedicine and HMIS. This would require holding seminars focusing on explaining the concepts and models. Proposals for Pilot activities need to be developed to show how the concepts can be translated into realty. For ensuring wide spread use, coverage and access there is a need to develop a Government policy on these topics. This would require setting up task forces under the MOH to come up with recommendations to create an enabling environment for introducing IT in the health sector. There is need to develop a legal framework for e-Health and to get the legislation approved from parliament. Advocacy for eHealth would need to be supported.

In conclusion the PIMS experience clearly highlights the need of a strong commitment and ownership, properly tested and debugged software, support and maintenance, staff training, creating awareness for e-health, standardization and above all adequate resources as crucial to the success of any eHealth initiative.

About the Author

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GECAMed: A Fully Featured Open Source Software for Medical Practice Management

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Abstract: **The amount of patient related information, doctors have to manage and potentially exchange is tremendous, making it logical to put all this information in electronic form. GECAMed is a free and Open Source Software which helps doctors to manage, structure and exchange patient data in order to provide a better expertise and follow-up. It is a complete set of tools where doctors can also manage invoices, theirs appointments and all the administrative data they have to care about.**

Introduction

While there are a lot of applications available, commercial as well as free or open-source, most have major drawbacks. Open-source software is either badly designed, no longer under development or is in a too early stage of development to be taken into account for immediately effective working in a medical practice. Commercial software from smaller companies are challenged by the fast technical and medical progress which demands a continuous up-to-date long term development. Proprietary software also often has the disadvantage of making the recovery, import or export of data difficult. In addition doctors prefer not being dependent on a given company and want full access to the source code as well as to patient data.

The goal of this project is to implement a free and open source software continuously developed by specialized people in close collaboration with doctors. This software allows physicians to manage patient's administrative and medical data and therefore contributes to the "chain of care" by facilitating their exchange between health professionals. The first phase of this project was dedicated to general practitioners while in the second phase it is planned to develop specific modules for different specialties.

Another important point of this project is the collaboration with commercial companies interested to sell services linked to this project (support, backup, updates). Since the code of the software is open, everyone can adapt the software to his or her own needs. This in turn might contribute to solve the problem of evolution of the software.

Material and Methods

The electronic health record, which was implemented in GECAMed [1], follows the “Subjective, Objective, Assessment and Plan” (SOAP) approach (First proposed in 1969 by Dr. Larry Weed). This method mirrors the reasonable way of the doctor’s assessment concerning a patient’s status. It considers four major steps starting with a patient’s subjective description of his condition, followed by the doctor’s objective examination resulting in a diagnosis, which finally ends up with a treatment plan.

Technicalities

Even though most doctors are using computers running Microsoft Windows as an operating system, there are however some doctors who opted for other systems as well, namely Mac OSX and to a lesser degree Linux. In order to offer a common solution to everyone it was clear right from the beginning that the solution ought to be platform independent. This requirement led to the decision that the JAVA programming language was the language of choice for developing GECAMed.

GECAMed being a client-server application, the deployment platform of choice is the JBoss Application Server (http://www.jboss.org). The JBoss application server is a J2EE certified platform for developing and deploying enterprise Java applications, Web applications, and Portals. It provides the full range of J2EE 1.4 features as well as extended enterprise services including clustering, caching, and persistence [3].

The JBoss application server includes the Hibernate (http://www.hibernate.org) persistence service, even though it allows using other persistence layers as well. The persistence layer bridges the gap between the object-oriented data model and the actual database tables for storage of object properties. One of the major advantages of Hibernate is that it is database agnostic, i.e. there’s no dependency with the actual database engine underneath. This gives commercial companies the freedom to choose the database they feel most comfortable with. However, when installing GECAMed out of the box, it comes with a PostgreSQL (http://www.postgresql.org) database, a powerful, open source object-relational database system which is often compared to the open-source equivalent of an oracle database.

In order to improve GECAMed depending on real needs, the CRP Henri Tudor regularly collects the feedback from the user group and provides respective updates.

Results

The results of the project to date are modules for:

- the management of patient medical and administrative records,
- doctor's agenda,
- DICOM images,
- handling of multi users with different permissions,
- a Luxembourgish health care system compliant billing module,
- as well as an integration of the Labo-project [2] solution to exchange laboratory results.

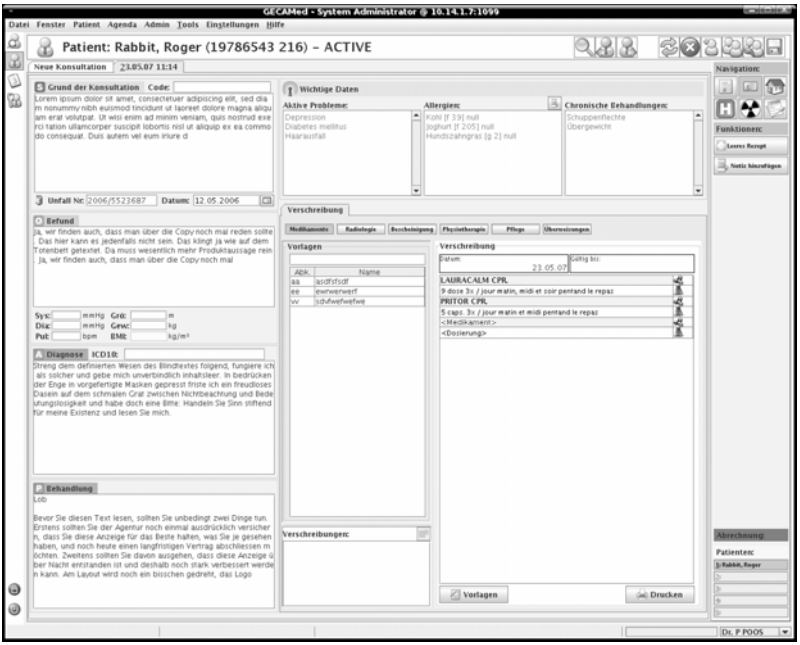

Fig1- The consultation screen with the SOAP approach. Left: SOAP approach reflected up to down, upper right: critical patient data , lower right: treatment plan.

The first version of GECAMed was released in September 2008 and is freely available to download from: http://santec.tudor.lu/project/gecamed.

Since this first release, the group of users is continuously growing. This is also supported by trainings, specially designed by the CRP Henri Tudor, for respective needs of the target groups, comprising all levels of health professionals from the secretary over the general practitioner up to the medical specialist (e.g. radiologist)

Furthermore, the use of GECAMed has been recently established in the new medical houses in Luxembourg, Esch-sur-Alzette and Ettelbruck.

Conclusion

Due to the fact that doctors are using and supporting GECAMed, this free and open source software can serve as a good basis for future cooperative development. In this regard the main focus will be to extend GECAMed to medical specialties in order to further increase the target group of health professionals and to facilitate their data exchange.

Acknowledgment

The project was supported by the “Ministère de la Culture, de l’Enseignement Supérieur et de la Recherche” [4], Pfizer, AstraZeneca, the Association des Médecins et Médecins Dentistes (AMMD), and independent doctors.

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About the Author

David Baldacchino studies mathematics and Informatics at the University of Metz, France. After he finished his studies he joint the SANTEC team of the CRP Henri Tudor in the year 2000. He has his main focus on health related database development and maintenance. He was and is involved in several projects as a research engineer as well as a project leader. He has his main competences on Electronic Health record and databases.

How To Secure eHealth Data Transmission and Protect Privacy?

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A recent Europe-wide survey on e-health [1] has found that 87% of European General Practitioners now use a computer, 80% of whom are using electronic patient records. But can we have enough confidence into digital information and e-transactions? How can we rely upon existing security mechanism? Is the information reliable? How are privacy needs and professional secrets preserved? Where the responsibility is? Are some of the fundamental questions that should be answered for an effective e-heath system as emphasized by Shreeve's e-Heath 2.0 3rd rule definition [2]: “Realize that Health 2.0 is absolutely reliant on interoperability of health information. Everything […] must be based on standards, be seamlessly transitioned between environments per standardized security and privacy protocols”.

The standards applied today, even in banking institutions [3], are permissive and weak. Nowadays, medical records transmitted are too often, and too easily, accessible by malevolent people.

Consequently, how the dematerialization of the medical records can decrease the frauds and of the swindles to the social security and the benefits scheme? Today, preventing fraud and scams over Internet is a major and serious issue for the e-health community.

Our paper presents the next reliable generation of e-Health infrastructure that could fit secure and strong requirements to achieve a high level of confidence and efficiency into e-health services by introducing quantum physic and responsibility notions.

Keywords: e-Health, Security, Privacy, e-Transmission

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Identity and Privacy Management Technologies for "Health 2.0" Services: Enabling Secure User-Driven Online Services for Healthcare

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Abstract: **"Health 2.0" addresses the use of Web social media services for healthcare, user-centric healthcare that focuses on patient empowerment and cost reduction through the use of new technologies. Patient empowerment and online community eHealth services face identity and privacy data management challenges that can be met through the use of user-controlled privacy and identity management solutions and services.**

Introduction

Recent studies [1] show that the Internet has become the foremost channel for searching health information and that Internet users are increasingly more driven to health information provided by peer-groups and social media services. These tendencies are now paving the way for new patient-centric, online community and patient-empowering healthcare and eHealth services. As patient, caregiver and service provider interactions using the open Internet become more ubiquitous and networked, so does the need to create better adapted privacy and identity management solutions become stronger. User and patient data are prone to serious dangers and risks related to information theft, loss and misuse that grow exponentially as more users are connected to a growing number of new services. Securing privacy and personal data online is as vital to the patient's fundamental rights as to the emerging eHealth applications and services that thrive to empower patients and generate better care with less cost.

User and Patient-centric Privacy

Transparency, portability, and ease-of-use are a key in the applications of user-centric healthcare. Health data should be alive and auditable, instead of artefacts that are stored, filed, and stagnant. Secured patient data should be made collaborative, relevant, and accurate at all times for patients and their family.

The basic hypothesis to be made about user privacy and identity management in open Internet community services is that control of privacy and identity information is user-driven and that Internet user identity is

contextually defined. This core hypothesis has formed the foundations of the highly influential "Laws of Identity" [2], which is a set of 7 principles to which an Internet *Identity Metasystem* should be built upon. An identity system should provide: 1. User Control and Consent, 2. Minimal Disclosure for a Constrained Use, 3. Information to Justifiable Parties only, 4. Directed Identity, as opposed to Universal Identity, 5. Pluralism of Operators and Technologies, 6. Human Integration, 7. Consistent Experience Across Contexts. An *Identity Metasystem* is a service layer that enables Internet users to control their identity information online and to share this data in their own terms. Identity Service Providers have the role of providing only metadata on the user's identity and to provide interoperability between different applications and contexts where identity information is used. The current evolution in the field of user-oriented, identity claims based services has produced two popular solutions: Web URL (Universal Resource Locator) based OpenID and security token based Information Cards. During the past years OpenID and Information Cards have become ubiquitous, even though public or commercial adoption has not been as immediate. There are currently over ½ billion OpenID "enabled" Internet users and all Microsoft® Vista™ equipped PC's have a built in Information Card service ready called CardSpace®. The potential for user adoption is thus unlimited.

User-controlled identity and privacy data is based on the concept of contextually defined partial identity. OpenID and Information Cards provide the users with tools to control the type, quality, extent and amount of identity information they want to share with others. For eHealth service providers, user-centric identity services provide new solutions for interacting with patients on their own terms, securely and in compliance with privacy regulations. After all, every human interaction involves identity, at least to some extent. OpenID and Information Cards offer easy to use and intuitive solutions for the human interface, and highly interoperable Web Service standards based integration for the machine interface. This combination enables new ways to provide eHealth services that empower patients and supports community interaction in existing eHealth environments.

The human interface for identity and privacy management has long been an unresolved problem and numerous attempts have been made using smartcards, secure e-mail, secured websites and other service specific legacy approaches. The main challenge has always been to mitigate security with usability [3]. The challenge remains as long as security is not designed in the solution's fabric itself and the question of identity and privacy are not addressed from the user's perspective [4]. OpenID and

Information Cards addresses this challenge by offering generic frameworks for managing identity information and security that can be adopted and implemented in any service context, and what essential: even across national borders since users and patients themselves are the keepers of the keys to their personal data.

Demonstration case on homecare for seniors

Internet based eHealth services that tackle the challenges of ageing well in a safe home environment, carry great socio-economic opportunities for our ageing societies. Privacy and identity management is one of the hardest challenges to meet with patients and users that are not accustomed to computers and the Web. The imaginative use of open identity services such as OpenID and Information Cards are key tools for implementing intuitive, easy to use and humane Web interaction interfaces for senior users. Information Cards offer a real-life wallet metaphor to address the concept of partial or directional identity. In the European Union Competiveness and Innovation Programme funded T-Seniority project, the Finnish pilot organisation implements open identity services to enable senior patients to interact with caregivers, relatives, friends and other service providers with the use of an interactive touch-screen based web service solution.

Identity management plays a key role in the service concept as senior patients may authorise and provision service providers to access personal data such as home address, service preferences etc. Also patient consent recording is an essential part of the interaction process where care-givers may require access to the patient's medical data in order to avoid unnecessary travelling. Control of identity directionality is another important element when senior users use other web services such as public eServices from the municipality or eCommerce services provided through the senior service portal. In all contexts the senior user needs to be in control of the information she is giving, but without the need to understand the technical operations. The role of the identity service provider, together with the eHealth service is to assure that the senior user can fully benefit from highly personalised and high added value Web-based services without exposing one's personal information in the process. The *Identity Metasystem* offers the solution for developing user-specific identity solutions that integrate seamlessly with security solutions, commercial service applications, and most importantly: integration with underlying existing eHealth applications and electronic health record systems.

Demonstration case of user-centric eHealth application

A Me Server® approach, patented by Polka, defines a circle around a person with their information preserved and translated between networks, including web and mobile. Polka's Me Server applications for user-centric healthcare provide secure identity management, real-time collaboration with a team of health advocates, and synchronisation and sharing on an open standards record format. Polka is putting forth the idea of a portable document standard that is secured with credential information, enabling personal audits and transparency of who said what and when so true transparency and sharing can begin. When all sources (family, doctors and experts) can see the electronic version of a paper trail, it delivers further clarity and background for better healthcare collaboration.

As an example, the user has a "User Centric Information Store" that stores health information from all sources, with proof of each document and source. The information can be shared with experts and applying proof that the flow of information is authorised by the patient. The expert is now able to synthesize data by condition, prescription, treatment, allergy, or episode. After commenting, the expert proves that she made changes to the original documents, and delivers it back to the user. The same scenario extends to the other experts contacting the initial expert. This application offer a new communication tool that provides relevant documentation and a new way to share information readily, accurately, and with the user's own terms. In a homecare situation, the patient can easily authorise a family member to view and edit her record, update new doctors, new medications, and other pertinent information to keep track of her health and progress together.

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About the Author

Teemu Rissanen has been working in IT security since 2001. His expertise covers the areas of trust and security solutions, consultancy services and security studies. He has designed and carried out concepts and systems for paperless processes, secure infrastructure applications and

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As project manager he has lead the consortium in charge of the manufacturing and personalisation the next generation FINEID organisation certificate smartcards in Finland. Teemu has a strong expertise in smartcard technology implementation for various business fields. Currently Teemu is involved in an EU project where he provides consultancy and expert services on identity management and secure data sharing for providing outpatient eHealth services. His main interests are in consulting on solutions for better managing identities and privacy data in the fast evolving domains of Web Services, SOA, Clouds and social networks, where consumer, citizen, business and government solutions and needs converge.

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Ontological Engineering Approach for Breast Cancer Knowledge Management

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Abstract: **Ontologies are being used nowadays in many domains, including medical domains. Merging ontologies allows for the creation of ontologies that later can be composed into effective ontologies as well as for recognizing patterns and similarities between ontologies. The challenge in ontology merging is to ensure that all correspondences and differences between the ontologies are reflected in the merged ontology. This paper presents the process of developing web-based breast cancer ontology and discusses the process of merging two web-based breast cancer ontologies; the developed one and the other one developed by Williams.**

Introduction

Medical Ontologies are introduced for solving problems such as the demand for re-use and sharing of patient data, their transmission and the need of semantic-based criteria for purposive statistical. In this sense, the unambiguous communication of complex and detailed medical concepts is now a crucial feature of medical information systems. In [1] there is a detailed description of some of the most important medical ontologies in terms of their site, purpose, URL and Languages in which the ontology is implemented. We chose the breast cancer because it is the most common cause of cancer in women and the second most common cause of cancer death in women in the U.S. For medical aspects of breast cancer see [2]. This paper discusses the developing of web-based breast cancer ontology. In addition, merging of our developed ontology with the recently published ontology MDMDomain is also discussed.

Developing a Web-Based Breast Cancer Ontology

The breast cancer ontology was encoded in OWL-DL format [3] using the Protégé-OWL editing environment [4]. The knowledge concerning breast cancer is collected from many sources including: MedicineNet [2], the World Health Organization (WHO) [5], the breastcancer.org [6], the

ehealthMD [7] and the National Comprehensive Cancer Network (NCCN) [8].

In this ontology we have two main super classes

- MedicalThings which has sub classes Diseases, Medical_Interventions,Pathological_Category, References.
- People which has the sub classes; men and women.

The class Diseases has a subclass Cancers which has a subclass Breast_Cancer. The class Medical_Interventions has subclasses Diagnostic and Therapeutic. The class References has subclasses Causes, Disease_Stage, Staging, Symptoms and TNM_Stage. Some of the subclasses mentioned above may have its own sub classes as shown in fig 1. These entire sub classes are related with is-a link. The breast cancers are described in terms of its symptoms, causes, stages, pathological category, diagnosis and treatment. In this context, we described causes, stages, and symptoms as references. While diagnosis and treatment are described as medical interventions as shown in fig 1.

Fig 1: The Developed Breast Cancer Ontology

In the breast cancer ontology, we described the diagnosis of the breast cancer as instances of the class Diagnostic. Also causes, stages, staging (how to determine the stage of the cancer) and symptoms of the breast cancer are described as instances. All of the technical developed **classes** and their **instances** (Diagnostic, Staging, Symptoms, Disease_satge, TNM stages and causes) are described in details in [9].

Merging Two Web-Based Breast Cancer Ontologies

This section presents briefly the process of merging two web-based breast cancer ontologies; namely our developed ontology and the recently published ontology MDMDomain [10]. In this respect, we use the IPROMPT tool [11]. Table 1 shows the slots of our breast cancer ontology and MDMDomain ontology that are merged together in the new merged ontology. In this table, F means that the property is a functional property and T means a transitive property. Note that, the slots that are grouped together in one cell in the table below are sub properties of the property mentioned above it (e.g. has_disease is a sub property of personal_attributes property and so on.)

Table 1: The Slots merged together in the new ontology

Slots of MDMDomain Ontology	**Slots of the developed BreastCancer Ontology**
Disease_Attributes • has_TNM_M (F) • has_TNM_T (F) • has_TNM_N (F) • has_stage (F) • has_pathological_type (F)	 hasMstage hasTstage hasNstage hasStage hasPathologicalType
personal_attribute • has_disease	 hasDisease

The MDMDomain ontology describes breast cancer in terms of its structure, diagnosis and stages while the BreastCancer ontology describes the breast cancer in terms of its stages, diagnoses, symptoms, causes and treatment. After merging these two ontologies the new one describes the breast cancer in terms of its structure, symptoms, causes, diagnosis, stages and treatment.

Conclusions

This paper presents the development of a web-based breast cancer ontology encoded in OWL-DL using Protégé-OWL tool. The knowledge is collected from many sources including: MedicineNet, The World Health

Organization, The breastcancer.org, The ehealthMD and The National Comprehensive Cancer Network. In addition the paper presents the process of merging two web based breast cancer ontologies. The first one is the developed one and the second one developed by Williams. To perform merging, the PROMPT algorithm is applied using the IPROMPT tool. This algorithm identifies potential merge candidates based on class-name similarities. The result is presented to the user as a list of potential merge operations then the user chooses one of the suggested operations from the list or specifies the operation directly. The system performs the requested action and automatically executes additional changes derived from the action. It then makes a new list of suggested actions for the user based on the new structure of the ontology, determines conflicts introduced by the last action, finds possible solutions to these conflicts and displays these to the user. From this example, it is clear that the merging process requires the intervention of human to be done without conflicts which means that the fully automation of merging process is almost impossible since it requires good knowledge of the domain, understanding of each ontology point of view, and even the use of negotiation strategies between the designers of the different ontologies in order to make proposals, discuss them and to reach an agreement. The merging tool can be used to guide a user to the next possible point of merging, to suggest what operations should be performed there then left the decision to the user.

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He was one of the founders of the following events, First Egyptian Workshop on Expert Systems 1987, Int. Cairo Conference on Artificial Intelligence Applications in 1992 and Int. Conf. on Intelligent Computing and Information Systems 2002, and one of the main sustainers of annual Int. Romanian Internet Learning Workshop Project (RILW), 1997.

In addition he was Secretary of Egyptian Computer Society (1984-1990), Member of National Committee in Informatics – Academy of Scientific Research and Technology (1992-200), Member of Egyptian Committee in the Inter-Governmental Informatics Program, IIP-UNISCO, Paris (1988-1990) and Coordinator of the Annual International Conference for Statistics, Scientific Computing, and Social and Demographic Research (1983-1990). In addition he was a partner of a MEDCAMPUS Projects on Methodologies and Technologies for Distance Education in Mediterranean (1993-1995). In addition He is a Member of the Editorial Board of 15 international and national Journals in the following countries: Canada; Italy, Romania, Japan, Turkey, UK and Egypt. Also, He is member of many Int. Scientific Societies and associations in USA, UK, Switzerland, Austria, Canada and Egypt.

Towards The Use of Machine Learning Algorithms to Predict Human Immunodeficiency Virus Drug Resistance

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Abstract: **Several factors contribute to the success or failure of antiretroviral treatment (ART), but drug resistance is arguably the most critical. The aim of this study was to investigate the use of four machine-learning algorithms in determining highly active anti-retroviral therapy (HAART) resistance. The optimal algorithm was a combination of two machine-learning techniques, which was called the UKZN-implementation. The UKZN-implementation produced an accuracy of 88.9% ± 6.8 at 95% confidence interval (CI), and a correlation of 0.745 ± 0.16 (95% CI). The UKZN-implementation produced a statistically higher accuracy or at least the same accuracy when compared to the accuracies reported using international gold standards**.

Introduction

Several factors contribute to the success or failure of antiretroviral treatment (ART), but drug resistance is arguably the most critical [1]. There are two laboratory methods for testing HIV resistance: genotypic and phenotypic assays. Unlike phenotypic assays, genotypic assays are cheaper, faster and can yield multi-drug resistant profiles, and are thus preferred. However, genotypic testing requires interpretation of mutations, genotypic variation patterns and inference of the phenotype using complex rules [2]. This type of environment is conducive to machine learning.

The aim of this study was to investigate the use of machine learning algorithms in a computer based HIV resistance prediction tool for patients on highly active anti-retroviral therapy (HAART). Each algorithm takes the poll region of the HIV gene in the infected patient as input, and predicts the phenotypic response of that patient to particular HAART, i.e. it aims to aid in the determination of HIV resistance by finding a correlation between genotypic and phenotypic data that facilitates classification and regression prediction.

Methods

Machine-learning algorithms work by trying to learn associations between given inputs and outputs of training data. The algorithm initially starts with a random or user-defined association. With each input-output data element, the association model changes such that it better represent the domain, i.e. it is been trained. Once an acceptably accurate association model is created, it can be used to predict outputs of any input data in that domain. The method used to learn the association is dependant on the machine- learning technique. Four machine learning algorithms were employed in the interpretation of the genetic HIV data: Support Vector Machines (SVM), Gene Expression Programming (GEP), Particle Swarm Optimization (PSO) and Multi Layer Perceptrons (MLP).

SVM learns by embedding the training data in a higher dimensionality and tries to learn a liner association between input and output. Gene Expression programming learns by mimicking evolution, i.e. it applies reproduction, mutation and selection of the fittest, in order to automatically evolve a mathematical model that simulates a particular process. PSO is a technique that optimizes the prediction ability of a model by mimicking the flight of a flock of birds.

Protease and Reverse transcriptase HIV-1 Subtype B sequences which consisted of 99 amino acids from position 1 to 99, and 201 amino acids from position 40 to 240 respectively, were obtained from the Stanford HIV drug resistance database (HIV drug Resistance Database, 2008, http://hivdb.stanford.edu). The almost 3000 sequences obtained represented mutations to the amino acid positions in the wild-type HIV. Associated with each sequence was a phenotypic IC_{50} (inhibiting concentration at 50%) score obtained using ViroLogicTM (Virologic, 2008, http://www.virologichiv.com). In order to facilitate machine learning, the amino acid list of each sequence (input) was represented by an array where each position in the amino acid sequence is represented by a single binary digit, where 0 indicated that no mutation occurred at that position and 1 indicates that a mutation occurred. The output representation for regression was $Log(IC_{50})$, and resistant or not-resistant groups for classification.

Results

We found that the optimal algorithms are Support Vector Machines for reverse transcriptase inhibitors and Back propagation Multilayer Perceptron for protease inhibitors. Used together they are called the UKZN-implementation. When compared to actual phenotypic resistance profiles, the UKZN-implementation produced an accuracy ranging from 85.4% to

96.3% with an average 88.9% ± 6.8 at 95% confidence interval (CI), and a correlation coefficient that ranges from 0.673 to 0.947 with an average of 0.745 ± 0.16 (95% confidence interval).

The results obtained from the UKZN-implementation were statistically compared to HIV-db and the results of other published algorithms and gold standards using Chi-squared and Z-tests. The UKZN-implementation produced a statistically higher accuracy or at least the same accuracy when compared to international gold standards. It was as accurate as AntiRetroScan [3], Visible Genetics/Bayer Diagnostics Guidelines 6.0 [3], and statistically more accurate than Committee Neural Network [4], Dr Seqan [5], Geno2Pheno [6], RegaInst [5], retrogram [5], Stanford HIV-DB [3, 5]

Discussion

By implementing such algorithms one hopes to understand new, and confirm existing knowledge of the HIV resistance domain. Results of this study confirm that computer based interpretation algorithms can be applied to predict HIV drug resistance from genotypic data. The high accuracies and correlation coefficients obtained also indicate that improvements to these interpretation algorithms are possible.

Even though the use of such algorithms with genotypic data is advantageous over phenotyping, its application in resource poor settings will be limited due to the fact that genotyping is not part of routine care. Thus resistance prediction algorithms should be developed using routine biological, physiological and virological data to predict HIV drug resistance.

Conclusion

Gene expression programming and particle swarm optimization are relatively new additions to the field of classification and regression. This study marks one of the first attempts at using such machine learning algorithms in this problem domain. The comparison of the support vector machines, gene expression programming, multi-layer perceptron and particle swarm optimization with the Stanford HIV-db contributes to the domain's current knowledge and understanding of interpretation algorithms.

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Using Ontologies for Data Integration in Integrated Care Networks

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Abstract: **Exchanging data across organizational borders is often affected by data quality problems during data integration processes. Integrated care networks are care organizations, which encompass continuity of care, shared care, and seamless care. Participants in these networks often use different information systems, varying classification schemata, and identify patients with unequal attributes. Our objective is to show how ontologies can be used to identify semantic mismatches and to perform data cleaning during data exchange in these networks.**

Introduction

Public health care systems are often inefficient and cost intensive. The concept of integrated care has been established to improve this situation. Providers and professionals are able to create networks, which allow them to exchange patient-specific data. These networks enable the shared access to medical resources and examination findings.

Interchanging data between heterogeneous data sources often yields into integration problems:

- Record Linkage
- Data Cleaning
- Semantic Mismatches

Patients are usually being described using their name, date of birth, and other attributes. These attributes have to be identified in each local information system. During the integration process data from different data sources have to be mapped to identify a patient correctly and to collect each piece of information about the patient.

In many cases errors and inconsistencies in data can be found. These have to be identified during the integration process. Last, diverse organizations use different classification systems to describe diseases. For instance, the International Classification of Diseases (ICD) [1] or operation and procedure codes exist in several versions. These have to be reflected during the integration of patient data. In some cases concepts exist in different sources, which have the same syntactical meaning, but different semantics.

IMIV is a public funded research project, which defines a reference model for the management of health care networks. MedoCom [9] is an IT-based platform developed in IMIV. Its main goal is to support trans institutional information management with focus on high quality for the integrated data. In this paper we show how ontologies can be used in integrated care networks and how they can solve the described problems.

Data quality problems

Data quality problems can be distinguished into syntactic, semantic and domain specific mismatches [2].

Syntactic errors include missing or wrong fielded values, uniqueness violations or referential integrity problems. A couple of existing tools can be used to correct these errors as described in [3].

Semantic errors are non-existing values like ICD-codes, which don't exist, or invalid attribute value combination. For instance, several ICD-codes cannot be combined with specific operation and procedure codes. Or, in tumor classification scenarios, a prostate tumor might not be identified with a female patient. Ontologies have been studied for a long time for an application in data quality management [4-5]. We introduce ontologies and their application in data quality tasks in the next section.

Domain specific data quality problems occur when the meanings of values are not clearly defined. For instance, the ICD-classification exists in several versions, defined in different years. This yields into problems when health care provider within a networks use different versions of these classifications and their data has to be exchanged. Furthermore, patients' data sets have to be identified correctly and reconciled when their data are exchanged between different information systems of integrated care networks and the Medocom information system. The concept of ontology based information integration is described in detail in [6] and can be applied for the exchange of patient data beyond institutional borders.

Using ontologies for data integration in public health care networks

Ontologies [7] are a shared representation of a common domain of discourse. A specific domain can be described using concepts, individuals, and relationships among them. Ontology matching and mapping [8] are techniques to define mappings between different Ontologies.

Ontology matching can be applied to integrate different data sources on a semantically level. The first step in the MedoCom approach is to create a taxonomy, which is extended by relations between the entities to create an ontology of health care networks. Figure 1 displays a section of MedoCom's ontology. When a previously unknown information system is

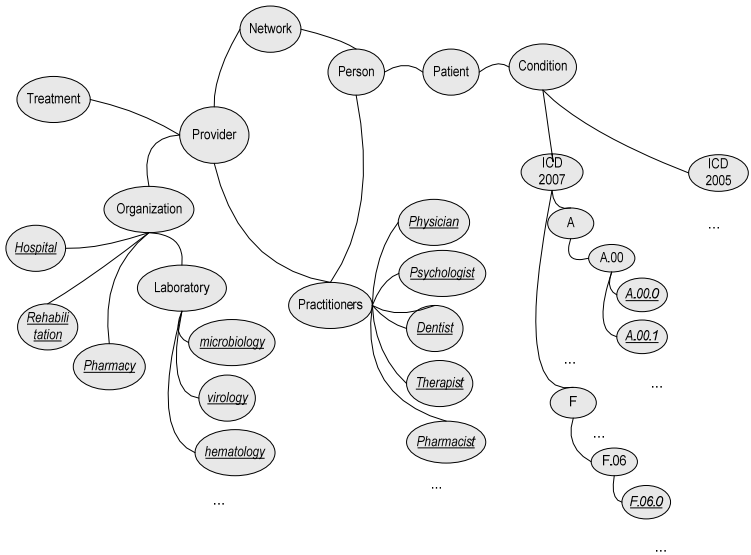

Figure 1: Part of the ontology describing health care networks used in MedoCom for ontology matching

integrated into a network, a new Ontology is generated [10] and then aligned with MedoCom's Ontology using automatic comparison of class and property names, which can be accomplished using string metrics [11]. Once the Ontologies are matched, Entities, i.e. field values can be extracted and reconciled into MedoCom's own information system.

Ontology mapping is used to integrate ICD-classifications from different years. Figure 2 shows the ICD-code "Z96.-" (i.e. the existence of an implant), which exists in all German modifications of the ICD-classifications in the years 2005 to 2007. It is shown that in 2005 the specializations "Z96.1" to "Z96.9" exist. In 2006, the code "Z96.8" has been described in more detail with the codes "Z96.80" and "Z96.88". In 2007 this has been extended with "Z96.81". Data have to be mapped to a target classification during data integration processes in public health care systems. For instance, when the target system uses the 2006 version of ICD, then values from 2005 and 2007 have to be mapped to the target classification. The example in figure 2 shows that the newly introduced value "Z96.81" in 2007 can be mapped to "Z96.88" in 2006, but not vice versa.

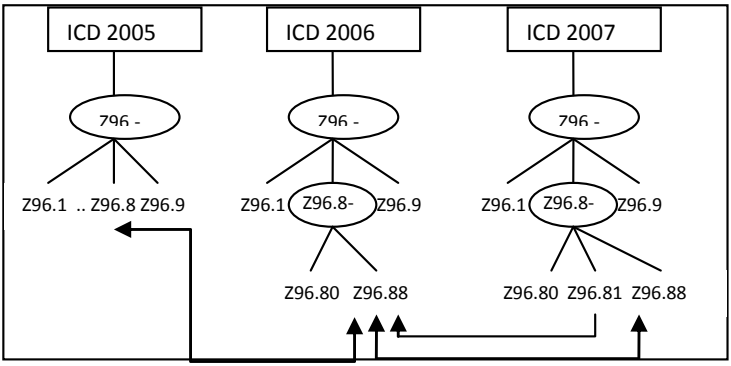

Figure 2: A mapping ontology containing different mapping definitions or ICD-codes from different versions

The 2005 value “Z96.8” can be mapped to the value “Z96.88” in 2006 and this mapping is allowed in both directions.

Such a mapping ontology can be described using the Web Ontology language (OWL). This allows for an automated approach, in which the ontology can be used to convert values from one version to another.

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Session 14

eHealth in Support of Routine Medical Practice

24-Hour Anonymous Medical Information Service Using the Mobile Telephone in Sweden: A Pilot Study during the Summer of 2008

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Introduction

Previous studies have shown that Store & Forward technique (S&F) in teledermatology (TD) has a high diagnostic accuracy [1-4]. Mobile telephone penetration in Sweden was 96% in 2008 [5], and 107 million Multimedia Messaging Service (MMS) were sent in 2007 [6], these numbers are similar in other European Union countries and globally cellular phone subscription penetration reaches over 60% according to the International Telecommunication Union [7]. High demand for the National Health Service (NHS) increases with medical advances. Socialstyrelsen (the Swedish National Board of Health and Welfare) estimates that the health resources in Sweden will increase by 20-25% in the coming 30 years and the extraordinary costs for health and social services will use 14-15% of the Gross National Product, which can be compared to today's 10.5% [8].

A pilot study in mobile telephone teledermatology was carried out by the Graz group from Austria [9], which showed that nearly 2/3 of skin diagnoses based on pictures taken with a mobile phone camera agreed with the clinical diagnosis made by a dermatologist face-to-face.

The purpose of this study was to examine if a teledermatology consultation service using an anonymous citizen's built-in digital camera in a mobile phone could be used to provide a probable diagnosis and recommend management. We assessed the agreement between the diagnoses given to the citizen with 10 university dermatologists. A voluntary citizen follow-up survey was also assessed.

Method

Using the Tele-Dermis® platform, Swedish mobile phone users could in July and August 2008 send a MMS anonymously including one photo and text describing a visual medical concern. The citizen received a Short

Message Service (SMS) with a confirmation number and text stating that a doctor was looking at the query. The citizen received a MMS from a dermatologist within 24 hours with medical information which contained a probable diagnosis in Swedish including the medical term, an explanatory text, treatment advice and if a doctor should be seen in person. The webpage www.iDoc24.se was provided with detailed information about the service; what the citizen could expect of the service, the cost of the service, liability and how to send a good quality photo with relevant medical information about the query in a MMS.

The liability of the service follows that of the National Health Service internet, telephone service and Swedish law. The citizen is anonymous to the doctor and cannot be traced without the errand number the citizen receives. They were always advised to see a doctor in person if the medical concern progressed over time.

10 000 flyers were put on boats and given to people in harbours in Bohuslän which is an area on the west coast of Sweden popular among sailors and cottage tourists. After the consultation, the citizen was encouraged to fill in a Web Form survey that included 12 follow-up questions with multiple choice questions and free text.

A case follow-up with ten university dermatologists with varying experience; one specialist with 25 years experience, one specialist with six years experience and eight with four years experience was also conducted. The 10 dermatologists were given a power point presentation (PPT), with ten cases that were picked by the author; the cases included both cases with good quality photos and cases with bad quality photos, a fair mix of the 18 queries. Each case was answered with a diagnosis, differential diagnosis, treatment advice and the time taken to answer the survey.

Results

During the two months, 18 queries were received and answered within 24 hours, 14/18 were given self-treatment information, 3/18 were recommended to see a doctor in person and one was asked to give more information but never did.

Reliability Assessment

The ten dermatologists all agreed on the diagnosis for 4 of 10 cases: erythema migrans, striae, and two arthropod reactions. Four cases (rosacea, eczema, herpes simplex and viral exanthema) had a high (60-70%) concordance. There was great variation on treatment recommendations in all cases except erythema migrans, where all gave the advice to see a doctor for antibiotic treatment. For arthropod reaction and striae the citizen was

advised self treatment. The other cases varied with different self treatments or to go and see a doctor in person. The picture quality and text information was limited; only two cases had satisfying information. The dermatologists took a range from 8-25 minutes to answer the power point presentation, the median was 10 minutes.

Citizens Web Form survey

Only 6 of the 18 citizens answered our web follow-up survey which consisted of 15 questions. The gender ratio was 1:1. The age range was between 21 to 41+ years, the mode was 21-25 years. Only three had used our website prior to using the MMS service. Four were satisfied with the service and four trusted the answer received. The number of citizens who used the answer for self treatment was four and three used the answer to search more information on the internet. Two made an appointment to see their doctor. Four would use the service during any day of the year, two would mainly use it on vacation and two would use it prior to seeing their doctor. Two would use the service on intimate queries and 50% thought it was good to be anonymous. All were willing to pay at least €5 for the service.

Discussion

The summer pilot proved that the application works technically. Considering that 10 000 flyers and 107 million MMS were sent in Sweden in the year 2007, the number of generated queries was low. This could possibly be due to a low frequency of skin queries, technical difficulties in sending a MMS requiring a prefix before the text in the MMS or a preference to see a doctor in person. There could be concerns that the health service did not have a governmental authority connected to it or possibly discomfort in having their phone bill automatically charged. It is a question of the benefits and the convenience outweighing the uncertainty surrounding the service. The quality of the digital photographs was not as high as expected, however it was possible to give a probable diagnosis and treatment information. From the 10 randomly selected queries in the PPT, the average time to answer a query was between 1 to 2.5 minutes, which means that the method is not time-consuming. The results show that certain medical concerns such as Lyme's disease, striae and arthropod reactions had complete interobserver agreement, while rosacea, eczema, herpes simplex and viral exanthema had a concordance. Even though the feedback from the citizens was very low, the results imply that the service could be a helpful medical information service and provide guidance for self treatment. The citizen also seems willing to pay for the service.

Conclusion

The pilot study indicates that an anonymous MMS patient query to a dermatology specialist using the Tele-Dermis® application can be a complement to using the internet for self diagnosis and self treatment on clear diagnoses. The service can serve as a complement to national governmental telephone and internet medical information services like the Swedish citizen telephone health service called Sjukvårdsrådgivningen [11] and NHS Direct in the UK [12]. The service can potentially avert citizens with common dermatosis that are treatable with prescription-free medication from having to book an appointment with their general practitioner. More research should be done to find economically viable models and medically sound services that encourage patient's well-being.

Acknowledgments

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An Investigation into the Adoption of Technology by Primary Health Practitioners in the South East of Ireland

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The European Union (EU) is supporting and advancing the growth of innovation of Research Technology and Development (RTD) in Health Informatics, with initiatives such as the formation of the eHealth European Research Area group. There is emphasis on developing an information communication technology (ICT) framework for health care staff clients and patients that will increase higher patient/staff participation in health related initiatives in order to enhance off-site based services for clients/staff and patients. However, for such initiatives to be successful current understanding and usage of ICT needs to be assessed to provide baseline information.

This paper presents results of a survey of the population of GPs (N=200), in the South East of Ireland, and their understanding and use of ICT by general practitioners and to investigate their future needs. A twenty-item questionnaire was distributed focusing on GPs training in ICT, current resources available to them and their use of ICT in their practice. A total of 104 GPs responded to the survey – a response rate of 52%.

Data was statistically analysed using SPSS v14.0. The results indicate that there is an under utilisation of technology and that GPs require greater (ICT) support and training. The survey results also indicated an urban/rural divide and location divide in relation to these issues.

The findings of this survey will be used to identify current deficits and needs in relation to ICT.

Keywords: ICT, medical practitioners, technology adoption

Clinical Use of Wearable Technologies or Chronic Patients' Early Hospital Discharge

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Abstract: **Chronic Obstructive Pulmonary Disease (COPD) is a chronic disease, characterized by frequent exacerbations and admissions. Early discharge is one of the most promising approaches and wearable systems that allow continuous wireless monitoring of bio-signals, can play a significant role to this change. 48 COPD male patients were randomized and 24 of them were early discharged and monitored with "Healthwear" system and 3G video sessions. Transmitted bio-signals included ECG, heart and respiratory rate, oxygen saturation, activity and body position. Average hospital length of stay for the study group was 3.6 days (6.8 days for the control group). 1 patient was readmitted and 2 Emergency Room (ER) visits were required for the study group (3 readmissions and 8 ER visits for the control group). Outpatient clinic visits were 2 versus 32 for the two groups respectively. Wearable systems can be proved useful for early discharge, remote follow-up and personalized care.**

Introduction

Early hospital discharge is one of the most promising approaches for efficient healthcare system intervention in order to control cost and provide qualitative services. New technology can play a significant role to this change. Wearable systems like "Healthwear" [1], a garment with biosensors embedded into the textiles coupled with a portable electronic unit (PPU), responsible for the transmission of the signals, is a promising concept for emerging healthcare delivery including early discharge.

Population and Method

48 male patients admitted from the ER of "Sotiria" Chest Diseases Hospital of Athens, due to an acute exacerbation, were considered eligible and randomized into two groups. They were informed in details about the trial and signed the informed consent form, according to a specially designed checklist. This recruitment was based on inclusion criteria (chronic obstructing pulmonary disease that remains in a stable condition,

stage IIB or III according to GOLD, being hospitalized at least 4 times in the last 2 years, having an elementary level of cooperation) and exclusion criteria (other medical conditions that might interfere with their undergoing, inability to learn, poorly motivated).

Study group patients were instructed how to use the garment and PPU during their hospital stay. The hospital physician played a key role at the design and implementation of the care plan, while the primary care physician was also alerted.

For every patient during his hospital stay, bio-signals acquisition from the wearable systems were simultaneously compared to well-recognized stand-alone medical devices (electrocardiograph, heart rate and oximeter) in order to determinate the clinical accuracy of the medical data.

Immediately after hospital discharge, scheduled follow-up started, according to a holistic personalized care plan. A nurse home visit was performed in all cases within the first 48 hours after early discharge, to ensure patient stability and to re-evaluate care plan.

Patient follow-up with "Healthwear" system started from the first day after discharge. Measurements included heart rate, electrocardiogram (ECG), respiratory rate, oxygen saturation, body position and activity.

These measurements were transmitted from the PPU to the "Healthwear" server trough GPRS data transfer, while the patient could be at home (photo 1) or during outdoors activities. The attending physician could access these data by login in to the server and review bio-signals, either at the same time (online) or after (offline, unattended) the transmission.

In addition, video sessions with the attending physician were performed in many cases with the use of 3G mobile phones (photo 2). With 3G video session, doctors had an additional tool to view patients' clinical condition and an opportunity to check easier medication compliance.

During the first week after early discharge, patients were monitored more intensively with 3 bio-signal sessions per day (plus the home nurse visit), while 1 session took place during the second period, according to the personalized care plan. Additional bio-signal transmission could be also made round-the-clock. The whole follow-up period for every patient was 30 days.

Fig. 1,2. Patient wearing "Healthwear" garment and video session with the attending physician

Results

The "Healthwear" system was used under various circumstances, e.g. sitting, sleeping or exercising.

Study group patients remained at the hospital for an average length of 3.6 days in comparison with 6.8 days of control group.

The mean number of bio-signal sessions per patient was 50.3 for the follow-up period.

In many cases, 3G video sessions were performed in addition to bio-signal transmission. The mean number of video sessions was 7.3 (3.1 during the first week).

A total of 1388 transmission sessions were analyzed: 1207 (87%) of the sessions were considered successful. 124 of the failures were due to GSM cellular network signal quality (interference of large structure, living at basement level) and other technical problems. In 49 cases, the failure was focused on problems at the receiving server. In 8 cases, low battery level of the PPU device was the reason of the transmission data failure.

One patient was readmitted and 2 Emergency Room (ER) visits were required for the study group (3 readmissions and 8 ER visits for the control group). Outpatient clinic visits were 2 versus 32 for the two groups respectively.

The hospital services used by both groups for a period of one month after discharge, is presented in table 1.

	Study Group	Control Group
Length of Hospital Stay (days)	3.6	6.8
Readmitted patients	1	3
Number of emergency room visit	2	8
Number of out-patient clinic visit	2	32

Table 1: Use of Health Services for the two groups

Discussion

Wearable solutions seem to be an attractive tool to facilitate early discharge approach in chronic care management. More intensive research has to be focused on this topic, not only to investigate how it can be used in other diseases except COPD (eg. coronary disease [2]), but also whether it can be combined with other services (eg. telemonitoring of vital signs during exercise and home based rehabilitation).

An important limitation that is planned to be solved soon is the fact that this garment is currently suitable only for male patients, as the accuracy for ECG sensors' position and acquisition has not been validated yet for females with various breast sizes.

Conclusion

During this trial, the feedback from the 24 patients, allows the prediction that wearable and wireless systems can be proved as new era's tools in patients' remote follow up and personalized treatment, especially valuable in early discharge, as well as in home based monitoring during sleep and outdoor activities.

Acknowledgment

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Periklis Giovas, MD is specialized in Internal Medicine. He has focused his interest on telemedicine in Aegean Islands and ambulance telecardiology since 1994. He joined “Sotiria” Hospital e-Health Unit as a research associate in 2002. He was actively involved in home telecare and rehabilitation of chronic patient with the use of ICTs. He was also involed in Unit’s candidature for e-Inclusion Award 2008, where Sotiria was selected as the Award Winner. He was editor of “Telemedicine in Practice” book.

Development of an Integrated E-Prescription System with Adverse Drug Events Alert for Community Health Center in Indonesia

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This paper describes the design and development of an integrated electronic prescription system with Adverse Drug Events (ADEs) alert, that has been improved from our previously developed "simple e-prescription system". The system is intended to be used in a community health center (CHC, *puskesmas*), a hospital, as well as a group of community health centers and community health office in Indonesia.

Publications from a number of developed countries reported a number of adverse drug events that resulted in significant number of injuries, deaths, and financial expenses. It is believed that similar cases also exist in Indonesia, although there is no quantitative data reported on ADEs yet. The new and improved integrated electronic prescription system with ADEs alert is proposed to improve general patients and medicine data management, to shorten the overall processing time, to support medical doctor in preparing paperless prescription and to avoid the Adverse Drug Events, as well as to support the recording and reporting of both patients and medicine data.

To implement the system in a typical Community Health Center, we need at least three personal computers connected in a local area network, specially developed software packages, and an internet access to facilitate the remote data reporting, tele-consultation and tele-coordination. A hospital will need more PCs since more departments are required with more number of patients. The software packages have been designed to work on either Windows or Linux Operating System. They are composed of the following functions: Patient data recording (used during patient's registration), Patient medical examination record (during medical examination), e-Prescription preparation with ADEs alert capability, Internal patients and medicine data recording & reporting systems in the data base, Medicine inventory update, Regular reporting of both patient and medicine data to the health office, as well as Tele-consultation & Tele-coordination, and Distance Medical Education. The ADEs alert software

should do the following functions: drug interaction test, duplicated therapy test, dose computation and reminder, as well as possible contra-indications and allergy occurrence reminder.

Upon completion of the whole system's hardware and software, a series of laboratory experimental tests will be conducted. The test results will be evaluated and used to improve both the hardware and software of the system prototype. Despite its anticipated problems that may occur, the final improved prototype will then be tested in at least three Community Health Centers and/or hospitals to simulate real clinical environments. Since the previously developed "Simple e-prescription system" has been functioning properly, it is expected that the "New Integrated electronic prescription system with Adverse Drug Events alert" will be able to function successfully as well, to help preventing & reducing ADEs, and improving the quality of healthcare & streamlining the healthcare processes in Indonesia.

Keywords: e-Prescription, Adverse Drug Events, e-Health, Community Health Center

About the Authors

Irma Melyani (born in 1979) graduated from Faculty of Pharmacy, Universitas Padjadjaran in 2003. She joined Faculty of Pharmacy, Universitas Padjadjaran as academic staff since 2006.

Now she is pursuing her master degree in Biomedical Engineering, School of Electrical Engineering and Informatics, Institut Teknologi Bandung. Her current research interests include e-prescription and telemedicine system.

S. Soegijoko (born in 1942) received his Electrical Engineering degree from Institut Teknologi Bandung (ITB), Indonesia in 1964, and obtained his Doctorate degree from The USTL Montpellier (France) in 1980. After completing his duty from 1966 to 2007 as a teaching staff at ITB, he is currently an Adjunct Professor on Biomedical Engineering at the same institute (ITB). His current research interests include: Biomedical Engineering education, e-Health & telemedicine, and Biomedical Instrumentation. He is particularly interested in Engineering education and research collaborations involving international institutions/partners.

Improving Patient Care through Real-Time Electronic Data Capture with Digital Pen and Paper

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Digital Pen and Paper (DP&P) technology captures and converts handwritten information in medical and social care forms into digital format, eliminating the need to type up notes. The digital pen looks like a ballpoint pen. A tiny infrared camera at its tip tracks its movements relative to a grey dot pattern printed on the form, recording and storing what is being written. Stored data is synchronised with backend systems via a USB link or a mobile phone.

Petter Ericson MSc is one of the inventors of DP&P technology. He will demonstrate the technology and share his perspective on how it can help streamline field data capture in health and social care.

Learning objectives:

- Understand the pros and cons of DP&P relative to other data capture technologies
- Understand how DP&P can help reduce waiting lists and meet government targets
- Learn how innovative clinicians and care providers use DP&P to make better use of staff time to increase the speed and quality of care delivery:

1. Speeding rollout of France's national breast cancer screening programme:

   'Plan Cancer' offers bi-annual breast scans to women over 50. Scans have to be interpreted by two experts. Replacing handwritten notes with DP&P meant paper notes no longer had to be re-entered electronically, reducing the turnaround time from up to three hours to under 30 minutes and boosting data accuracy to over 95 per cent.

2. Improving pain assessment and treatment in palliative care (Sweden):

   Symptom control is a challenge for palliative home care. A DP&P system from Linköping University enables palliative care cancer patients to submit pain diaries in real time. Trial patients valued improved contact with clinicians, a sense of increased security and the pen's ease-of-use. The system also enabled quick medical responses to changes in patients' health.

3. Preparing for a flu pandemic in California:
   To benchmark preparedness for a flu pandemic, the Department of Public Health for Solano County, California, organised a large-scale drill just before the annual flu season. Using a DP&P system, 'patients' filled in health surveys, with data becoming available instantly for triage. As a result, the drill achieved the target vaccination rate of 350 patients per hour stipulated by The Center for Disease Control and Prevention.
4. Improving elderly care in Stockholm:
   The City of Stockholm will roll out DP&P on a large scale later this year to improve home care for its elderly population. The technology has already been deployed successfully in 30 municipalities around Sweden, where homecare nurses use digital pens to register their arrival and departure times on each visit and tick off the services delivered to each patient, on a digital form. Similar systems are also being used in the UK and other countries worldwide.

Keywords: Electronic Data Capture, Home Care, Elderly Care, Digital Pen and Paper

About the Author

Petter Ericson is the co-inventor of digital pen and paper technology. With a degree in Engineering Physics at Lund Institute of technology, he joined C Technologies – now Anoto – in 1997 as head of software development. In 1998 the world's first consumer hand-held image processing device, the C-Pen, was launched. Two years later, Anoto was founded as a spin-off from C Technologies. Mr. Ericson currently acts as ANOTO's Chief Science Officer, spearheading the company's Research and development activities. He has filed patents for over 40 inventions in the field of image processing and digital pen and paper.

Medical Data Acquisition, Processing and Collection for eHealth Solutions – DAPSEpro

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***Abstract*: The aim of this paper is to present approaches in the project DAPSEpro "Medical data acquisition, processing and collection for e-health solutions". This is a research project in the area of e-Health oriented to complex investigation of new concepts and methods for continuous acquisition, transmission and collection of patient's vital data.**

Introduction

The analysis of the publications in the area of e-Health shows that since year 2005 the amount of scientific papers, state strategic documents, surveys and other related documents increased a lot. This includes pan European strategic topics for research. According to the EU Commission's eHealth Taskforce report [1], the health sector in the EU employs almost 10% of the total workforce and corresponds to almost 9% of gross domestic product. An analysis of e-Health media found stable growth of WEB services oriented to e-Health market [2]. The analytical paper [3] surveys the research in the telemedicine and discusses new paradigms in this area. Materials and surveys [4-10] discuss the same target. All these surveys and analyses envisage that research in the area of e-Health is very important in all its aspects – from medical and engineering tasks to legislation and safety.

Currently major activities concerning e-Health in Bulgaria are in the area of hospital management systems, health insurance system and the legislation for data privacy protection. This makes this project even more important that only respecting its medico-technical goals.

Main Goals

The **main goal** of this project is extensive research in the area of e-Health. This includes complex investigation and analyses of concepts and methods for continuous acquisition of patients' vital parameters, transmission, collection and binding of that data for diagnostic and disease tracking purposes and for health care. Pilot areas for investigation are decided to be pulmonology and nephrology – areas different in many types of data

collection and chronic diseases control.

A second goal is investigations on the improvement of life quality and healthcare based on the e-Health technologies presented.

In the area of medical systems we can differentiate the following two major types – hospital/laboratory systems oriented to analyses and diagnostics and mobile systems controlling patients' vital parameters outside of hospitals. There is one more type – wearable mobile systems for military/rescue purposes, oriented to full and extensive control of all vital human's parameters but they are out of scope of this project.

Basic Analyses

In the area of hospital system one can find huge number of different providers, system, apparatus and equipment. Systems and equipment from different vendors are usually incompatible and cannot be integrated.

Normal hospital activities generate huge amount of data from different types of analyses. In case of control of chronic diseases this results to the problem of data collection because mostly results are heterogeneous, not related to each other and very differ in type of computer representation. All of this makes analyses of these data, correlation between different results and metrics on visual data extremely hard.

Today we can find two types of relations between the doctor and the patient – "face-to-face" and remote (so-called "phone" connection). The architecture "Patient-Phone-Doctor" is based on the paradigm that the existence of live & stable connection between the patient and his/her doctor is indispensable. In case when communication is unstable or is missing patients are starting to feel lost. This is very powerful stress factor making people to feel sicker than they are.

Wireless technologies are new hardware basis making possible design of new types of medical equipment. These technologies are able to solve some of problems stated above but they are producing new questions – are acquired in real-time data valid and how to protect and secure those data.

In conclusion we can point to the following problems as basis for the proposed research work.

1. *Interface incompatibility between different medical systems*

Medical systems from different vendors are more or less incompatible. The problem here is that a kind of technology, similar to "Plug-and-Play" is not proposed and even only targeted for design.

Second problem here is the type of interfaces of available wearable/mobile biosensors. Mostly they are custom designed to be connected to specific equipment produced by the same provider.

Possibilities for integration – hardware and program interfaces, medical reliability, power consumption and autonomous life-time are a point for investigation and summarization.

2. Collected data are distributed, heterogeneous and changeable

Hospital medical systems and mobile sensors collect a diverse variety of patient information represented in many digitized or hard-written types Creation and support of patient's analyses library is well known problem currently handled manually in the most cases. Now this problem becomes computer-based one.

Additional problems rising with data collection management are:

- Data tracking for different (incl. real-time) sources
- How to track raw (original) data and their sources when data are travelling between different libraries and collections?
- How to keep records for data authenticity depending on source, equipment and obtaining methodology?

3. Expansion to new track "biosensors-patient-media-hospital server-doctor"

Remote connection between the doctor and the patient has two targets:

- Preventive diagnostics – It's based on implementation and exploitation of programs for everyday self-analyses and self-control of health status.
- Diagnosis in pre-emergency and emergency situations – on-site analyses and diagnoses in case of emergency situations.

In the area of preventive diagnostics the system "Patient-Media-Doctor" will lead to the following advantages:

- Increases the quality of medical care as a result of presence of real-time data gathered for a long period of time (including last-minute information).
- The life style of the patient is not limited and decreased when he/she is far from his living place and from usual medical centres caring of him.

The problem here is to find new methods for preventive diagnostics and control for diseases such as asthma, COPD, bronchitis, emphysema, fibroses, pulmonary embolism, prevention of chronicle nephro-insufficiency, arterial hypertension, renal failure, chronic glomerulonephritis, follow-up of patients with chronic renal failure in pre-dialysis stage, based on real-time on-line control and acquisition of patients parameters exploiting wearable sensors and mobile communication agents – GSM and devices based on 802.11 and 802.15.4 (Zigbee) standards.

4. Data validity, security and protection.

Data validity is very important to make decision-making process stable

and safe. This includes time validity, safety of delivery as well sensor validation, time-sequences recovery and equipment self assessment.

Expected Outcomes

Expected results and outcomes of this project can be formulated as follows:

- Design of pilot version of architecture for e-Health solutions oriented to health-data acquisition, transmission, collection and binding.
- Development of pilot version of wireless system architecture for continuous collection and transmission of patients' vital parameters.
- Definition of functionality (incl. autonomous) of mobile agents depending on connected to them biosensors.
- Methodology for sensor validation and failures management.
- Design of methodology of pre-critical situations discovery based on built-in autonomous functionality of the mobile agent and on the functionality distributed between mobile and hospital systems.
- Increasing diagnostics quality and research possibilities based on new continuous data streamline.
- Design of basic functionality of advising system.
- Increasing the quality of health care and life for patients with chronicle diseases.
- Increasing patients' mobility.

The expected results have both fundamental character in the field of e-Health and applied character in connection with computer science, signal processing, data-bases and multi-tier secured communication systems.

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I. Evgeniev graduated the Technical University of Sofia as an engineer of Automatics and Telemechanics.

From 1984 he worked as an engineer in the department of Systems and Control Engineering, TU Sofia. From 1987 he is an assistant-professor in the department of Systems and Control Engineering. From 2001 he is head of Advanced Control Systems Laboratory, TU Sofia and from 2003 vice-head of the department of Systems and Control Engineering.

Scientific interests are in the areas of formal models for system generation, program generation of control and data acquisition systems, real-time operating systems, embedded and mobile systems design, real-time networks. Scientific and technical leader of a number of EU and Bulgarian projects.

Medical Information System – The Possibility to Integrate eHealth in Routine Medical Practice

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Health care organizations are challenged daily by the need to manage and integrate clinical, financial and operational information. As this need grows and evolves, it is required a medical information system (MIS) that can keep pace. Effectiveness of a health care organization depends on its goals and objectives, its geographic location, soundness of its operations and efficiency of its management system. The administrator's efficacy depends upon the efficiency with which s/he is able to achieve the goals and objectives. Some of the major factors determining the effectiveness of a health care organization include patient care management and satisfaction as well as implementation and management of medical databases. Health care organizations are very expensive to build and operate. Administrators and professionals have to be extremely cost conscious. Effective medical systems and procedures need to be implemented to ensure proper utilization of existing and usually limited resources toward quality health care.

The present article is going to describe MIS implemented in Medical Center "Neoclinic", which is being fully utilized to provide quality service. The system has enabled the medical personnel to serve patients efficiently and to use the possibilities and advantages of eHealth routinely in everyday practice. This is new glance upon the Medical Information System, which can be viewed as the possibility to integrate eHealth in routine medical service.

Keywords: Medical Information System, eHealth, Medical Databases, Health Care

MEDIKIDZ: A Novel Solution to the Global Problem of "Paediatric Patient Information Provision"

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Provision of patient-focussed disease education has made a significant impact on clinical outcomes – both in terms of concordance, and disease management. Despite these findings in adult populations, there exists worldwide, a paucity of health literature that is both comprehensible and engaging for children. Young patients rarely understand the underlying nature of their disease. Our own government recognises this shortfall, with the National Services Framework (2004) stating 'Parents AND their children need to be fully informed, and provided with information about the nature of the illness, different interventions and treatment options". What then if a child could be self-motivated to learn about their disease?

To address this issue we have created the Medikidz – a ground-breaking educational innovation for children's health education. The 'Medikidz' are five superhero characters that teach children about disease, medicines and treatments, by combining consultant peer-reviewed medical content with child-focussed humour and comic-style animation. Each comic book covers anatomy, physiology, pathology, pathophysiology, investigations, diagnosis and pharmacological/surgical treatments that may be experienced by a child within each specific paediatric illness. Individual investigations are further explored in medical procedure pamphlets (for example Medikidz explain MRI, CT, bone scan, endoscopy etc), while medicine information pamphlets explain the specific rationale, biochemistry, regimen and side-effects of individual drugs. The Medikidz education tools will an online virtual world, within which children can explore a planet-sized human body and interact with others from around the globe - eradicating the stigma and embarrassment children commonly experience when diagnosed with a chronic condition.

The Medikidz offering is currently undergoing a research phase to vaidate its effectiveness as an educational tool in the paediatric population. We hypothesise that this method will fill a void in our approach to paediatric medicine: empowering children with the knowledge of what is happening

within their own bodies, and providing them with skills for self management.

About the Authors


Kim Chilman-Blair

Dr Kim Chilman-Blair, Founder & CEO of Medikidz Ltd

A clinical doctor from New Zealand, Kim first attained a BSc in Pharmacology, followed by a Postgraduate Diploma in Pharmacology and Psychological Medicine. Throughout her undergraduate studies, Kim trained and worked as a freelance academic medical writer and editor, writing both for medical journals, and as an international medical journalist. She then undertook an MBChB at Otago Medical School to become a clinical doctor. Kim also studied a Masters in Entrepreneurship, through the Otago Business School. During this time, her idea for Medikidz received first place in the NBR Business Competition, providing $20,000 of initial funding. After 2 years as a house surgeon, Kim left her clinical job to work full time as CEO and founding director of Medikidz Ltd, along with Medikidz co-founder Dr Kate James.

Monitoring the Implementation of Clinical Practice Guidelines in Albania through a Simple Health Information System

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The Albanian Health System has little tradition with using Clinical Practice Guidelines and similar treatment protocols. In general, apart from the professional judgment of the providers, there exist little limitations to their diagnostic and treatment choices at primary, secondary and tertiary level. The Health Insurance Institute (HII) has developed a system to limit the prescription freedom of PHC doctors. Every year HII issues a drug protocol that states, for every reimbursable drug, the diagnosis and conditions under which it can be used. HII uses since a couple of years a Health Information System that collects all the reimbursable prescriptions, inputs the information in a database and processes the results to make sure that no medicines are associated with the "wrong" diagnoses.

Last year, the Ministry of Health (MOH) commissioned a consultancy company to develop Clinical Practice Guidelines for the ten most frequent conditions that are encountered at the PHC level. The company came up with the requested CPG-s as well as with a methodology on how to update and elaborate CPG-s in the future.

The next development concerns a new, simple Health Information System that MOH and HII decided to adopt for nationwide implementation following the joint piloting with the two USAID funded projects that helped in its development. The HIS starts with PHC doctors filling a simple encounter form (see figure attached) for every visit. A database is used to input the information at the Regional Health Information Offices and the information is processed and used for different purposes.

The sections containing the ICD-9 codes of the diseases and the special codes of the procedures (see the bottom right corner of the encounter form) can be used to monitor the adherence to the developed Clinical Practice Guidelines. Each diagnosis can be linked with one or more procedures and these lasts will be coded. The software can later be programmed to identify whether a patient manifesting a given diagnose was taken care according to the relevant CPG. Thus a simple, encounter-form-based HIS can be used to

successfully monitor the degree of adherence to the Clinical Practice Guidelines in the Albanian Primary Health Care System.

Key words: **h**ealth information systems, clinical practice guidelines

About the Authors

Erion Dasho, MD, MPH is an Albanian public health expert and ophthalmology resident. He is currently spending a year at the University of Regensburg to research possible opportunities for the use of telemedicine solutions in the benefit of his country's health system. For a few years, Mr. Dasho led the Health Management Information Systems component of a USAID funded project in Albania and the results of the project are now being taken for nationwide implementation by the Albanian Ministry of Health.

Practical Experience and Research Project about Teleconsultation in Latin America Using Wireless Devices

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Teleconsultation offers patients in remote communities the opportunity to consult with specialists in other locations; these innovative systems are particularly useful in developing countries with poor hospital network and not enough medical specialists.

In September 2008, a cooperation program located in Colombia, South America between a private medical marketing company (NISSI-Octapharma), a technological development company ICT (NISSITECH), a medical services company (NISSI Medical Care) and a non-profit foundation (MANA), ran a telemedicine pilot test. This test, by means of portable and wireless teleconsultation equipment, used the voice transmission and information GSM/3G network to assess hemophiliac patients from remote communities with the fewer medical specialists than larger cities.

This telemedicine pilot test has been well received on the part of involved patients and specialist doctors. Additionally it has helped to overcome technological barriers and served as a cost-benefit study, enabling the development of a private company business plan to offer teleconsultation services that promise be sustainable and rapidly climb in Colombia and Latin America.

In December 2008, the FRIDA program (Regional Fund for Digital Innovation in Latin America and the Caribbean) approved the financing for the second stage of this pilot test as an investigational project of remote patient monitoring by using wireless devices. In this second stage the investigation will included the selection and integration of telemedicine software and hardware in agreement to the true necessities of the Latin-American context. The investigation will be done in close co-operation with a public university (Universidad Tecnológica de Pereira) and will study the reception of different telemedicine equipments using by doctors, scientific community and patients of different geographical zones and culture characteristics.

The partial results of this investigation will be available on March 2008.

Keywords: teleconsultation, developing countries, telemedicine pilot test, remote patient monitoring

About the Authors

J. F. Lopez:

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Role of Nurses in Different Directions of the Telemedicine Activity in Saratov Railway Clinic

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Abstract: **This article contains the experience of using telecommunication in the daily practice of nursing activities, applying Tandberg Corporate videoconferencing system, in Saratov Railway Clinic during last year.**

Keywords: Saratov Railway Clinic – Telemedicine centre, teleconsultation, tele-education, nurses

There are 560 nurses working in Saratov Railway Clinic.

Saratov Railway Clinic is a multitype hospital, has patient capacity of 534 beds and employs the leading health professionals of the field.

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

For the past 3 year nurses from Saratov Railway Clinic participate in the following trends in development of tele-medicine and information technologies:

- Tele-education and professional tele-discussions;
- Monitoring patients at home;
- Preventive checking of the cardiology parameters using SMS and MMS (mobile technology);
- Plus nurses took part in different stages of the use of a medical information system.

One of the first steps of the tele-medicine project that is developed in Saratov Railway Clinic was the approbation of the automatic information system. Thanks to that, medical records were documented digitally.

Nurses are those that have to fill and are filling primary medical documentation at the moment of patients' hospitalization. They are also recording all prescriptions, directions for laboratory analyses that doctors appointed, etc. This gives the possibility for a more rational distribution of the operation time. In addition, more time and attention is devoted to patient.

During last year the nurses applied mobile technologies for the control of the regime of labor and rest of patients within the framework of project "Home monitoring". With the help of Short Message Service (SMS) patients that were taken care of in Saratov Railway Clinic, received periodic reminders about:

Fig. 1

Fig. 2

- The need for preventive treatment in the rehabilitative center or
- The time of preventive visit to the doctor (Fig. 1 and 2). In addition, with the help of SMS the nurses obtain from the patient primary information about the changes in the health status.

We hope that information technologies and tele-medicine in the hands of nurses will help our patients to be comprised more thoroughly by preventive procedures.

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Standards of Clinical Guidelines in Telemedicine

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Telemedicine-based services promise that the delivery of appropriate and clinically and economically effective eHealth care services contributes to more efficiency, or better performance of the health care system. Effective care in an efficient system makes it possible, first, to make optimum use of available financial resources and, second, to deliver universal, high-quality services. But the new structure of services in eHealth-supported environment creates new challenges for the reimbursement, the privacy and the staffing of the system. Telemedicine-oriented clinical guidelines have to be developed on the appropriate treatment and care of people with specific diseases and conditions to reflect the challenges.

Our research has targeted a standard set of Telemedicine-oriented practice guidelines, which will help informaticians to develop telemedicine services in ambulatory care, decision makers in financing to built a new structure and reimbursement of services, trainers to create new programs in the CME and patient to understand the main issues of telemedicine services and to cooperate with the new solutions. Several practice guidelines for Telemedicine-based ambulatory health care in cardiology, pulmonology, gynecology and stroke care will be developed by the end of the year by the Hungarian eHealth8 Consortium together with experts and service users.

The presentation is focusing on the core elements of Telemedicine-oriented standards of clinical guidelines, which facilitating a development of telemedicine services at home and at the workplace.

Keywords: Telemedicine applications, Standardization and interoperability, eHealth integration into routine medical practice

Telemedicine Diagnostic Group

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A multi-disciplinary Telemedicine Diagnostic Group is in development. It will substantially shorten the time-to-acquire a diagnosis, establish a course of Treatment and take appropriate actions to place a Patient in a position of safety under proper Health Care, co-operating with existing Telemedicine and Traditional Health Care Services, e.g., Hospital Groups.

A Diagnostic Group is composed of selected Multi-disciplinary Diagnostic Teams the membership of which can be fixed or variable. Multiple networked Diagnostic Groups can be created to serve large geopolitical regions with individual Groups specialized, e.g., Diabetes, Heart, Paediatrics and Medical Imaging. All Groups will utilize a common Clinical Practice Electronic Record System; individual Groups may develop extensions to accommodate specialized services.

Medical devices within a Telemedicine environment may be limited to those available to Carers and Patients. Recent advances in these Medical devices have greatly enhanced their portability, accuracy and utility, especially when combined with remote data processing. Emphasizing data capture and preliminary data processing, with multiple communications links to a remote Diagnostic Team Processing Center, early analysis leading to a more accurate diagnosis is feasible. Continuous data transfer and analysis can detect state change permitting alterations in the diagnosis and treatment. Procedures are based upon signal analysis, tracking, pattern matching, and correlation.

These procedures, including the Medical devices, are usable within Traditional Health Care Delivery environments. As personal devices the resultant data can be integrated into personal Patient Health Care Record Systems, thereby providing continuous, detailed, accurate Health records.

A Patient Knowledge Base will be available as a repository with presumed access available to the Diagnostic Groups. This will extend the amount of Patient historical data available to a Diagnostic Team when needed.

To illustrate the Diagnostic Group and Teams three examples from potential Telemedicine environments are provided: (1)a remote multi-Patient Transportation event in which Emergency Services are required, (2)the interpretation of a Medical Image, or a sequence of such historical Images, where Quality is an issue, (3)a Patient's self-doubt regarding

personal Health and competency results in a request for assistance via Telepsychology and/or Telepsychiatry.

For Diagnostic Groups, Digital Libraries in support of eHealth and documentation will be developed.

About the Author

Thomas Clark: Experience and training have covered control systems, fault tolerant, highly reliable, secure and distributed computer systems, networks and storage, health care informatics, telemedicine, medical devices and open-source medical applications. Current design and development activities involve telemedicine, eHealth, rural health, health care Grids, remote control, patient – centered health care and patient self-help.

Telemedicine in Russia: Possibilities for Co-operation from the Finnish Perspective

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Abstract: **The fast growth of living standard is pushing the Russian health care providers to renew their processes and implement new technologies. Some big changes can be expected in the future. The aim of this project has been to study the present utilization of telemedicine in Russia, and to map the potential Russian market segments for Finnish telemedicine service providers and technology companies.**

Introduction

Telemedicine is nothing new in Russia. The country has a long history of developing remote monitoring and data transmission technologies utilized in many telemedicine applications. Currently the utilization of telemedicine is mostly limited to extending the coverage of health care services. In the future, information and communication technologies are likely to become more important parts of supporting and enhancing the basic health care processes.

The results presented in this paper are based on the preparation of a Finnish-Russian research project, which is aiming to study the possibilities for implementing different types of western eHealth applications in the Russian markets and starting joint development projects, both in terms of technology and health care provision.

Russian Expertise

Russia has high quality know-how in many technology areas – such as optics, material science and physiological metering equipment – which are also very important in health care equipment development. The software programming sector in Russia is very advanced and the know-how available indisputable. History of telemedicine in Russia is very closely linked with space medicine and development of biotelemetric systems [1]. Utilization of remote sensing technologies developed in numerous space programs in civil health care offers many opportunities.

“Moscow to the regions” was one of the very first attempts to create a national telemedicine network. The network started to operate in 1997 and is used still today. The idea of the network is to connect medical institutions in Moscow to the large regional hospitals, which serve as hubs for connections to small remote units in each region’s municipal units. In 2005, the possibility to use satellite technology was implemented, which enabled the creation of mobile telemedicine units (MTUs). These units and satellite connection make diagnostics and data transfer possible basically everywhere. The development of MTUs is inherited from space medicine [1, 2].

Telemedicine network in Arkhanglesk, one of the rural areas of Russia, was developed as a joint project with local hospitals and Norwegian Centre for Telemedicine in 1996-2001. The data transferred through internet included images of X-rays, fibrogastroscopy, and ECG, among others [3].

At the end of 90s, St. Petersburg area was struggling with high amount of child cancer cases. To overcome the high number of child cancer, co-operation with US specialists was started. In this project, MRI scans and other patient data was transferred through email for consultation. The co-operation worked well and was cheap to maintain [4].

Need for Changes

The decrease of health care financing in the beginning of 90s, after the collapse of Soviet Union, resulted in shortages in many basic supplies. The main problems currently with health care include cardiovascular diseases, HIV and some forms of tuberculosis. The average male life expectancy in Russia is still only about 60 years, some 10 years lower than the average in Western Europe [5]. Of course health care can’t be held solely responsible; the general lifestyle factors play a major role as well. Organizationally Russia suffers from its history. The soviet system was oriented towards specialist care; the culture of preventive (primary) care has just recently become into spotlight. Generally the co-operation between primary and secondary care is still too limited. The availability and quality of medical services varies greatly [6].

The Russian government has recently taken actions to solve some of the problems in public health care. A lot of equipment has been revamped, salaries increased, structural changes initiated and money allocated also to research [6]. At the same time new private institutions have started to emerge. These institutions provide very high quality services, but only a very small portion of the population has access to these services.

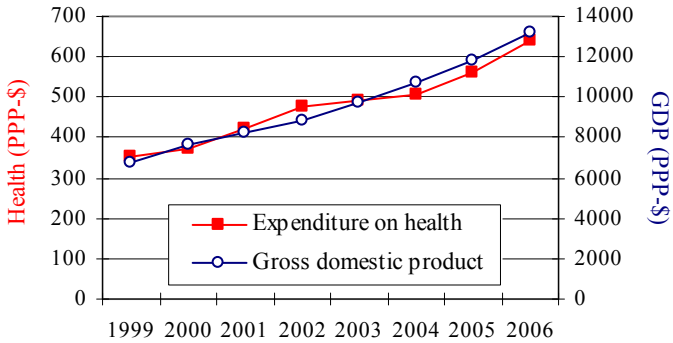

Fig 1. Growth of GDP and expenditure on health per capita in Russia [7-8]

The annual growth of living standard in Russia in the last 10 years has been between 6-7%, far higher than in most western countries. This has also increased the general spending on health [Fig 1]. Growing income differences have created very heterogeneous health care system, but also the public sector is facing more and more pressure. Aging of population is a serious problem. Most of the elderly people can only afford to use public services. Despite the government efforts, there is still a lot to be done to develop the Russian health care system to match the needs of the future. One interesting aspect is to study how different types of eHealth solutions could improve the processes in Russia.

Current Utilization and Future Prospects

In order to receive a clear image of the current utilization of telemedicine in Russia, representatives of two medical institutions were interviewed. The first institution is fully privately financed, whereas the other one receives most of its financing through governmental sources.

Information systems

The general equipment utilized at the private institution is very high-quality, however, the information system is not quite on the same level. The basic infrastructure is present; new computers are available to doctors. The main information system used includes basic scheduling possibilities and case histories for patients. However, the software was originally designed for small private clinics and is too limited for the needs of this hospital. The biggest problem is the lack of comprehensive approach. Additional software applications are needed to perform other functions (e.g. fetch x-ray images from the server).

Lack of integration is a very common problem in Russia; comprehensive resource planning systems (EPR) in health care are not yet in use. This is partially due to the fact that the government has not created all required standards related to health care data transmission and protection. It's estimated that in Russia, there could be up to 800 different software applications utilized in health care, all created for one specific purpose [9].

The public institution has similar problems. Their information system is being developed in co-operation with the local university, but currently its functionality is still rather poor and only electronic schedules of doctors are utilized. Medical records are still stored on paper. Public institutions cannot currently afford to purchase any commercial products available on the market, and they are very much dependent on decisions coming from above. This public unit got involved in the development process, since they believe that government needs to see references of working systems, which could then become standards also in other hospitals.

Home and elderly care

Home and elderly care are becoming more and more important in Russia. Currently these applications are still very new in Russia among private individuals and mostly limited to only some alarm systems. However, very similar technologies have been used in Russia already for years while providing health care to the rural areas of the country. In this study, both of the health care institutions interviewed found a possible segment in their customer base:

1) Private institutions want to stand out of the crowd by offering services that are not available in other institutions. The health-conscious wealthy customers could find interest in preventive home monitoring.

2) In the public sector, home monitoring could solve some problems related the aging of population and work as a reference for many other public institutions.

Conclusions

eHealth applications are not yet very widely utilized in Russia, but it became very clear that ICT will be involved in health care processes to an ever greater extent in the future. Within this project, a deeper analysis of the relevant factors will be conducted and the opportunities for Finnish and Russian health care actors identified. Identification of the opportunities isn't enough by itself; the actual co-operation models need to be formed as well.

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Telemetric System for Monitoring of Pregnant Uterine Activities

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A pregnancy is a physiological state which should be monitored regularly. Despite that health of born children depends strictly on pregnancy and labor courses, telemedicine is still seldom used in obstetrical care. Monitoring of uterine contractions is one of clinically important procedure, especially in women having a high risk of a preterm labor.

The goal of the presented study was to develop a telemetric system which aims in remote monitoring uterine contractions. Because an electrical activity of an uterus may provide more information than mechanical the proposed system measures an electrohysterographical signals registered from two electrodes. One is placed on a body of a uterus and second one is situated on an uterine cervix. These signals are be collected in a data base and can be used in clinical studies. The hardware part of the monitoring system consists of the embedded microprocessor system equipped with peripherals necessary to collect the biomedical data (the EHG signal) and to transmit the data to the server via the GPRS network.

A minimal user interface is also provided to allow initial configuration of the system, to manually start the measurement.

In the prototype solution the Atmel's NGW100 board is used as the microprocessor system. This solution facilitates software development, as the standard Linux OS with gcc compiler and GNU software libraries may be used.

The image of the operating system is installed on the SD memory card, which allows quick installation and upgrade of the system. The same card may be used for storing of data files, when transmission to the server is temporarily not possible.

Connection to the GPRS network is provided by the SIM600 GPRS module, manufactured by the SIM Technology, however it is also possible to use another AT commands compatible GPRS modem equipped with the asynchronous interface.

Acquisition of the EHG signal is performed by two MCP3201 12-bit A/D converters, connected via the SPI bus. The signal is previously amplified by the biological amplifier with digital controlled differential gain (54 dB or 74 dB), excellent CMRR, and bandpass-filter 0.05 Hz - 1.6 Hz (-3dB). The user interface consists of the minimal 6-key keyboard, and simple LCD display (2 rows with 16 characters).

Personal data of patients and registered EHG signals are stored in MySQL RDBMS. Database is accessible through a standard internet browser. All communications with MySQL server are secured with SSL protocol. The user interface for database is implemented with PHP scripting language. The EHG client device communicates with the EHG server using dedicated protocol which is also based on SSL protocol. The EHG server is a mediation layer between EHG client device and MySQL database. It is implemented with Python scripting language.

Keywords: pregnancy monitoring, uterine contractions, electrohysterography

The Establishment of a National Cancer-Register: A Tool of Improving the Quality of Cancer Service Management and Improve Quality of Cancer Patients Care

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Cancer-register - it is constantly updated and updateable list, including full details of codified patients, their diseases and treatment.

The concept of the Register includes the formation of a database of cancer patients, but on the basis of this information - an adequate assessment of cancer care in the quantitative criteria, the possibility of control (optimization) process, and medical check-up, great accuracy in epidemiological studies and analysis of remote results.

The main phases of implementation are:

1. Study of the subject area. An analysis of the existing system of cancer registration information: principles of collecting information, all existing sources of information, medical records, information flows in the structure of cancer services and their regulations, terminology and concepts of its strict definition, analysis and classification of applications, which are scheduled to put on these data, design goals and model the flow of data.
2. Study of the research. This period of cancer, the study of signs, which describes a patient with cancer, treatment and course of pathology, the study of features used and the existing international classifications, the analysis of existing approaches to the analysis of data quality.
3. Design of information technology. Search and identification of the best ways to implement applications based on the requirements developed in phases of analysis. At this stage, a domain model is transformed into the scheme of databases and the specification of storage. Designed models of applications, working with data stored in databases, quality control procedures. At the same time designed screen forms, reporting formats, an interface for interaction between user and system.
4. Implementation of the system. Development of user and operational documentation. Education of user personnel. Input data, converting files, a series of tests on the correctness of the entire software. Tested

on real data and workplace users. Recorded failures and shortcomings of the software, and suggestions for further development of technology. This stage is one of the most responsible, as well as determine the viability of the whole system and training of user personnel.

Expected result

- The computerized database will allow people to explore the incidence of malignant neoplasms in various regions of Uzbekistan and the whole republic, as well as deaths from them.
- Examine the status of the diagnosis of malignant neoplasms in the territories: the individual clinics, clinics, research centers.
- Examine long-term results of treatment, depending on the options ordered by the user (in different nosological forms, stages of the malignant process, treatments, etc.).
- Build the basic indicators characterizing the state of oncological aid to the population of various regions of Uzbekistan and the whole republic.
- Analyze time-frame, taking place between the emergence of the first clinical manifestation of malignant neoplasms, treatment of the patient's illness to the doctor, the diagnosis and the start of treatment.
- In automatic mode, to monitor the compliance of timing check-up.

Conclusion

The main objective of establishing a Cancer-register in Uzbekistan is to improve the quality of care of cancer patients by improving the management of health resources.

Wireless Networking for Healthcare Applications

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Malawi is one of the poorest countries in the world. As a result, information and communication technology (ICT) and its services and expertise are minimal and mostly confined to the urban areas. Again, these have not been fully customized and integrated to benefit the poor masses through usage of low cost and appropriate technologies. For instance, the recent introduction of the wireless communication technology has seen tremendous improvement in communication replacing cable based infrastructures that have over the years become expensive to maintain due to their vulnerability to vandalism. With this in mind, there is acute need for technical expertise both in the private and public sectors to harness the integration and adaptation of such new technologies to ensure the delivery, reliable and affordable communication infrastructure that will trigger macro socio-economic growth.

In an effort to achieve this, the Electrical Engineering Department at the Polytechnic, University of Malawi runs the *Wireless Network for Health Applications* project since mid 2006. This work is being done with collaboration from the Radio Communications Unit, Aeronomy and Radio Propagation Laboratory, Abdus Salam ICTP, Trieste, Italy. The goal of this project is to improve the delivery of health services by improving access to information and timely communication through low cost wireless-based communication network and basic telemedicine applications in the city of Blantyre. Some of the specific objectives of the project include the following:

(a) To improve access to information and ease of communication for the delivery of health services through increased Internet connectivity bandwidth, low cost wireless-based network and Voice over Internet Protocol (VoIP);

(b) To use basic telemedicine applications for the delivery of health services, such as exchange of medical records, statistics, epidemic surveillance data, transmission of X-rays; and consultations with specialists through email; thus availing expert opinion at the which otherwise is available only at referral hospitals;

(c) To increase knowledge and skills of staff in health centres around the country on how to use ICT facilities for the delivery of health services; and

(d) To develop an appropriate model for wireless-based communication network for health applications to be replicated in other areas.

The project is comprised of two phases: network implementation and telemedicine applications. The first phase involved the development a pilot wireless network connecting two health centres to the main central hospital through the Polytechnic in the city of Blantyre. As of now, it is possible to make VoIP phone calls and access the Internet from the two health centres through the Polytechnic as a gateway. As the project approaches the second phase, it is observed that there is a need for further research on how to implement telemedicine applications.

Keywords: Telecommunication, Wireless networking technology, Telemedicine, Low-cost

Session 15

eHealth and Chronic Disease Management

Case Study: Using Telemedicine to Provide a Chronic Care Model for Haemophilia

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Abstract: **This paper describes the use of telemedicine, in particular an Electronic Patient Record (EPR) and Bar Code technology, help provide higher standards of patient safety and clinical service delivery management for patients suffering from Haemophilia. Results show that telemedicine can help improve levels of patient care and safety whilst reducing healthcare delivery costs.**

Introduction

Ireland is not unique in the fact that its current healthcare system is not sustainable in the long-term. In addition effective chronic illness interventions generally rely on multidisciplinary care teams. In order for this type of care programme to be effective it is important that the caregivers adopt a prepared and proactive approach founded on evidenced-based clinical information and delivered in a manner which optimises the maximum patient experience and produces better outcomes at both functional and clinical levels [1].

Haemophilia is a chronic disease that occurs almost exclusively in males and is characterized by delayed clotting of the blood and the consequent difficulty in controlling haemorrhage even after minor injuries.

The management of patients with haemophilia involves the administration of Clotting Factor Concentrate (CFC's), a medication which replaces the deficient clotting factor. Over 75% of patients with a severe form of the disease self-administering the medication in the home.

During the late 1970's and early 1980's the majority of regularly treated haemophilia patients were infected with HIV and/or hepatitis due to medication contamination. Because data used to capture CFC distribution, recall and usage was manually gathered, it was inconsistent, incomplete and retrospective, resulting in defective medication remaining in the supply chain for some time after steps were taken to remove it. These infections have led to profound medical and psychosocial challenges, which make the delivery of future clinical care a particularly sensitive and important issue for both the patients and their families [2].

Discussion

Innovation is essential to improve accessibility, affectivity and efficiency of healthcare delivery, especially in managing chronic disorders. Telemedicine promises these improvements provided that it complies with essential requirements with respect to quality and patient safety. Telemedicine must be implemented thoughtfully to yield full benefit to the patient. In order to improve service delivery and patient safety, St. James's Hospital has implemented a number of combined initiatives, these include:

- A national Electronic Patient Record (EPR) for patients with Haemophilia, deployed in multi-centres throughout the country;
- The introduction of a Validated Cold Chain Delivery Service, for distributing Coagulation Factor Concentrates (CFC's) ;
- Accurate and real-time tracking and tracing of Haemophilia medication, based on GS1 Standard Bar Code technology;
- Validation, (using GAMP), to ensure all software is written or modified in accordance with best international practice.

National Haemophilia EPR

The introduction of an Electronic Patient Record (EPR) to replace the traditional paper chart will eliminate the frequent problems of missing charts at outpatient clinics and outside normal hospital hours. In addition, the EPR has been deployed in other centres allowing for improved collaboration between clinicians with the sharing of key clinical information.

The EPR will present a legible, clearer format for vital clinical data, as well as a reduction of paperwork, documentation errors, and filing activities.

Other key benefits include:

- International disease coding (ICD 10) to standardise data entry and retrieval
- Alerts for medication errors (e-Prescribing)

Validated Cold Chain delivery system

The use of ad *hoc* delivery systems to deliver medication to patients resulted in an irregular service, which was both inconvenient to the patients and prone to error. Moreover, the fact that none of these delivery methods provided a validated cold chain system, coupled with the manual recording of treatments, led to both product wastage and inaccuracies in vital patient consumption data (which was necessary in the event of a product recall).

Implementing validated cold chain delivery was therefore essential for the storage, distribution and delivery of CFC's to patients with Haemophilia, both within the home and Hospital environment.

Bar code Scanning

The accurate tracing of CFC using unique (GS1) product bar-coding [3] is a critical component of this initiative. Bar code scanning pinpoints the location of medication at all stages of the supply chain. This is achieved by combining an electronic stock management system with the GS1 system to uniquely identify people, patients, medication (CFC's) and all locations (warehouse, delivery van, patient home, hospitals etc), throughout the supply chain.

Validation

Software Validation is an important key to ensuring that all software is written in accordance with best international standards. We chose GAMP (Good Automated Manufacturing Process) [4] as it has been widely used by the European Pharmaceutical Industry. GAMP is designed to produce documented evidence that provides assurance that all software follows strict developmental testing and implementation phases.

Results

Studies to measure the effectiveness of the initiatives have been undertaken. These were chosen to evaluate the impact of the implemented services.

EPR

Implementing the EPR has had a very positive impact on patient and clinic management and has overall improved patient safety. It has stimulated the move towards a "paper light" service and has significantly reduced the time searching for patient charts. This allows staff, (clerical, nursing and clinical) to concentrate more fully in direct patient care and patient management activities.

Cold chain delivery service

Central to haemophilia patient care is ensuring that patients receive their medication in a timely manner and that the medication transport and storage complies with international standards. In addition, a major deliverable of the project was to be able to initiate a rapid comprehensive medication recall.

A pre and post service audit was undertaken to assess the impact of the implementation of the validated cold chain delivery service on medication usage.

Medication wastage, due to failure of either cold chain conditions or delivery issues, reduced from €90,216 in the period July 2003 - July 2004 to zero wastage for the period August 2004 – August 2005, the first year of introduction of the efficient temperature controlled door-to-door delivery service.

Using barcode technology to track and trace the medication as it moves through the supply chain gives real-time data on storage, movement and usage. A mock product recall can now identify the location of all vials of the selected batch of medication within 10 minutes.

In order to measure to effectiveness of the service to the patient, a post service implementation satisfaction audit was undertaken. The audit shows that the removal of the ad hoc irregular and inconvenient delivery methods and introduction of a discreet reliable scheduled system has been an overwhelming success with 100% satisfaction in the new service.

Discussion

The goal of this connected health initiative is to empower patients to self-manage their care and help them improve their quality of life. One of the best ways we've been able to do that is by leveraging technology. However, technology is only an enabler – and it is only effective when it helps improve processes, speeds up workflow, and improves patient care.

The implementation of an EPR has allowed for the standardised "once only" capture of key clinical information, in addition the electronic method is more accessible, accurate, and useful in the overall management of haemophilia.

Validated cold chain distribution reduces the risk of product wastage. Electronic tracing of CFC using unique (GS1) bar codes reduces documentation error and facilitates optimal product recall, identification of recipients of "at risk" products and improves quality of patient consumption data.

The validation of software provides documentary evidence of best practice in all aspects of software lifecycle. It also ensures that requirements specified by stakeholders are delivered by the supplier.

Conclusion

Finding effective strategies for managing chronic disease has been identified as one of the major challenges facing health care professionals in the twenty-first century, particularly as the costs of long-term care continue to rise [5].

We have demonstrated that implementing a series of tightly controlled processes along with Telemedicine initiatives can improve patient care and

safety and help reduce medication wastage. This model could be adapted to provide a systematic approach to improving health care for people with other chronic diseases such as hepatitis and diabetes allowing healthcare to be delivered more effectively and efficiently to other chronic disease groups.

Finally, we have shown that Telemedicine works; it improves patient safety, improves process efficiency and can be economically beneficial.

Acknowledgments

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In his present role, Feargal is responsible for managing a multi faceted initiative that combines a number of strands including the use of an Electronic Patient Record (EPR) along with a validated cold chain delivery service using GS1 Bar Code technology to provide integrated patient management processes which is the first of its kind.

Development of Simple eHealth System for Tuberculosis Management at Community Health Center Level in Indonesia

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In this paper, we describe a preliminary development of an Internet and mobile phone-based e-health system for Tuberculosis (TB) management in a Community Health Center (CHC) or hospital. A standard DOTS (Directly Observed Treatment Short-course) strategy is applied to support the diagnosis and therapy of the TB patients in Indonesia. o assist the TB patients, in general, each CHC usually has simple laboratory unit, with limited medical personnel and medicine facility. Unfortunately, the number of TB prevalence is still relatively high, perhaps due to the relatively high percentage of patients with uncompleted therapy. Such cases are caused by several factors, for example: "healthy feeling" before completing the therapy, not taking regular medicine as required, not attending regular medical visit, and possible drug side-effects. The development of our ICT-based e-health system for TB management is expected to increase the number of TB patients with completed therapy.

Basically, the TB management e-health system under development includes measurement, recording, evaluation, reminder and reporting functions. The system consists of: personal computer (PC), simple digital microscope, patient database software, SMS (Short Message Services) gateway software, and telecommunication module. The simple digital microscope has been built from an analog microscope, digital camera and PC with appropriate image processing software; it is used to detect the Acid-Fast Bacteria and to capture patient's sputum in digital form. he digital data is saved in the web-based patient database for further information retrieval and education purposes to improve diagnosis quality of TB. The system can also be used to report to the Health Office Centre through the Internet to inform medicine supply and the epidemic in the covered area of the CHCs. From this information, the Health Office Centre can make an appropriate effort immediately. The system can also send 16 SMS reminders to the patient for taking the medicine or attending medical

visit during 6 months. Moreover, the patient can do remote TB consultation through her/his mobile phone using the SMS facility.

Moreover, the system can also be further developed for tele-consultation to a Pulmonologist or other medical specialist in the referral hospital. Therefore, the Internet and mobile phone-based e-health system for Tuberculosis management is expected to increase the number of TB patients with completed therapy and to improve the quality of their health services.

Keywords: e-Health, tuberculosis, community health center, Indonesia

Essential Enabling Infrastructures for the Development of Connected Health Markets and Practice

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Over the past 5 years the pace of development of Connected Health systems and services has been meteoric but is still not matched to the requirements for healthcare delivery transformation.

Progress is constrained not simply by the practical limitations of legacy systems and last generation fixed or mobile networks but by a wide range of capacity issues across areas of:

- Enterprise Eco-Systems,
- Education,
- International Knowledge Transfer,
- CH Standards Development and
- National/Regional Healthcare Policy Priorities.

The European Connected Health Campus is stimulating both top-down policy attention and bottom-up practicality in bringing together the Health and Wealth agendas – the poetry and plumbing of information-age healthcare.

This presentation will explain why the European Connected Health Campus is headquartered in the far north western corner of Europe and how this location has informed our view of essential enabling infrastructures.

Eye-Care: Teleophthalmology for Chronic Ocular Diseases

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Purpose of the study

To design, develop and validate an integrated ICT system for monitoring medical parameters related to patients suffering from chronic ocular diseases with a strong impact on health care services and, in particular, Diabetic Retinopathy (DR), Age-related Macular Degeneration (ArMD).

Proposed Methods

A prototypal info-telematics system will be designed, developed and validated on chosen samples of patients suffering from the above mentioned diseases. Specific digital biomedical devices will be used to acquire the ophthalmologic data. Their integration on with ICT tools (mobile phone, PDA, etc.) and dedicated software will allow to manage medical data in a web environment. Patients' ocular data and images will be transmitted from a health point of care located near the patients' home (in this last case with the assistance of ophthalmic technicians) to a service centre hosting a dedicated web portal. The system will allow to monitor these ophthalmologic patients at distance, without the direct presence of ophthalmologists who will be able to control some clinical parameters accessing the data base of the dedicated web site and giving so the appropriate diagnostic-therapeutic advices by E-mail/SMS.

Expected results

- To have an integrated well organized ICT system together with specific biomedical devices to transmit eye data in a secure way to have diagnostic-therapeutic advices in web environment;
- To improve ophthalmological patients' health conditions and their quality of life.

Results will be evaluated in terms of degree of easy access to the system, users' acceptability, medical efficacy and costs.

Conclusion

This project will allow to have a closed loop health system in ophthalmology to improve citizens' health condition, to reduce patients transfer with saving social costs for both patients and relatives, and to have a large international database useful for epidemiological studies and biomedical research.

Keywords: Telemedicine, Teleophthalmology, e-Health, TeleCare

First Steps in Tele-Neonatology

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Telemedicine is a powerful tool for support of clinical decision making, development of individual treatment program, improvement of medical workflow and care availability in neonatology.

Aim of the study

- Systematization and
- Analysis of our first telemedical consultations in neonatology, development of plan for further researches.

Materials and Methods

The group consists from 10 patients (6 males, 4 females) in age 2-27 days; one teleconsultation was spent in perinatal period (term of pregnancy 36-37 weeks).

Main diagnoses were:

- Orthopedic pathology (congenital, trauma in delivery) - 5 (50%),
- Plural congenital abnormalities - 2 (20%),
- Neurological pathology (congenital, delay of intrauterine development, perinatal brain injury) - 2 (20%),
- Skin pathology (congenital ichthyosis) – 1 (10%).

In 50% of the cases it was the first pregnancy with complications and bad gynaecological anamnesis. For telemedicine consultations approaches and recommendations of International Society for Telemedicine and eHealth were used.

Results and Discussions

10 teleconsultations were performed, as expert – 80%, as inquirer – 20%. One of the teleconsultations was synchronous in emergency clinical situation (duration 35 min.), all the others – asynchronous (duration 12-48 hours).

EMR includes 10 text descriptions of clinical cases, 8 digital x-rays, 11 clinical pictures, 2 ultrasound images.

Most often problems of treatment were discussed (primary tactics – 8, prognosis – 2, actions in early neonatal period, peculiarities and terms of

surgical procedures – 2); problems of correct diagnosis were discussed twice.

Every case was discussed by 1-4 experts from Ukraine, Russia, Austria, Germany and Turkey. Active surgical treatment was recommended 3 times, non-surgical – 4, additional diagnostic tests – 6, symptomatically treatment – 1, monitoring of health status and stage treatment – 2. All recommendations have positive influence to clinical workflow; one time unnecessary surgery and life-dangerous transportation was avoided.

Conclusion

Our first telemedicine consultations in neonatology have positive results and serious clinical efficiency.

Synchronous and asynchronous teleconsultations at the base of Internet (IP, web-platforms, e-mails, VOIP-videoconferences) are most effective clinical tools.

Our next researches will focus on home telemonitoring of fetus cardiological status, systematic teleconsultations for formation of tactics of early neonatology care, complex efficiency estimation.

Key words: neonatology, pediatrics, telemedicine, teleconsultations

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Helping Technology Deliver its Potential

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The need for healthcare services globally is increasing far faster than the ability to deliver them and as a result, healthcare resources and budgets are being stretched to breaking point. Governments will have a hard time applying the traditional centralised acute care models to the realities of an aging population. Exponential change is needed, and it is needed on a scale that is staggering.

What's required is a different model of care that can scale to the needs of an ageing population. Research shows patients prefer to receive care in their own homes, and the healthcare model must evolve to make the home the primary site of care for long-term conditions. Successful home care will require improved communication between patients and their healthcare team, and better access to health information. Research has shown that people who remain physically and socially active, while actively managing their own healthcare as they age, tend to stay healthy longer. If we could make it easier for older adults to connect and engage with physicians, nurses and carers from their own homes, we may be able to improve their quality of life and reduce the need for inpatient resources.

Technology is likely to be one important part of the home healthcare solution, and it needs to be available and workable for everyone. Simple, user-friendly technologies that can keep patients be active, involved and connected with their healthcare team could help preserve their quality of life and allow them to continue to live independently.

Moving toward a proactive, patient-centred model

Intel believes that new digital health technologies can play a role in meeting the challenges of an ageing global population. These technologies will place an emphasis on prevention rather than treatment and will require that individuals and their family and friends assume some responsibility for managing and directing care.

Ethnography: understanding people in their own environments

The number of people over 60 years of age worldwide will reach 1.2 billion by 2025. Intel's

Global Research Initiative is looking at the social and cultural similarities and differences in people's experience of ageing and health. The aim is to identify opportunities where new technologies can address the challenges faced by an ageing population. Our journey starts and ends with the patient.

Global Aging Experience project

Developing entirely new technologies for everyday use requires a thorough understanding of how people live and what they really need. Intel ethnographers studied older adults in the United States and Europe and found common themes in their attitudes and needs. To better understand the ageing experience, Intel's ethnographers have spent time in more than 1,000 homes and 150 hospitals and clinics across 20 countries.

Using open-ended interviews, observations and multi-day visits to people's homes, they studied how people interact with each other and their environments. What do they find easy or difficult? What kind of device or intervention would help them the most? This information was then fed back to the engineers and scientists who design and produce the new technologies.

People want to stay engaged and have a sense of purpose. They need to stay connected socially, but feel that it is important to maintain their independence. Interestingly, many adults in the study were in a state of denial about the negative impact of ageing, which may lead to delayed awareness of cognitive or physical decline.

Ethnography informs technology

Intel's design engineers translate ethnographic research into innovative design concepts for health technologies. This type of work is currently underway at the TRIL (Technology Research for Independent Living) Centre in Ireland, which is a joint initiative between Intel and Ireland's Industrial Development Agency. Intel Digital Health researchers are working alongside multi-disciplinary researchers from Irish universities to innovate and deliver technologies that support independent ageing in a home environment. The initial focus of their efforts is in falls prevention, cognitive function and social connection.

The importance of social interaction is sometimes overlooked, but it is a key contributor to healthy ageing. Social participation is a strong motivating factor for exercise, which boosts health, and also lessens the burden of cognitive decline.

An example for this approach is how we have included video conferencing facilities into the Intel® Health Guide, initially enabled only for the clinician to make outbound calls, but in the future we plan to open this feature up to allow patients to talk to their relatives and friends. Also

the design has incorporated a touch screen with no key board and mouse making it easy for those who have never used a computer before to engage. The text is large and accompanied by audio to help those with poor vision. So the design of the product has been developed from our understanding of the needs of an elderly population who are living with chronic disease. Similar research has been used to look at the clinicians needs too, ensuring the clinical interface supports easy of use and logical work flows.

Digital healthcare in the home and beyond

Intel's Digital Health Group is currently working on a range of solutions designed to make home healthcare a reality and to better care for ageing and chronically ill individuals, and as described above, the first of which is focused on managing chronic diseases.

Introducing new technology

Telehealth is now on the public agenda in the UK but has not yet become the standard of care. There has been some work undertaken by the Care Services Improvement Programme (CSIP) to issue advice on the best ways to overcome potential barriers to the implementation of telecare and telehealth technologies. These are consistent with Intel's experience, but there are some particularly critical barriers that need to be tackled for there to be a sustainable development of technology:

- **Responsibility for telehealth:** As with most new innovations they need champions to support the project and allow it to demonstrate its value. At this stage it is not always clear who is the driving force within organisations such as PCTs for the introduction of telehealth. This may be because this is not high on their agenda or there is no individual responsible for its introduction.
- **Sharing best practice:** Despite the propensity toward bespoke solutions, there remains considerable merit in knowledge transfer. Presently, it appears that PCTs act independently on telehealth projects and do not communicate their experiences in a coordinated way. The Kings Fund's Whole System Demonstrator Action Network, an online resource for telecare, telehealth and the management of long term conditions allows for sharing learning amongst the group.
- **Interoperability:** Nurses often ask for more IT to make their lives easier, but when it is delivered it can be complicated, poorly implemented and does not integrate well with other systems, making their lives more difficult. Intel has been a strong supporter of interoperability as evidenced by our involvement in the development of the HL7 standards for remote patient monitoring, and our leadership

efforts in the Bluetooth Medical Device Working Group. At a European level, Intel is also committed to helping to create a large marketplace of interoperable personal telehealth devices and services through the Continua Health Alliance. (The Continua Health Alliance was launched just over a year ago and has over 150 member companies. Members include industry leaders in personal health, consumer electronics, technology, fitness and services. Continua will be preparing guidelines for interoperability within three target areas: chronic disease management, aging independently, and fitness/wellness. These guidelines will become a certification mark targeted at integrators, professional healthcare providers and consumers identifying products that will deliver value through interoperability)

- **Changes in working practice:** The implementation of telehealth is likely to require a significant change in working practice and training on its use. There may be an initial increase in workload and transition period before it is integrated into practice and the benefits realised. Whilst some stakeholder groups may well resist the introduction of technology, or even actively oppose it, equally, many nurses can already see the potential benefits but require the capacity for the transition and time to train their patients. Lord Darzi's report recognises the need for health care practitioners to change the way the work, '*New technology is changing the way they work. Patients and the public, quite rightly, have increasing expectations of personalised care. Workforce planning, education and training need to change to enable staff to respond more effectively and flexibly to this dynamic environment.*' Intel recommends that change management tools are developed to support this transition. In addition, there should be appropriate training and education provided for healthcare professionals as part of their Continued Professional Development (CPD). Over the longer term the application of ICT and telehealth should be incorporated into undergraduate courses.

Understanding healthcare needs

The ultimate goal of Intel's ageing research is to understand the healthcare needs of older people and their carers and to innovate the next generation of technology to support them. By helping people to become more proactive in managing their health, and providing carers, physicians and nurses with the information and equipment they need to deliver care whenever and wherever it is beneficial, Intel hopes to play an important role in addressing the needs of our ageing population.

To learn more about Intel's health research efforts or to find specific research papers on the technologies mentioned in this piece, visit www.intel.com/healthcare/research

About the Author

Dirk Roziers started his career as a researcher in physics with the Philips Research Laboratories in NL and moved into the telecommunications industry when he joined AT&T in 1991 where he held several positions as software developer and systems engineer.

In 1997, Dirk moved to Dialogic as a technical consultant and later on became a product marketing manager.

Following the acquisition of Dialogic by Intel, Dirk assumed the role of business development manager in EMEA for Intel's Modular Communications Platform program.

Over the last 2 years Dirk's been responsible for Intel's market development activities in EMEA for its Digital Healthcare Division and products.

Dirk obtained an engineering masters degree in Physics from the University of Gent, Belgium as well as a second engineering masters degree in Medical Sciences from the University of Leuven and followed a postgraduate program in information technology at the University of Brussels and a postgraduate program in telecommunications at the University of Antwerp.

ICT Use by Doctors in Kuwait Public Hospital

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Abstract: **This paper presents selected results from a large study which explored the information needs and information seeking of doctors in four public hospitals in Kuwait. The paper focuses specifically on the results pertaining to Information Communication Technology (ICT) use. A strategy of sequential mixed method procedures was followed using focus groups, a paper-based questionnaire and semi-structured telephone interviews. The results established a picture of the ICTs used by doctors and suggest that enhancing ICTs in Kuwait public hospitals (KPH) is key to improved healthcare services and sound clinical decision making.**

Introduction

Information Communication Technologies (ICTs), such as the Internet and computer based patient records, have the potential to improve health information provision by facilitating the production, storage, processing, dissemination and exchange of clinical information. This study explores these issues within a Kuwait context. Kuwait is small and wealthy country, located in the Middle East. In recent years, the government in Kuwait has sought to join the Information Age through a series of government work programmes. One obvious feature of this is the use of ICTs in all government sectors. Today, Kuwait is the third largest information technologies market in the Gulf region, after Saudi Arabia and the U.A.E [1].

Turning specifically to Kuwait's healthcare services, a primary health care system has been implemented in all primary health care centres in Kuwait in recent years and the implementation of a secondary health care system (HCIS) in hospitals is underway. The research reported here explored the extent to which the system is being used by doctors in their medical practice and also sought to identify other ICT resources used by doctors. In addition, the study identified doctors' difficulties in using ICTs for obtaining the information they need for clinical decision making.

Research method

Three stages of data collection were adopted in this research: focus groups, a paper-based questionnaire and semi-structured telephone interviews. This mixed-method approach, or triangulation, aims to explore the issues involved in the research from many points of view to improve the consistency of the data [2]. The study was conducted in four public hospitals in Kuwait: Al Sabah hospital, Al Farwania hospital, Al Amiri hospital and Mubarak hospital. Three focus groups and 20 semi-structured telephone interviews were conducted. 1000 paper-based questionnaires were disseminated to all doctors working in the four study hospitals in January 2008 and the data collection was completed in February 2008. 541 questionnaire responses were received, giving a response rate of 54%.

Results and Discussion

The results showed a general lack of information technologies in the KPH. A very small number of respondents indicated they had online databases in their hospitals and when they did they were free databases provided for trial periods only. In addition, the facilities for accessing information resources were not distributed equally between the departments in the hospitals. For example, the accessibility of the Internet was very limited. It was available in some doctors' offices in the wards and in the offices of consultants and heads of departments. The results showed that the Health Care Information System (HCIS) was available in all hospitals except Al Sabah hospital. Doctors' use of the system varied between the three hospitals, however. It had only recently been introduced in Mubarak hospital at the time of the primary research and used only for entering data such as patient diagnosis, progress and medication and writing discharge summaries. The system had made more progress in Al Amiri and Al Farwania hospitals and was used to enter patient data and the results of investigations, such as laboratory tests and X-rays results. The interviewees stated their problems in using the current HCIS. There was no facility in the system to retrieve old patient data, for example, so patient data were repeated for every patient admission. Other problems were that the system does not show the results of investigations, it did not provide a statistical summary of cases and the system also suffered from frequently being down and unavailable.

Although the results of the study showed a lack of ICT resources within Kuwait government hospitals, the doctors indicated that they relied heavily on ICT for accessing the information they needed for clinical practice. Almost all respondents said that they used the Internet, nearly all of them

reported that they used it at home and around a quarter of the respondents used the Internet in the hospital. The low use of the Internet in hospitals raises two critical issues. First, since doctors are professionally very time pressured, they do not have time to access the Internet in the hospitals. Time constraints on searching online resources have been similarly indicated by several previous studies [3, 4]. The second issue is that because the Internet is not accessible in all departments in the hospitals, doctors rely on using the Internet at home. This was confirmed by the questionnaire results which showed that around half of the respondents were dissatisfied with the accessibility of the Internet in their places of work. The situation was similar to that in studies by Tan, Stark, Lowinger, Ringland, and Pearson [5] and Ajuwon [6] which indicated that doctors were dissatisfied with the accessibility of the Internet in their hospitals. The most common reasons for accessing the Internet were for email and for keeping up-to-date. An interesting issue arising from the results was that more than half of the respondents in the questionnaire obtained information from the Internet to answer their colleagues' questions and also patient questions. It seems that interpersonal communication is an important motivating factor encouraging the doctors to obtain information from the Internet. There is evidence in the literature that doctors are experiencing patients bringing Internet printouts to consultations [7]. Thus, doctors need to be ready to cope with patient expectations. The most frequently accessed resources on the Internet were online databases such as MEDLINE, PubMed and NEJM.

The use of telephones, personal mobile phones in particular, to obtain information was another notable feature on the study. Most of the participants in the focus groups and interviews indicated the necessity of using mobile phones to communicate with their colleagues. They revealed that mobiles facilitated quick consultations with their colleagues. Also, sometimes they shared cases and discussed new issues arising in their specialist area by phone. The questionnaire results supported that and showed that the majority of respondents (82.4%) communicated with their colleagues by mobile. Another interesting issue found in this present study was that the interview results indicated that a few participants obtained information from medical programmes by watching T.V. and listening to radio stations. They mentioned that the media provided them with good information about handling emergency cases but stressed that information should be evidence based.

It was found that personal collections, consisting primarily of electronic resources, was the information source used most frequently by the respondents (81.9%) in the four hospitals. Most of the doctors in the interviews and the focus groups indicated that they usually accessed

wireless Internet via their personal PDAs and laptops. There is also evidence from the literature that PDAs play a crucial role in doctors' medical practice [8, 9]. Most of the doctors in this study subscribed to some online journals such as NEJM, EMJ, the Lancet and Paediatrics, and they also accessed departmental guidelines and PowerPoint handouts from seminars and workshops via these technologies. Generally, all interviewees emphasized the importance of using their personal collections and said this was their preferred source of information for a number of reasons. Firstly, they reported that their personal collection satisfied their information needs including help in practicing their profession, keeping them up to date with new developments in their specialty, improving their clinical decision making and providing information for lectures and seminars. Secondly, their personal collections gave them independence and the capability for better and more effective time management. Thirdly, they indicated that these are quick reference sources which they can use in any place and whenever they want them. They are also good sources to refer to in emergency cases.

Conclusion

ICT implementation is an ongoing government policy in the Kuwait Public Hospitals. It has been found in this study that doctors are adapting to cope with the new developments in information technologies in their environment by utilizing their personal ICT tools. There is an obvious shift from using traditional ICT resources such as CD-ROMs and desktops to PDAs and mobile resources. Mobile ICT resources could be the ideal tools for doctors who are often busy moving from one scenario to another in their working day and need to be able to keep up to date with the latest information at all times.

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• Taught two modules: Introduction to Written Communication& Management of Small Business for undergraduate students from College of Technology Sciences in Applied Institute for Education & training.

Remote eHealth Dietary Services to Improve the Quality of Ageing

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Ageing of the population is a major event in the world: people older than 65 years of age are the major segment of the population. This phenomenon will increase in the next future and will be a social-sanitary problem if associated to disability. An urgent need of an integrated approach to such problem is emerging. Gerontological/geriatric literature unanimously indicate that diet is one of the fundamental approaches to contrast/prevent the age associated alterations. Recent studies also stressed the great heterogeneity of the aging process, whose rate is quite different in different individuals. The literature highlights that aging process and the pathogenesis of age-related diseases are influenced by oxidative stress, inflammation status, and gut microbiota, and that it can be modulated by nutritional status and corrected by a dietetic intervention associated or not to nutraceutical food supplements. Thus, an healthy personalized dietetic approach specifically formulated for elderly people, with a defined pattern of nutrients, is emerging as a key strategy. Beyond, functional foods and nutraceutical supplements become an opportunity for the elderly consumer to improve the individual diet for specific needs. Equally, the efficacy of functional foods and nutraceutical supplements is improved by the overall quality of the diet. Moreover to improve the subjects' compliance to the diet it is necessary to allow for eating habits and traditional recipes, and to allow to modify foods or recipes selected in daily menu in accord to the different conditions, without impair the pattern intake of nutrients and dietetic functional compounds recommended for elderly people. Because to modify eating habits is very difficult this intervention must to be make only if necessary and it is expected a positive result. Than the dietetic intervention and the functional foods and/or nutraceutical supplements must to be formulated on the basis of the biological individual phenotype predictive of the positive result. The great number of variable involved in diet formulation can be managed by a new E-Health Dietary Services. These services consist in the delivery of recipes and procedures containing nutraceuticals and probiotics specifically designed for Elderly People and institutions dealing with Elderly People throughout a new IT web platform. The E-Health Dietary Services approach will be based on the recognition

and management of the (healthy) food intake as a crucial step to control, balance nutritional substances (including nutraceutical compounds) and environmental stress in order to increase the quality of life and prevent diseases in elderly people, largely characterized by inflammation, oxidative stress and gut microbiota alteration. The E-Health Dietary Services can contribute to the valorization and exploitation of functional or nutraceutical foods in preventing and contrasting the inflammation, oxidative stress and gut microbiota alteration in elderly people. The develop of an innovative ICT system (RISTOMED web platform), which integrates nutritional and epidemiological data for a remote E-health service, will contribute to the identification of new processes and procedures for a correct delivering of nutraceutical food supplements in order to specifically establish the appropriate introduction of these supplements in the common diet of the elderly subjects according to a standard healthy diet for elderly people and to the development of a methodology to support nutritional claims for specific nutraceutical food supplements.

Keywords: elderly, nutraceutical, eHealth dietary services

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Fabio Buccolini was born in 1969 and he lives in Rome. He is Vox Net CEO and responsible for the R&D in healthcare and telemedicine. In his experiences there are tutoring, training and speaking as an expert in a lot of events at national and international level. He has published more than 15 scientific and technical papers at international level and attended some specialization courses also in Telecardiology, Teleradiology and Telemedicine forming part of the experiences in the EU projects he is managing in order to link E-Health and biotechnology.

Alessandro Pinto was born in 1963 and since 1st september 2000 he joined the Faculty of Medicine and Surgery of the University of Rome "La Sapienza".He carries out his teaching and scientific activity in the facilities of the “Food Sciences and Nutrition Institute” focusing his research activities on food habits, lifestyle and use of food supplements. Specific topics are well being and food behaviour in patients suffering from pregnancy diabetes; monitoring of nutritional status and habits in geriatric age; alimentary intolerances to define a new diagnostic algorithm and a corrected dietoterapic approach. He is an ordinary fellow of the Italian Society of Human Nutrition (S.I.N.U.) and of the SIO - Italian Society of the Obesity.

Telemonitoring in the Management of Patients with Chronic Digestive Diseases from Remote Areas

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Abstract: **This article presents part of an ongoing project started four years ago which has aimed to provide an expertise operative digestive endoscopy on freelance basis to patients living in remote areas.**

In this context, we have had to examine a large number of patients with medically acute benign and chronic diseases. These chronic conditions included a large spectrum of digestive diseases like inflammatory bowel disease, celiac disease, chronic diseases of the liver and pancreas as well as digestive neoplasias. We, also, aimed to monitor at a distance (telemonitoring) their clinical status and lifestyle, thus, permitting them to live at home with the active collaboration of the local nurse and GP. This allowed health staff to initiate treatment at the early stage of disease and avoiding unnecessary hospitalization.

This telecare has been achieved by the widespread availability and use of mobile phones in our country. Our willingness and commitment to conduct such project overcome all difficulties that have arisen from time to time.

Keywords: telemonitoring, chronic digestive diseases, mobile telephone

Introduction

For several years, we have been conducting an experimental project, reported previously [1], of giving specialized care on interventional digestive endoscopy throughout Algeria on freelance basis.

The project, allows specialist to offer medical service to patients living in remote areas. Thus avoiding the need to travel to the hospitals situated in the north of the country .It has proven to be cost-effective as it saves time and money of the patients who had to spend on costly trips and accommodations for themselves and accompanying members of their family

Patients with chronic diseases were inadequately followed up for reasons ranging from a lack of local medical expertise to poor social and economic conditions. These chronic conditions included a large spectrum of digestive diseases like inflammatory bowel disease (IBD), celiac disease, chronic

diseases of the liver and pancreas and digestive neoplasias. It is well known that these conditions like IBD carry a heavy financial burden [2]. Efforts are made by our Public Health to give facilities to patients with chronic diseases. Drugs are given freely to these patients who are registered regularly to public insurance but poverty, unemployment, lack of medical expertise in remote areas undermine all these efforts .

The purpose of this project is to monitor at distance the clinical parameters and evolution of these patients. It permits them to live at home with the active collaboration of the locally nurse and GP who keep an eye on their health status. This follow up will prevent or diagnose a flare up of the disease or drug side effects without a need for a hospitalization when it is not necessary.

Materials and methods

Due to inadequate care, most of these patients with chronic diseases presented at consultation with some degree of severity .This necessitates a short admission to undertake a work up and to start medications including a large spectrum of drugs.

A large proportion of these patients, were illiterate which requires more time to inform them and explain the course of the disease. Additionally, a diary card completed by the patients and /or the nurses according to clinical parameters of follow up, were provided to them along with referral letters to their local GP and local nurse that included our contact coordinates (mobile telephone number and e-mail address).

Typically, treatment is started and a daily enquiry is made by telephone or email, when the patient has access to this latter. Patients were invited to feel free to call us at any time if needed. Regular work up was made according to our travelling planner. Patients included and spectrum of diseases is reported in table 1.

Results

Most of the patients were motivated and closely followed the advice and recommendations given to them. The mean time of follow up has been about 24 months (36 to 06 months).

Telemonitoring with the active collaboration of local GPs and nurses have prevented many potential complications due to side effects of drugs taken or to the natural history of the disease. All the telephone calls from patients or GP’s or nurses seeking medical advice or treatment were answered. Short Message Service (SMS) was also used to provide correct prescription to get to the pharmacist. Almost all the patients included in this study were living in remote areas .The bothering of the telephone calls was dealt with

according to our commitment and willingness to conduct such a project. Charges were so thought about to minimize them to the least possible.

Table 1

	IBD N=95 CROHN'S DISEASE 43 ULCERATIVE COLITIS 52	CELIAC DISEASE N=12	LIVER DISEASES N=36	CHRONIC PANCREATITIS N=2	ENDOSCOPIC FOLLOW UP N=60
Mean Age (y) **Range (y)**	31 18-53	32 27-38	39 27-58	44 42-46	53 34-74
Sex ratio M/F	1,5/1	1/3	1/3	2/0	2/1
Localizations and other aspects of diseases	LB 29 Proctitis 25 SB 07 LB, SB 18 Perianal 07 Pancolitis 09	GFD Alone 08 Resistant 04	Compensated PBC 2 AIH 2 Decompensate 32		Metachronus neoplastic lesions: LB polyps 56 Familial polyposis 04

Abbreviations: IBD: inflammatory bowel disease; M: male; F: female; y: year; LB: large bowel; SB: small bowel; GFD: gluten free diet; PBC: Primary Biliary Cirrhosis - AIH: Autoimmune Hepatitis

Discussion

This is an open study to ascertain the acceptability and feasibility of telemonitoring of chronic digestive diseases by mobile phone in remote areas. Relevant data were taken retrospectively and accounts for obvious bias. Unlike S. Bali [3] number of parameters were not taken into account like number of telephone calls, liability, mean duration time of a call, cost sustainability of this system depends on our commitment and willingness to conduct this study in spite of some bothering telephone calls

Central to this success, has been the widespread availability and use of mobile phone (more than 23 millions units) enabling communications with various parties at all time. This domestication of mobile phone for health professionals including patient monitoring, disease surveillance and prevention is becoming of paramount importance for a large country as Algeria with 33 millions of inhabitants, which suffers a lack of balanced distribution of its healthcare infrastructure and personnel

The experience taken from this ongoing study let us to agree with Dr. Howard Zucker, Assistant Director-General of World Health Organization ,

who said: “The explosive spread of mobile phone networks across the developing world has created a unique opportunity to significantly transform how countries can tackle global health challenges," [4]

However, in a large systemic review of the nature and magnitude of outcomes associated with telemonitoring of four types of chronic diseases G. Pare et all conclude that future studies need to build evidence related to its clinical effects, cost effectiveness, impacts on services utilization, and acceptance by health care providers [5].

Conclusion

The results of this study suggest that regardless of their illiteracy condition, socioeconomic status, age, patients comply with the telemonitoring through the use of telephone mobile. Telemonitoring of chronic diseases seems to be a promising patient management approach which may reduce the financial burden of the raise of their health care costs.

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Session 16

Telenursing

Presented by the ISfTeH Telenursing Working Group

Computerized Decision Support Systems in Telenursing: How Is it Perceived by Telenurses?

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Telephone advice nursing (telenursing) is an expanding service in many Western countries and in recent year's centralization of telenursing services has occurred in some countries. Telenursing is a complex and knowledge intensive health service were registered nurses (RN's) individually triage callers need for further care, give self care advice or refer the caller to appropriate care giver. These telenurses have numerous patient encounters every day, regarding all ages of callers and questions presented to the telenurses addresses a broad variation of medical conditions.

Telenursing has shown to be appreciated by the population as well as cost efficient.

In an attempt to ensure quality and safety within telenursing the use of computerized decision support systems (CDSS) increased since CDSS enables uniformity and consistency of advices given to callers.

Traditionally, telenurses have relied on clinical knowledge, collegial support and books when triaging callers and few studies describe how telenurses perceive CDSS in their daily work.

Eight telenurses from three different telephone advice call centres, all using CDSS took part in semi-structured interviews in 2006. Data were analysed using qualitative content analysis.

The aim of the study was to describe telenurses experiences of working with CDSS. Telenurses described that the CDSS had both positive and negative influences of their work. They described that the CDSS simplified their work, complemented their knowledge and gave them a sense of security. They also described how the CDSS contributed to quality improvement of telenursing. The negative aspects of the CDSS were described as being inhibited by the system. Telenurses described how they perceived the system as partly incomplete and controlling and that they sometimes disagreed with the measures presented by the system.

These advantages and disadvantages perceived within the system can be connected to the concepts of usability: user-worthiness and user-friendliness. Software should be easy to learn, contain few errors and be easy to orient in, to enhance usability. Hence usability could be further improved in the present system.

There might be a risk that the CDSS will mechanize and undermine the communication between callers and telenurses. It is important, in order to increase the telenurses' professional competence and the feeling of tele-presence that callers not only are given a correct estimation of their conditions but also a sense of security and confirmation. Otherwise callers may seek emergency care solely because of insecurity and anxiety.

Keywords: Telenurses, Experiences, Computerized decision support, Qualitative research

About the Author

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Publications - Ernesäter A., Holmström I., Engström M (2009). Telenurses experiences of working with computerized decision support: supporting, inhibiting and quality improving - accepted for publication in Journal of Advanced Nursing.

Detective or Educator? - Telenurses' Understanding of Work

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Background

Telenursing is an expanding part of health care in many western countries and telenursing work is likely to be understood in a variety of ways. The way in which a person understands work, influences how work is performed. Telenursing demands high levels of competence.

Aim

The aim of the presentation is to describe the different ways of understanding work among a group of Swedish telenurses.

Method

A qualitative interview study was conducted during 2004-2005. Twelve of the 20 telenurses working at a call centre in Sweden were interviewed, five of them twice because of organizational changes. The 17 interviews were analysed using a phenomenographic approach.

Findings

Five different categories were identified in the data: (1) Assess, refer and give advice to the caller (2) Support the caller (3) Strengthen the caller (4) Teach the caller and (5) Facilitate the caller's learning. The first category can be seen as a base for telenursing work and was the only category used by some telenurses. The second category has components of traditional caring and the third is a coaching function. The fourth category contains a teaching component, but the fifth is the only category where the caller's learning is in focus. Telenurses who reported the fifth way also included all other ways of understanding work. Hence, this seems to be the most comprehensive way of understanding work.

Conclusion

The different categories can be seen as a telenursing "workmap", worth to use for reflection. This can expand telenurses' current understanding of

work and promote their competence development. Telenurses need to be aware of their role in public health education.

Keywords: telenursing, communication, competence, health education

About the Author

Elenor Kaminsky graduated for Registered Nurse 1985, Paediatric Nurse 1991, District Nurse 1994 and Bachelor of Medicine 2001. Her clinical background is major Child Health Care (Neonatal and Children's emergency room, among others), but also from the Swedish Pharmacy Callcenter; giving self-care advice to the public. Since 2007 she is a Doctoral Student in the Telenursing Field."

”It’s Easier to Talk to a Woman”: Aspects of Gender in Swedish Telenursing

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Background

Telenurses at call centres in Sweden offer triage recommendations and self-care advice to the general public over the telephone, on a wide range of health problems. The demands on telenurses are multifaceted and competence is needed in many fields such as nursing, pharmacology, psychology and communication. Previous studies have shown that telenurses encounter many ethical dilemmas and that some of these are to do with gender related issues. Most telenurses, as well as most callers, are women. Previous studies have reported that men are less likely to call the UK national helpline, NHS Direct. Women make more calls than men do. It could hence be argued that telenursing is a service mostly handled by women for women, although this was probably not the political intention. It is, therefore, reasonable to believe that gender plays an important role in the work of telenurses.

Aim

To describe and explore gender aspects in telenursing as experienced by Swedish telenurses.

Design

Descriptive and explorative qualitative design.

Methods

A purposive sample of 12 female telenurses in Sweden participated in in-depth interviews twice during 2004–2005. The transcribed interviews were analysed inductively with a stepwise thematic method.

Results

Five themes emerged from the interviews, namely: 1. *female subordination in the family*, 2. *disrespect in dialogue with female nurses*, 3. *distrust in fathers’ competence*, 4. *reluctant male callers* and 5. *woman-to-woman connection*. Hence, the female telenurses found it easier to talk to a female than a male caller

Conclusions

Gender construction and cultural gender norms seem to be at work in the encounter between Swedish telenurses and callers. Questions of power relations, the picture of the mother/woman as the primary carer for small children and distrusting men in their parental role were particularly highlighted.

Relevance to clinical practice

Telenurses should be aware of the risk of stereotyping their dialogues with callers in a way that seems to fit better with female callers' ways of communicating. Clinical supervision based on reflective practice and peer reviews of calls might diminish this risk. Telenurses also need more training in handling overt or covert power messages based on male superiority.

Keywords: gender, nurses, telenursing, Sweden

About the Author

Inger Holmström RN, PhD is associate professor of Caring Sciences att Uppsala University, Sweden. Her special research interest is telenursing. She has edited a telenursing textbook in Swedish and is giving graduate courses in this subject.

Telehealth's Evolution and Future in Canada

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Canada has played a significant role in the development of telehealth programs and the standards to support these programs. While much has been done, many untapped opportunities still exist and several issues remain as threats to the optimal effectiveness of telehealth services.

Key words: telehealth, telenursing, Canada, standards, issues, opportunities

About the Author

Lois Scott is a business developer and health care professional who conceptualized and implemented Canada's first province-wide telehealth/telecare program with a public-private partnership arrangement; and subsequently, lead the growth of the company to be one of the largest providers of telenursing services in North America. Scott has played a leadership role in the development of Canadian and international telehealth industry and clinical standards; has served as a founding member of several telehealth networks and associations; and has been invited to speak at many conferences in North America and Europe. Scott's contribution to nursing, in particular as a telehealth pioneer, has been recognized several times; most recently by the Canadian Nurses Association who granted her their prestigious Centennial Award.

Telenurse – The Main Person in Medical Station of Small Village in the Near Future

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For Russia, a country with a huge territory formation of telemedicine consulting and training system for frequently alone nurse in medical station of small remote village will ensure solution of the most vital social and economic objectives for those rural inhabitants - make sure that the best physicians are readily available to assist every resident of the most remote regions of Russia. Now inhabitants of remote villages can get qualified help only if they have visit district or regional hospital – average distance in East regions of Russia about two – three hundred kilometers or even more.

But the situation can be change-over if the work of each medical station will be organized on the basis of digital platform (not very expensive) and minimal set different medical equipment that are possible to connect to digital interface of the platform.

Modern Russian mobile complex gives as a good sample of such equipment. These complexes use telecommunication as well as satellite for address exchange of medical information. It includes diagnostic system of functional diagnostics doctor: electrocardiograph, spirograph, phonocardiograph, glucometer, cholesterolmeter, measuring instrument for blood pressure and extra laboratory equipment. The content of the complex can be connected to it extra: ultrasonic portable scanner, haematological analyzer (about 20 characteristics), portable urine analyzer, mobile X-ray apparatus (in the suitcase), without X-rays microanalyser of general blood bilirubin, complex for dermatoglyphics examination.

So such mobile complex includes the set of diagnostic equipment that is beyond the dreams of the municipal medical station now.

What we can change to convert modernization into real medical unit?

- First - on the basis of country transmission channels permanent modernization supply municipal medical stations with good communication possibilities.
- The next, second step – new standards for nurses training on the basis of Russian telemedicine association experience in telemedicine. Our program have to be modified by nurses school on the basis of previous experience - modern telecommunication facilities (communication channels, protocols, equipment) in the

context of telemedicine objectives. Remote video consulting technologies on the basis of videoconferencing include works with diagnostic equipment under supervision of remote doctor.

This parts of training, as shows our long term experience, are very important for nurses that work alone in a village and nobody cannot help them up to the moment when normal videoconference connect the nurses and remote medical consulting center.

The third step – supply our training course graduates with the full set of videoconference and diagnostic equipment for the rural and very remote medical stations.

In a world now it is possible find a wide range of appropriate equipment not very expensive and complicate. As a result telemedicine consulting practices with the use of diagnostic units gives inhabitants of remote villages real medical examination of a patient under supervision of a remote consulting physician that works together with their nurses and can prepares of highly professional recommendations. Of course visit to remote clinic will be only if previous examination show serious problems with the health of inhabitant/

Keywords: telenurse, telemedicine, e-medical station

Session 17

Extreme environment and eHealth

Organized in cooperation with Belgian Institute for Space Aeronomy, Brussels, Belgium

Cardiac Arrhythmias in Ischemic Heart Disease and Space Weather

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Abstract: **The aim of the research was an investigation of the solar activity and geophysical factors cyclic action's influence on a prevalence of arrhythmias in ischemic heart disease (IHD). The results of investigation of the spectral analyses in the time structure of cardiac arrhythmias with special attention to components previously reported as characteristics in solar-terrestrial physics and found as signatures in cardiology are presented. Different types of cardiac arrhythmias, from April 1983 to 1992 by Fourier-analyses in the connection with space weather are investigated. We have obtained both approximated periods of cardiac arrhythmias in IHD and a space weather periodicity. Coincidences between cardiac arrhythmias and fluctuations of space weather are revealed. We have found that a cycle of solar activity causes arrhythmias' periodicity.**

Introduction

All the manifestations of solar activity, such as sunspots, solar flares, coronal mass ejections (CMEs), solar prominence eruptions (SPE), X-ray flares, solar Radio and UV radiation are changed with the 11-year period. Different active formations originated in the solar atmosphere in stage of its active phase carrying out the solar energy into the interplanetary space throw the interplanetary magnetic field (IMF), forming the space weather. The space weather disturbances interacting with the Terrestrial atmosphere, causes variations of climate, geomagnetic storms, disturbances of ionosphere and etc [1, 2].

According to the modern biorythmologic and chronobiologic conceptions any biological matter represents an independent self-sustained oscillation system and its endogenous biorhythm is determined by the exogenous rhythms of external physical systems. Some authors think that a synchronization of biological system with external synchronizers takes place [3, 4]. The continuous and periodical changes of cosmic and

geophysical factors can be determined as such a synchronizing factor [5-7].

The matter of total synchronization hasn't been yet fully studied. Because it is not fully clear a mechanism of a space weather influence on disturbances in biosphere, it is very important to study the spectral elements in the time structure of different cardiac diseases with special attention on the components, which are already revealed in Solar-Terrestrial physics.

Spectral analyses of medical and space data

The aim of the research was to reveal the influence of variations of the solar, interplanetary magnetic and geomagnetic fields, powerful solar flares and solar radiation $F_{10.7}$ over the cases of arrhythmias in patients with IHD.

The data of the 1902 patients' 24-hour Holter- and ECG-monitoring were studied retrospectively. 1783 cases of various types of arrhythmia were registered. Among them - 502 patients with supraventricular extrasystolic arrhythmia (S), 345 patients with supraventricular paroxysmal tachycardia (P_S), 578 patients with single ventricular extrasystolic arrhythmia (V_1) and 358 patients with multiple ventricular extrasystolic arrhythmia (V_m).

Almost a half of the material studied includes results of the Holter-monitoring. Another half was a result of an electrocardiography records from different hospitals. Criteria for the Holter-monitoring were existence of arrhythmias in the patient's diagnosis. Our material includes data of patient's observation during 24 hours a day 7 days a week.

We had daily data of arrhythmias. Because of lack of data, which is obligatory for Fourier analysis for cases of the arrhythmias were used the 10-daily smoothing data.

The power spectra of the cases of all types of arrhythmias, as well as for each type separately were investigated. On the Fig. 1 is presented power spectrum of cardiac arrhythmias' daily variations.

We determined more significant periods for variations of all types of arrhythmias, as well as for each type separately. We studied variations of different types of arrhythmias during descending phase of the solar activity cycle 21, minimum and ascending and maximum phases of the cycle 22.

In the Table 1 the main periods of different types of arrhythmias in the time interval from several days to several years (expressed in years) received by the spectral Fourier analysis are shown. All these periods are characterized with high amplitudes of the Fourier analysis.

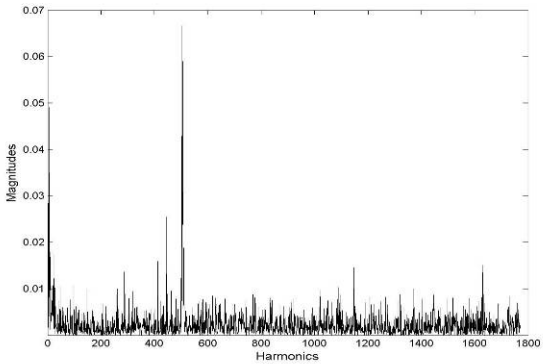

Fig. 1. Power spectrum of cardiac arrhythmias' daily variations

As seen from the Table 1 in the main periods of space weather factors (ΔH, non-photic solar activity, $F_{10.7}$, IMF, HSF) and arrhythmias we met the similar, and in some cases - the analogue periods, which revealed the resonant character of reason-result connection between those events. With using the spectral analysis we have studied common tendency of periodicity of the cases of arrhythmias during the 11-year cycle. 1.3 year periods is revealed for $F_{10.7}$, ΔH and for arrhythmias, as well as semi annual, quasi annual and quasi-biennial periods is found in $F_{10.7}$, SMF and in all types of arrhythmias [9-11]. The periods – 157d ($0.^{y}430$) and 154d ($0.^{y}422$) are known as Rieger's periods, exist in the hard solar flares and in arrhythmias. A well-known solar period 78^{d} ($0.^{y}214$) is found in the periodicity of all types of arrhythmias.

Table 1. The main periods of the Space Weather components and different types of arrhythmias finding for the solar activity cycle 22.

$F_{10.7}$	IMF	ΔH	HSF	SA	S	P_s	V_1	V_m	All
	$2.^{y}02$			$2.^{y}0$	$2.^{y}4$			$2.^{y}0$	$2.^{y}41$
		$1.^{y}6$				$1.^{y}62$	$1.^{y}60$	$1.^{y}60$	$1.^{y}60$
$1.^{y}3$		$1.^{y}3$			$1.^{y}39$	$1.^{y}38$	$1.^{y}33$	$1.^{y}33$	$1.^{y}37$
$1.^{y}1$	$1.^{y}05$				$1.^{y}10$	$1.^{y}08$	$1.^{y}00$	$1.^{y}00$	$1.^{y}07$
					$0.^{y}65$	$0.^{y}65$	$0.^{y}67$	$0.^{y}67$	$0.^{y}64$
			$0.^{y}43$		$0.^{y}44$	$0.^{y}44$	$0.^{y}40$	$0.^{y}44$	$0.^{y}44$
			$0.^{y}21$		$0.^{y}24$	$0.^{y}23$	$0.^{y}23$	$0.^{y}22$	$0.^{y}22$
	$0.^{y}08$	$0.^{y}08$			$0.^{y}07$	$0.^{y}07$	$0.^{y}07$	$0.^{y}07$	$0.^{y}07$
			$0.^{y}06$		$0.^{y}06$	$0.^{y}06$	$0.^{y}06$	$0.^{y}06$	$0.^{y}06$

Conclusion

There is obtained wider spectrum of periodicities from the several years up to quasi-biennial and quasi-annual periodicities [9-11].

During the 11-years cycle of solar activity (1983-1992) 27-days quasi-periodical peaks of different types of arrhythmias are revealed. All types of arrhythmias have 160 days (0,^{y}44) periods. Variations of solar and interplanetary magnetic fields and solar flares maybe play a role of synchronizing factors for the similar periods of arrhythmias.

Hence we conclude that the most part of the periodicity, established by us, are modulated with space weather factors periodicities.

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Extreme Environmental Conditions and Tele-Health – Present Situation and Future Trends

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A rapid degradation of the natural environment with recent evidence of climate change has brought new interest in monitoring of interactions between humans and the environment. The typical applications are:

1. Individual monitoring of physiological and environmental parameters, e.g., members of Antarctic expeditions, commercial divers, test pilots, fire-fighters. This is used mainly in occupational or sport medicine and the primary development drivers are safety and legal requirements and monitoring of human performance. The technical focus is on low weight, miniaturization, simplicity and low bandwidth transmissions. The future functionality of these personal health systems is expected to expand beyond pure monitoring and shall include advisories for integrated health management in specific situations.
2. Emergency and disaster relief monitoring of populations or groups in specific environmental situations, e.g., earthquakes, floods, search and rescue operations, armed conflicts, or detached working places The integration of data from tracking and location systems with airborne and space-borne imagery, with GIS (Geographic Information Systems) tools and with the relevant on site logistic factors is mandatory in order to provide coherent health-related information. Space-borne technologies are frequently used for data acquisition, transmission and for real-time audiovisual communication. Data accessibility and reliability are important, and different systems' components typically operate in the low to high bandwidth range. All these technologies are proven and available, but significant gaps exist among health care professionals in understanding their advantages, performance and specific applications.
3. Long-term monitoring of trends in large population groups, based on epidemiological data and on the observation of changes and trends in the natural environment, e.g., land, oceans, atmosphere and space weather, using both space- and ground-based observation networks. The importance of this type of monitoring, and the role of space technologies in e-health in general, is expected to increase significantly in the next few years.

We provide a brief overview of existing technologies, systems and methods and of new trends in Earth observation, in tracking and location, in communication, and in search and rescue with emphasis on data integration relevant to the human health.

Additional information can be found at: http://www.isunet.edu/spaceweather

Keywords: extreme environments, space technology, integrated monitoring, climate change, space weather

Fundamental Aspects and Mechanisms of Space Weather Health effects

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Abstract: **Space Weather hazards were well studied during last tens years mainly in connection with their effects on technical systems, while biological effects of solar and geomagnetic activity (GMA) were ignored for reason of a very low intensity of natural electromagnetic fields (EMF). Their intensity is in region from 0.1 to several hundreds of nT. These values are significantly weaker than EMF noise of anthropogenic nature and about 10 order of value lover than the characteristic energy of biochemical reactions [1] having thermal scale (kT). However problem of biological reactions and mechanisms of non thermal action created by weak VLF EMF (< 1mT) is now under intensive experimental and theoretical investigation in connection with EMF pollution of environment. Some progress have been achieved during last 20 years in particular by our two groups working at IKI and IZMIRAN in cooperation with various clinics and institutions in Moscow and in USA (Minnesota, MN), Japan, Germany, Bulgaria, Israel and other countries.**

Introduction

1. A new hypothesis about mechanism of biological effects of helio-geomagnetic activity (Space Weather).

Open nonlinear complex biological systems are very sensitive to noise level signals being far from stability and use them for self organization. Our concept had been proposed in beginning of 90th according which biological systems integrated rhythms of heliogeomagnetic factors in their time - structure during evolution. This happened similar to origin of endogenous circadian rhythms that have been biologically integrated due to the daily rotation of the Earth and due to changing of luminosity and temperature [2-3]. An external oscillating signal can be "captured" by a biological system and integrated into its time - structure when the system is in unstable state and the noise has a definite level - a phenomenon known as

stochastic resonance or stochastic filtration.[1,4]. One of the new ideas on this mechanism is based on the existence of magnetosomes in biosystems, discovered by Kirschvink et al [5]. Another plausible idea based on existence of iron components in erythrocytes. The main objective of our paper is to present arguments pro existence of synchronization of endogenous biological rhythms by Space Weather rhythms and to show resynchronization effects connecting with Space Weather hazards.

Material and methods

A special study in laboratories, clinics and statistical data were performed. For the first time in heliobiology spectral methods were used as well as investigation of cross-spectral correlations and synchronous variations of both, medico-biological and helio-geomagnetic characteristics over the solar activity cycle. Clinical investigations were done by traditional medical instrumentations and methods allowing comparison of results. Control groups of healthy volunteers were organized for reference purposes. The Holter monitoring, viscosity characteristics of blood in arteries and capillaries, production of stress hormones and melatonin by adrenal and pineal glands were performed.

Results

It has been shown that biological rhythms with periods coinciding 28-day solar rotation period and its harmonics and sub- harmonics (approx. 14 d., 7 d. 3.5 d.) as well as the other very low periodic (micro pulsations- in range of heart rhythms) and very high periodic rhythms (11-yr.) were likely revealing themselves on each adequate biological level.

It can be seen from Fig. 1 that during the first 4 months (upper bands, right), the baby's heart rate and diastolic blood pressure were characterized by about 27, 14, 7 and 3.4-day components. Approximately similar components are seen at left part of figure characterizing the GMA - Kp – index rhythms. The main targets for the GMA factors appear to be the heart and cardiovascular system (among 10 diseases for 6 000,000 ambulance calls only myocardial infarctions (MI) and sudden deaths (SD) correlated with the GMA [3]. During large planetary magnetic storm caused by plasma cloud from the Sun, the number of myocardial infarctions increased by 13% from 80 000 ambulance registered cases.

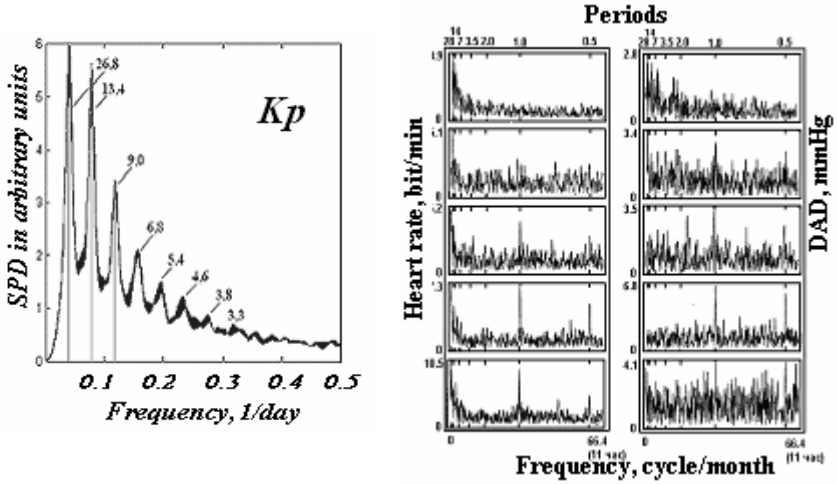

Fig.1 Left - spectral power density (SPD) of geomagnetic Kp-index. Right: 26 months monitoring of heart rate HR (left) and diastolic blood pressure DAD –right data averaged for 4 months (5 spans) and analyzed by Fourier transform.

Even more in paper by Ozheredov et al. at this conference similar percentage for MI dependence on simultaneous jumps of Kp and P-atmospheric pressure have been obtained for 2800 observations in intensive care units of two Moscow clinics. Biological systems are the most sensitive to the effects of GMA factors in state of instability. For this reason there are "groups of risk" associated with the state of adaptation system: undermined (in patients), immature (in children), and burdened by other stresses (f.e. cosmonauts).

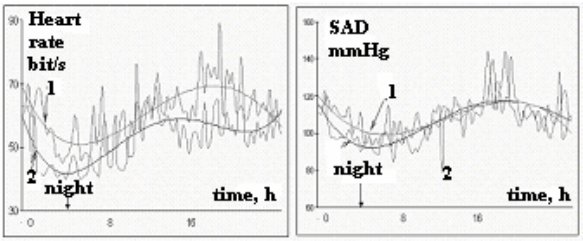

Fig.2 Examples of heart rate (left) and systolic blood pressure (right) measurements over 24 hours obtained from the same cosmonaut flying on the International Orbital Station during 4-6 months. Line 1 shows data obtained one day immediately after a geomagnetic storm. Line 2 corresponds to data during quiet

geomagnetic conditions. The magnetic storm seems to have affected both variables, notably during the night (With Baevskii R.M. from .IMBP RAS)

Experimental observations were made of rabbit heart functional characteristics and morphology during geomagnetic disturbances as compared to magnetic quiet [4]. Resynchronization of heart rhythms and destruction of its cardiomyocytes leading to a decrease in contractile heart power similar to the action of external loads were detected (Fig.3).

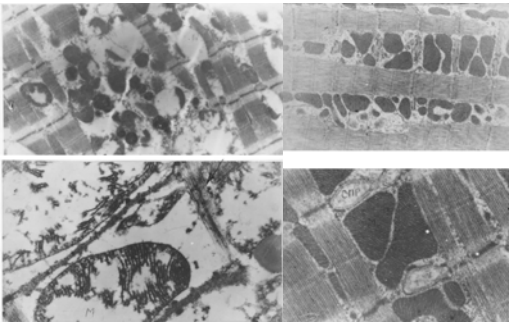

Fig.3 Normal structure of cardiomyocyte of a rabbit during quiet geomagnetic conditions (right) and cardiomyocyte of a rabbit during main phase of a magnetic storm (left) (the electronic microscopy with 20 000 enlargement) Situation is recovering on the recovery phase of magnetic storms

Conclusion

We discovered that the geomagnetic storms create specific and nonspecific adaptive stress reaction in humans. Nonspecific reaction follows by stabilization of heart rhythm, increase of blood viscosity, increase of secretion of stress hormones, increase of cortizol and depression of melatonin. The specific reaction is type of meteo- stress reaction and affects of vascular tonus. In heliobiophysics there are two main questions: 1) which values of Space Weather parameters theoretically capable to give rise significant biological reply? 2) how large is the risk to mix up biological reply on another external factors with reply to the Space Weather influence? Obtaining answers to these questions connected with non stationary analysis of time –series. In the modern version this research is based on the pattern recognition analysis with system of iterative tags selection. Namely problem is to create selection algorithm for Space Weather parameters, which will produce results the most stable in time. The optimizing algorithm underlying recognition is fastened on intellectual techniques of search of variants of ranges of values of parameters of

"authentic" responses. Any search of variants as it is known converges generally slowly and demands very big expenses of machine time.

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Geomagnetic Storms and Human Health - From Research to Applications

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The possibility that conditions on the Sun and in the Earth's magnetosphere can affect biological systems at the Earth's surface has been debated for many decades. The direct physiological effects of increased solar activity due to higher exposure to ionizing particles, which are relevant mainly to space travel and to high-altitude airplane flights, are comparatively well understood. The correlation between geomagnetic fluctuations and the development of pathological conditions in human organs has been documented in different studies, and several mechanisms of interactions between living cells and extremely weak electromagnetic fields have been suggested to support the observational evidence. Some of the conclusions are that: geomagnetic effects are more pronounced at higher magnetic latitudes; extremely high as well as extremely low values of geomagnetic activity seem to have adverse health effects; and that a subset of the population (10-20%) are predisposed to increased health risks due to variations in the geomagnetic field.

A three-stage strategy, using combinations of e-health tools with environmental information networks, is proposed to reduce these risks:

1. Continuing research, with a focus on retrospective evaluation and on prospective data collection from selected populations at high geomagnetic latitudes during geomagnetic field fluctuations and on the comparison of these results with studies done in the past. More scientifically sound explanations of interaction mechanisms between living cells and geomagnetic fields are necessary to clearly define the very high or very low values of geomagnetic field as a "health risk."
2. Prediction and warning service, which would distribute users' tailored geomagnetic data from geomagnetic observation centres to individuals at risk and to relevant health care institutions.
3. Mitigation and feedback service, which would provide monitoring and evaluation of physiological data, an advisory on potential effects of space weather and on specific therapeutic measures, e.g., prophylactic

medication, and would also maintain an interdisciplinary information exchange platform.

Implementation of this strategy in health care will most likely result in risk reduction to individuals, in improvement in the prevention and in the quality of care and, ultimately, in cost savings. The energy-producing industries in northern countries have been successfully using similar approaches to mitigating the effects of space weather on pipelines and power grids for the last 20 years. By adapting their knowledge to health care and implementing the above strategy, it is probable that the risk to individual will be proactively mitigated thus improving the quality of care and reducing overall costs.

Additional information and links can be found at http://www.isunet.edu/spaceweather

Keywords: geomagnetic storms, space weather, cardiovascular system, tele-service

Health Issues and Space Weather: An Introduction

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Abstract: **The possibility that solar activity and variations in the Earth's magnetic field may affect human health has been debated for many decades but is still a "scientific topic" in its infancy. If found to be statistically significant, this field of research will have global implications, especially at high latitudes, due to globalization and to a growing increase in the human population there. By learning whether and, if so, how much the Earth's space weather can influence the daily health of people will be of practical importance. Knowing whether human genetics, include regulating factors that take into account fluctuations of the Earth's magnetic field and solar disturbances, indeed exist will also benefit future interplanetary space travelers. This paper introduces the space environment and the space weather induced health effects found in space as well as possibly on Earth.**

Introduction

The Sun, our closest star, is the source of heat and life that maintains life as we know it here on Earth. However, the Sun is forever changing and has a well-known eleven year solar cycle, switching between maximum and minimum activity. It is the Sun that can be said to be the driver of our local space weather. In simple terms space weather can be defined as how solar activity may have unwanted effects on technological systems and human activity. Spacecraft have to survive very hostile environments which can severely limit space missions as well as pose threats to humans. Many books have been written about the subject of space weather - see for example [1].

More controversial is the question of whether the geomagnetic environment when disturbed by solar activity can have either direct or indirect effects on human health and physiology even when the magnitude of the disturbance is small. In this paper a short overview of the space environment will be given followed by a presentation of the unwanted space weather effects on humans in space and possibly on Earth. The paper ends with a look into the future concerning these health effects.

Space Environment

Interplanetary space, better known as the heliosphere can be thought of as a vast magnetic bubble containing the solar system, the solar wind and the interplanetary magnetic field, as well as numerous particle populations, and dust. Phenomena such as UV, X- and gamma-radiation, energetic charged particles, plasmas, as well as space debris and meteoroids, must all be taken into consideration when going to space. Solar activity can trigger geomagnetic storms in the Earth's surroundings due to phenomena such as coronal mass ejections and the high-speed solar wind interacting with Earth's magnetosphere

It is especially the various populations of energetic particles in the energy range from eV to more than 10^{21} eV that fill our solar system that can mean trouble for satellites and interplanetary travel. Earth's radiation belts, principally composed of naturally occurring energetic charged particles trapped in Earth's inner magnetosphere, must always be considered for missions to space. However, it is the constant flux of galactic cosmic rays and the sporadic solar energetic particle (SEP) events that are the most energetic particles in space. The latter have energies ranging from a dozen of keVs to a few GeVs and are either linked to a solar flare or the shock wave driven by a coronal mass ejection. SEPs are mainly protons, electrons and alpha-particles, with small mixtures of ^{3}He nuclei and heavier ions up to iron.

Space Weather and Health Issues: in Space

Space weather effects such as radiation damage to on-board electronics, solar arrays, living organisms, etc. are all due to energetic particles. The effect of space radiation on humans is a potential showstopper to human space exploration. However, aircraft crew and passengers onboard airlines are also under risk of radiation, especially on polar routes. In this region of the geomagnetic field, the magnetic field lines are open and energetic particles can reach down to lower altitudes.

High frequency radiation or high-energy particles can knock electrons free from molecules that make up a cell producing ions. As a consequence the presence of these ions disrupts the normal functioning of the cell. Cells that reproduce rapidly (e.g. skin, eyes, blood-forming organs) are the most susceptible to damage because they cannot repair themselves easily while replicating. The most severe damage to the cell results when the DeoxyriboNucleic Acid (DNA) is injured. Symptoms of radiation sickness are severe burns that are slow to heal, sterilization, cancer and other

damages to organs. Mutations or changes in the DNA can be passed along to offspring.

Space Weather and Health Issues: on Earth

It took many decades before the scientific community finally considered the possibility that solar activity may have a significant influence on the Earth's climate. In a parallel way, the possibility that solar activity and conditions in the Earth's magnetosphere may affect human health at the Earth's surface has been debated for many decades. As was previously applicable to the "climate" scenario, the main skepticism for the "human health" scenario is the missing physical link.

Much of the work on this topic has in the past been conducted in Russia and has therefore not been very accessible to the non-Russian-speaking scientific community, although this is slowly changing. Some of the major works over the last 30 years performed in the field of heliobiology - the branch of science that deals with the impact of solar activity on living organisms - were summarized a couple of years ago [2]. The three definite conclusions of this paper are: geomagnetic effects are more pronounced at higher magnetic latitudes; extremely high as well as extremely low values of geomagnetic activity seem to have adverse health effects; and a subset of the population (10–15%) is predisposed to adverse health due to geomagnetic variations. Very recently, a review of thematically selected papers and recently obtained results of cross-disciplinary heliobiological studies carried out by different research groups was performed [3].

The possible relationship between solar/geomagnetic activity and human health is important for humanity's future with respect to any future geomagnetic event, whether it be a strong geomagnetic storm or a further weakening and even reversal of the Earth's magnetic field. People are "migrating" on Earth more than ever before and one may speculate whether any short and/or long-term health effects (e.g. cardiac death mortality, myocardial infarction, neural and cerebrovascular system complications, accidents, traumas, influenza epidemics, etc.) are encountered when moving, for example from low to high geomagnetic latitudes. It has been suggested that such effects could specifically be enhanced at times of solar disturbances, and also for certain high-risk people who have lived in the same place all their lives. There are many questions to be answered:

- Are there some genetic factors that protect us from magnetic fluctuations?
- Are these parameters regulated over generations or can they change instantaneously as a function of location?

- What are the effects of technology-produced weak magnetic fields and their interactions with the geomagnetic field?

Summary and the Future

Space weather as a health risk in space is an accepted fact in the scientific community and for the most part well-understood. However, it will take some time yet to define what space weather as a health risk on Earth actually is. Identifying the physical links between space weather sources and different effects on human health, as well as the parameters (direct and indirect) to be monitored, will involve international teams of scientists, medical doctors, and engineers.

Society places high priority on combating health problems with the aim of protecting humans from potential lethal environmental sources. Indeed, extraterrestrial sources related to health issues in respect to both interplanetary space weather and our local space weather is a topic that may have more relevance to our daily health than we may yet imagine. Therefore pursuing this topic may benefit various human health issues, not only in the short-term but also in the long-term. Among other things, this effort will set the stage not only for future scientific research on the nature of such interactions but also for determining the focus of research that needs to be done in mitigating possible adverse effects to humans.

Finally, comparing results in the assessment of the degree of health risk in interplanetary space, on other planets, and on Earth will provide innovative information. Identifying the long-term socio-economic effects on society that such health risks would have is invaluable for the future of humankind.

Acknowledgment

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Heliogeophysical Variations, Human Health and Life Quality

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Abstract: **Investigating for long years the effects of extreme factors on human life and health, we are convinced that studies in this direction can be very useful for protection from adverse influences and for assistance the trend to improve life quality. A short review of the stages of the investigations about geomagnetic activity effects on healthy and sick persons, performed during the last years by the group "Medico-biological aspects of solar-terrestrial influences" at STIL-BAS is presented.**

Introduction

There is a growing body of evidence during the last years that solar activity and related to them geophysical and atmosphere variations influence significantly on living systems and human organism. A lot of investigators have confirmed that changes in the normal functioning of the central nervous system, vegetative nervous system, cardiovascular system and cognitive performance may be enhanced by the different geophysical variables [1-4]. The interest in revealing the correlation between variations of geomagnetic field (GMF) and human functional systems is increasing but the possible physiological and biophysical mechanisms through which these variations interact with different processes in the human organism have not been clearly established yet.

In the last 10 years we have been performing different investigations to indicate the significance of the relations between changes in GMF parameters and various aspects of human functional systems and human health. In this sense, various models of reproducing or removing some geophysical effects or examination of different groups of healthy and sick persons under different geomagnetic activity (GMA) fluctuations are quite useful. In our previous investigations, for example, the working environment on board space station "Mir" was used to study the aspects of physiological variations under such extreme factors effects; total solar eclipse (TSE) effects on biological objects and human physiological parameters was investigated; groups of healthy volunteers under different

variations of GMA were examined; the dynamic in the pathology of cardio-vascular diseases at different GMF fluctuations was studied.

Material and methods

At the beginning 7 healthy males, average age 37.5, isolated in a special press-chamber were examined. In this case press-chamber was used as a model of a partial GMF elimination. Brain and cardiac electrical activity were registered and arterial blood pressure (BP) was measured [5].

After that a group of 11 healthy persons with an average age 43.9 was examined. In total 261 registrations were performed – 183 at quiet GMA (5<Ap<10) and 78 at disturbed GMA (Ap>50) [6]. Arterial BP and heart rate (HR) were measured, pulse pressure (PP) was calculated and information about the individuals' general physiological and psycho-physiological state was gathered.

The next our results were obtained from examination of a group of 29 healthy volunteers a week before, on the day of TSE and a week after the TSE. GMA was disturbed (Ap=26) on the day after the TSE when examinations were performed and GMA was quiet (Ap=10) on the day of the registrations a week before the TSE [7].

Furthermore, at the beginning of 2001, 14 healthy persons with an average age 46.5, were examined. A comparison of the physiological parameters was performed for the days when GMA was quiet (5<Ap<10) to the registrations on the days with sharp although not large GMA changes (15<Ap<30 and abrupt changes in the 3-hour Kp-index) [8].

For the described 4 groups electrical cardiac activity (ECG) was registered too. Series of 128 consequent R-R intervals were measured and analyzed by time domain and frequency domain analysis.

Later, in the autumn of 2001 and in the spring of 2002 (a period when GMA was expected to be high), 86 functionally healthy volunteers (average age 47.8 years) were examined. Altogether 2799 registrations for each of the physiological parameters were gathered [9-11].

In the last years in collaboration with the hospital in Sofia UHAT "St. Anna" morbidity and mortality from different cardio-vascular system pathologies have been studied [12].

Spectral analysis, Student's t-test, correlation-regression and cross-correlation analyses, *AN*alysis *O*f *VA*riance (ANOVA) and post-hoc comparisons were used for establishing the effects. The number and the intensity of geomagnetic storms for the periods under consideration were analyzed as well as monthly and yearly GMA dynamic.

Results and discussion

The results obtained from the different our investigations were indicative for the existence of a relationship between cardio-vascular parameters, psycho-physiological state and GMA variations related to solar activity.

In the pilot investigations the number of measurements was smaller and the obtained statistical significance of the studied relationships was not of high degree, however the results were encouraging and were becoming more convincing at expanding the studies. The results from each of our different studies are presented in details in publications [5-12].

The spectral analysis of R-R interval series showed mostly a presence of changes in high frequency part of the spectrum (0.2-0.4 Hz). The changes were represented mainly in an amplitude increase in that spectral area which is indicative for the energy increases in this spectral interval [6, 8].

The results from the last and most systematic and prolonged examinations confirmed that correlation of different degree between cardio-vascular parameters, psycho-physiological state and GMA variations exists. It was established that the average values of systolic and diastolic BP, PP and subjective physiological complaints of the group increased with GMA increment and from the day before geomagnetic storms onset till two day after they finished [9]. Results indicated that females [10-11], persons on medications [11] and persons with higher BP degree [10] were more sensitive to GMA variations.

Statistically significant positive correlation was obtained between GMA indices and acute myocardial infarction (AMI) morbidity and mortality for Sofia region for the period 1995 – 2004 [12].

According to the yearly analyzed data the largest number of AMI morbidity and mortality was in 2000 and 2003 [12]. In these years the average values of GMA indices were highest. Similar results were obtained for other clinical diagnoses.

The experimental studies and their analyses enabled to conclude that the human cardio-vascular health state could be affected by GMA disturbances.

The dynamic of BP probably reveals an adequate compensatory reaction of human organism to environmental changes. However, larger abrupt variations in BP, out of the norm, for more sensitive persons can threaten their cardio-vascular state. The results about BP and AMI dynamic are consistent with the results obtained by other authors [13, 2, 3, 4, 14].

It is of great importance to conduct complex and synchronic investigations on the possible effects of geomagnetic storms on human beings in different latitudinal and longitudinal areas. One of our future tasks

is to expand the investigations and to include psycho-physiological and neuro-psychological tests.

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S. Dimitrova

Method of Psychophysical Parameters Monitoring for Revealing of Human Sensitivity to Geomagnetic and Meteorological Factors

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Abstract: **During last years it was established that human psychophysiological parameters significantly react to geomagnetic activity variations: simple audio - and visual motor reactions on sound and light signals are getting weaker, level of attention decreases and fatigability increases. No doubt, these parameters are very important for some professions such as air communicators, pilots, train drivers, etc., because may increases the probability of errors in their work.**
Authors developed a measuring technique that permits to fulfill psychophysiological parameters monitoring using computer, without lost of measurement quality. Corresponding software is developed. It is demonstrated psychophysiological reactions depend on meteo-factors and level of geomagnetic activity indirectly through state of health (arterial blood pressure).

Introduction

There are a number of publications in which dependence of psychophysiological parameters of healthy people on level of geomagnetic activity (GMA) is revealed [1-3]. Presman [4] suggested that an activation or deceleration of physiological processes, caused by geomagnetic field variations also depend on functional condition of every person at a given moment [4]. Deterioration of psychophysiological parameters is dangerous for people whose duties are connected with permanent concentration, necessity to focus attention and whose professions are with high social responsibility. Therefore, at the moment of magnetic storm beginning, the forecast of probable variations of individual psychophysiological and physiological parameters is important for any pilot or train driver who is

currently on duty. It is necessary to estimate not only the probability, possible amplitude, direction and time of reaction of an organism, but mainly - the degree of decrease in safety caused by these changes.

Materials and methods

Test experiment with monitoring of physiological and psychophysiological parameters was done in Simpheropol (Crimea) in February – May 2008 for 17 healthy volunteers (6 men and 11 women, in average age 19±1 years).

The parameters measured were: arterial blood pressure (ABP), rate of simple audio-motor reaction (SAMR); index of productivity of arbitrary attention (PAA-index). SAMR was estimated as an average response time delay from the computer sound stimulus and is measured in milliseconds. For estimations of PAA-index a standard psychophysical «proof test» [5] was used, adapted for a presentation from the monitor screen. PAA test duration was two minutes.

Correlation and regression analyses were used for data analysis after estimation of their applicability to the data sets and trend reduction.

Results

1) Character of reaction of psychophysiological parameters on action of meteo- and geomagnetic factors. For each of the 17 volunteers a personal analysis of relation between the arterial blood pressure and psychophysiological parameters and the parameters of weather and geomagnetic activity has been performed. It was found that twelve volunteers have ABP sensitivity of to the external factors. PAA-index sensitivity was found in nine volunteers, while SAMR-index - only for three. Both positive and negative correlation cases of psychophysiological indices to investigated external factors were observed.

It turned out that these bidirectional reactions of psychophysiological indices can be explained by the nature of personal health status depending on external factors.

For example, for volunteer number 17 the dependences of PAA-index from the Kp-index and temperature are positive (correlations are significant at $p < 0.05$), for SAMR - correlation with the same factors is unreliable. At the same time, correlation coefficients of PAA-index and SAMR with DBP values are positive and significant at $p<0.01$. Thus, the degree of statistical connection psychophysiological indices of this volunteer with the correspondent values of ABP is much higher than with geomagnetic and meteorological parameters.

The following scheme of cause-and-effect relationships may be offered: this volunteer has low average values of ABP (106/72). ABP slightly increases under the influence of external factors that leads to an improvement of health status and, consequently, to the improvement of both psycho-physiological parameters.

It was found that for those volunteers, whose psychophysiological indices directly correlated with the ABP values (6 cases), the signs of correlation of psychophysiological indices and ABP with the external factors coincide (Fig.1, 2) For the volunteers, whose physiological indices have worsened with increase of arterial blood pressure, signs of correlation of the ABP and psychophysiological indices with the external factors are opposite.

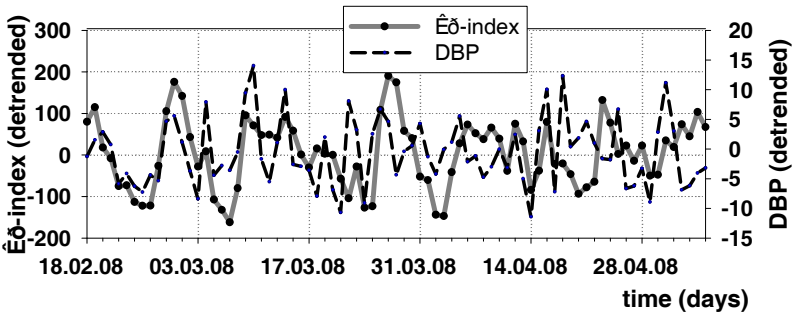

Fig.1. Illustration of coincidence of variations of DBP values and Kp-index for the volunteer 17

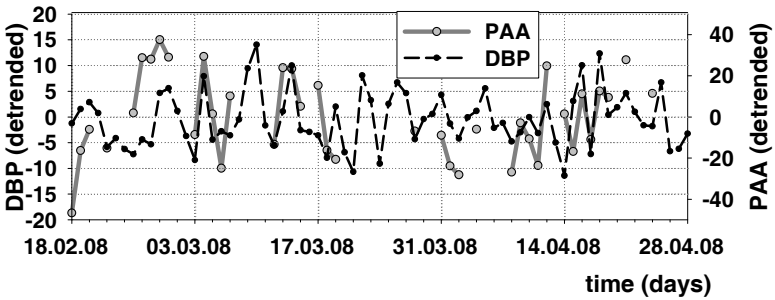

Fig.2. Illustration of synchronism of variations of values DBP and PAA-index for the volunteer 17

2) The analysis of amplitudes of reaction. Although values of blood pressure of volunteers obtained in this work are within the physiological norm, caused by them changes of psychophysiological parameters can have quite significant amplitudes. For example, for the volunteer 17 all variations

the ABP completely are in medical norm. At the same time samples of SAMR values, received in days with DBP above and below average value (72 mm Hg), differ significantly at $p<0.01$: they are worsen by 30-40%. These values should be taken into account especially by pilot medical control service.

Discussion and conclusions

This experiment confirmed adequacy of proposed measuring technique, showed the sensitivity of psychophysiological parameters to the variations of external factors. In the same time it was established that significant correlation exists between psychophysiological parameters and ABP values for all meteo- and magneto sensitive volunteers. Thus it is possible that connection between psychophysiological parameters and environmental factors is not independent. It might depend of volunteer's health status defined by ABP.

This preliminary results show necessity of synchronous monitoring of wide groups of healthy volunteers in different geographic regions. Such experiment is planned for Moscow, Sofia and Simpheropol.

Acknowledgment

The authors gratefully acknowledge the Presidium of the Russian Academy of Sciences for financially supported this study via the Program "Fundamental science - to medicine", 2008.

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Monitoring of Extra-low Frequency Atmospheric Pressure Fluctuations and the Risk of Cardiovascular Disorders

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The incidence of acute cardiovascular disorders increases considerably in patients with non-optimal circadian variation of basic parameters of cardiovascular system functioning. Additional variances of the amplitude of circadian changes, caused by the factors of environment, make the risk even greater.

The objective of this study was to examine possible relations between atmospheric variables and cardiovascular system functioning.

The method of round-the-clock ambulatory ECG monitoring during a long period was employed. R-R intervals of ECG were monitored in healthy subjects in Kiev, Minneapolis, and Tokyo continuously during at least 7 days and then compared with meteorological parameters (air pressure, temperature, relative humidity, and wind speed). In Kiev, also the total amplitude of natural atmospheric pressure perturbations (APP) in the range of 0.01-0.1 Hz was measured.

Day averages of the variables were considered. Wind speed and APP amplitude showed the most unequivocal connection with the characteristics of heart rate variability (HRV). An increase in APP or in the wind speed was usually accompanied by a significant increase in heart rate. The swing of circadian variation of heart rate and its variability also increased. The total power of frequency spectrum of R-R intervals dropped, but the ratio of the power of low- and high frequency bands increased. This indicates that an increase in sympathetic tone took place when APP and/or wind speed became greater. A decrease in the power of high-frequency component of the R-R spectrum, observed simultaneously, signalizes that parasympathetic tone lowered. The final numerical values of correlation coefficients will be presented after the whole series of observational data will be processed.

The correlation found between HRV characteristics and the wind speed is caused probably by the influence of APP, which are generated by air turbulence and are thus connected with wind speed. These observations

suggest that 1) HRV characteristics monitored continuously are highly sensitive to the influences of atmospheric phenomena and 2) extra-low-frequency APP can influence the amplitude of circadian variation of the important characteristics of cardiovascular system functioning and, consequently, the risk of unfavorable cardiovascular events.

This study examines whether the relation exists between APF and number of emergency transport events coded as circulatory system diseases (EEC). We considered the data of APF monitoring in Kiev for analysis of the APF effects on EEC. The data of simultaneous monitoring in Antwerp and Kiev were used to examine the possible general and specific regularities in daily dynamics of APF, which were very poor, covered in literature. The total hourly amplitudes of spectral components of APF in frequency range from 0.33 to 0.008 Hz (TA) were defined by specially developed computer program. Mean daily dynamics of TA over the year revealed wave shape with smooth increase from night to day and then inverse decrease from day to night. The year dynamics of daily mean of TA (MTA) was correlated with those of classical meteorological variables (daily temperature, atmospheric pressure, wind speed and humidity).

We suggest that two characteristics of APF: the high daily value and the low ratio of APF values during the day to those during the night (Rdn) might contribute to the increase in number of EEC. The number of EEC was significantly higher at the days with high MTA (3,72 – 11.07 Pa) compared to the low one (0.7 – 3.62 Pa, $p = 0.01$), as well as at the days with low Rdn (0.21 – 1.64) compared to the high one (1.65 – 7.2, $p = 0.03$). Concerning the emergency events related to different categories of circulatory system diseases there was difference between MTA and Rdn effects, which suggests the higher sensitivity of rheumatic heart and cerebro-vascular diseases to MTA, and ischemic and hypertensive diseases to Rdn.

In conclusion, the results of present study give evidences that the meteotropical aspects of APF, especially concerning people with circulatory system diseases are underestimated in medical meteorology. It seems that this class of diseases is very sensitive to natural levels of APF as well as to their daily dynamics. Such approach requires conducting of monitoring supervisions after the changes of extra low frequency atmospheric pressure fluctuations and this information transfer over the Internet and other electronic communication means.

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Possible Application of Modern Information Technologies for the Prophylaxis of Aggravation of Cardiovascular Diseases, Induced by Variations of Meteorological and Geomagnetic Factors

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Abstract: **The paper justifies the need to develop and propose a draft Internet-resource to assist patients with arterial hypertension in obtaining conclusion on individual sensitivity to meteorological and geomagnetic factors. We discuss the methods and mechanisms for its implementation.**

It is well known that during geomagnetic storms greatly increased a number of worsening of cardiovascular diseases, sudden deaths number, cases of severe violation of the cerebral circulation [1], as well as increases of arterial blood pressure (ABP) in a group of healthy volunteers [2]. It is shown that waves of temperature drop and growth also have a biotropic effect [3].

However, such dependences, typical for the population as a whole, are not suitable in a situation of personal prediction of magnetic storms danger for a particular patient, because in a certain number of cases the individual types of reactions can be opposite to average population reactions.

Thus, in special project carried out in A. L. Miasnikov Centre on Cardiology (Moscow, Russia) patients made self-control their APB performing measurements with ABP-monitors at home during 3 months, and then send them to physicians by e-mail [4]. As a result of analysis of these data it was established that most of patients had some unexpected wavelike variations of ABP which coincided with similar waves of geomagnetic activity (GMA) and atmospheric temperature (Fig.1). Such information could help in correction of anti–hypertensive therapy if

physicians can get information on individual sensitivity of patient, and a proper weather and geomagnetic activity forecast.

The most common reaction, observed in 90% of detected cases of sensitivity to the GMA, is the increase of ABP with increasing of GMA indices (Fig.1, Fig.3, left panel). At the same time, three of the patients from 33 analyzed people had the reverse reaction of ABP (Fig.2, Fig.3, right panel).

Fig.2 shows illustration directly opposite types of blood pressure response to changes in GMA in patients with similar sex, weight, stature, age and anamnesis, as in Fig.1. Both measurements were carried out at the same time (December 2001 - March 2002).

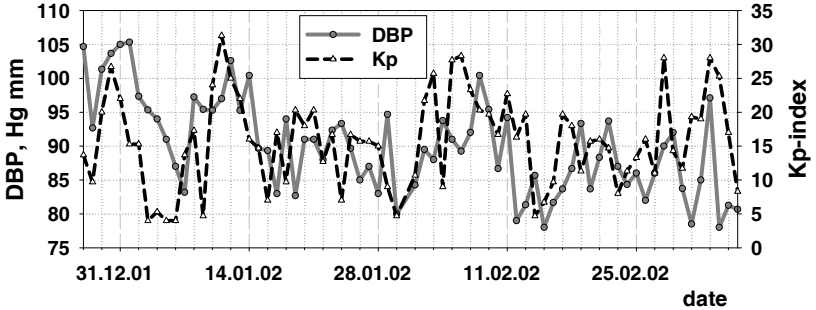

Fig.1 Typical illustration of coincidence of variations of DBP values and Kp-index for patient with arterial hypertension of the 2nd class (woman, 44 years old, stature 158, weight 70, AH duration - 9 years, mass index of the left ventricle of heart – 80, medication – indopamil-retard 1.5 mg + prestarium 2-3 mg).

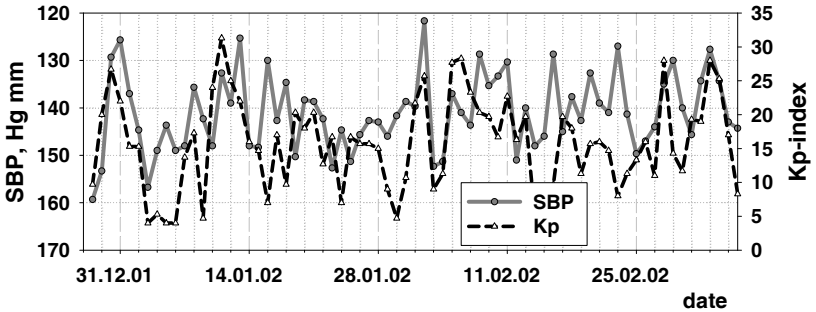

Fig.2. Illustration of inverse correlation of SBP values (shown in inverse scale) and Kp-index for patient with arterial hypertension of the 2nd class (woman, 55 years old, stature 160, weight 74, AH duration 22 years, mass index of the left ventricle of heart – 101, medication – indopamil-retard 1.5 mg).

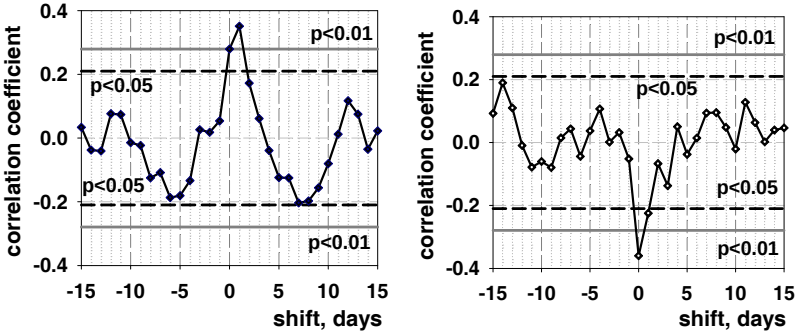

Fig.3. Cross-correlation functions between ABP and Kp-index for two patients. Left – patient from Fig.1, right – patient from Fig.2

Obviously, for the second patient the implementation of general recommendations to enhance the hypotensive medicine during geomagnetic disturbances could lead to excessive decrease in blood pressure and to the complication of disease.

Completely analogous situation exists for the individual patient sensitivity to temperature and atmospheric pressure. Thus, the problem of weather- and magneto-sensitivity in patients undergoing hypotensive therapy requires the analysis of sufficiently long time series of blood pressure measurements of this patient.

Many patients with arterial hypertension are doing daily records of blood pressure according to recommendation of the attending physician, so special organization of measurements usually is not required.

At the same time, the task of analysis of individual monitoring data can be addressed through the development and deployment of specialized Internet-resource, which would consist of an interactive Web-site and computing nodes to store large amounts of data and time-consuming calculations. This site can be created, for example, based on operating system Scientific Linux 4.7 Berillium using an intermediate level software gLite.

Possible functions of Web-site:

- To provide to registered user the interface for loading, storage and visualization of results of ABP self-measurements at the individual domain within the Internet-resource, as it is already done on www.monitorad.ru, where the downloaded information is available only for patients and their physicians. People who require a medical consultation can get it through this site. It covers more than 750 users over whole Russia;

- To permit on the user's request the access to data posted on the website to the doctor (in case of necessity of medical consultation), or to geobiophysicist (if one prefer getting the endorsement of individual meteo- and magnetosensitivity).

Objectives of the GRID-node:

- To gather information on the current values of geomagnetic and meteorological parameters in the place of residence of all registered site users, in real time;
- To publish this information in the form of problem-oriented database;
- To provide the computing power to geobiophysicist. With the accumulation of data he, for a request from a particular user, performs an analysis and verification of its ABP parameters dependence from environmental factors. The information about typical reactions of the humans on the operation of geomagnetic and meteorological factors, which already had been obtained earlier in various works [5-6], should be use to improve the accuracy of the analysis.
- In future – to organize extensive collaboration with the Internet-resources containing information about the real-time environmental factors and possible forecasts of weather and geomagnetic conditions for 1-2 days, automatically assess the potential danger of the situation for a particular user and assess the reliability of prediction.

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Revealing of Abnormal Space and Terrestrial Weather Conditions for Prediction of Brain Stroke and Myocardial Infarction Morbidity Increases

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Abstract: **Up to present day all the methods of exploration space and terrestrial weather influence on humans being have implicitly considered biological reply as either a stationary random process (nonlinear regression [1] or as a process with stochastic parameters (epoch superposing method). In other words, methods of change point revealing were essentially nonselective with respect to the boundary of abnormal weather parameters set, especially to its shape. Present work is to explain that the area which contains these abnormal values of weather parameters has significantly larger dimension (prominently greater than 3). We have got opportunity to estimate relative impact of multifactor influences. Let us consider all days (or any available timeframes) with morbidity as the "hazardous" days, and all the other days as "normal" days. Of course, "hazardous" day may have absolutely usual weather conditions. In return, say, Kp-index may ascend during any "normal" day. Eventually we will have two pattern sets in the space of multidimensional space of weather condition parameters. Now we will be aiming at division this multidimensional space into "normal" and "hazardous" parts. Indeed, when the trajectory of weather parameters comes into "hazardous" area, morbidity increases with approximately 80% confidence value. We obtained 10% days, which belong to "hazardous" area. An influence of atmospheric pressure P, temperature and Kp-index of geomagnetic activity have the following ratio: T : P : Kp = 7 : 9: 4.**

Introduction

Up to present day all the methods of exploration space and terrestrial weather influence on humans being have implicitly considered biological

reply as either a stationary random process (nonlinear regression [1]) or as a process with stochastic parameters (epoch superposing method). It is more modern and interesting to study which weather conditions are hazardous on basis of pattern recognition method. The most free from parameters linear pattern separation. However as it is well known linear separation can be applied only to cases when convex covers are none intersecting. It is easy to imagine that the space and usual weather factors are not principal factors which affect human health. Thus, as we can see from Fig.1 convex covers are intersecting and moreover have the same position of centers.

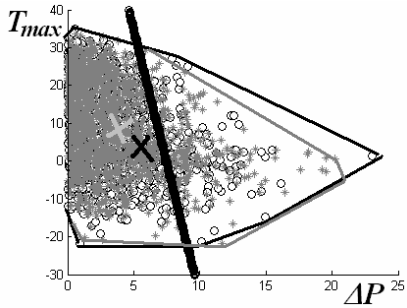


Fig.1 Intersecting of convex covers of two sets corresponding to days with (grey crosses) and without (black circles) morbidity from MI. Large grey and black crosses depict centers of corresponding covers. Thick black line separates two regions: left side is region where there is no dependence on weather parameters and right side is where such dependence takes place.

Traditional methods of linear separation will meet with direct recalculating of target functional (the balance of errors of the 1-st and 2-nd types: First type error is a wrong classification of normal patterns. Second type error is wrong classification of hazardous patterns) on the entire set. This target functional will not be smooth and search of its optimal value require infinitely large calculation time. For this reason we invented smooth functional connected with upper limits of errors of first and second type. Procedure of searching its optimal meaning is converging for finite time interval.

Method and results

Fig.2 (left part) shows meaning of impact factor in case of two-dimensional patterns. As can be seen from this figure impact factor – projection of weight vector **W** on axis p2 is larger for hazardous cases than for normal ones behind a separatrice. This way we can obtain relative input of each of 7 factors (P, ΔP, K –index, ΔK, T_{max}, T_{mean}, ΔT) participating in Space and usual weather effects (see Fig.2 right part).

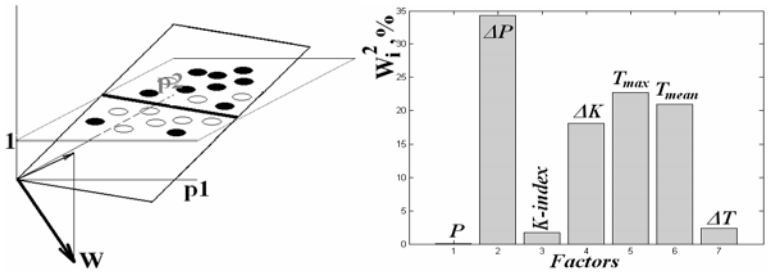


Fig.2. Left: Schematically presented estimation of impact factor of particular weather parameter/ Black points mean – hazardous samples (MI) while white one mean normal sample. Black line is the separatrice, approximately dividing normal and hazardous (behind line) conditions. Right side: Relative input of space and usual weather factors.

It is obvious that atmospheric pressure jumps ΔP, temperature and jumps of ΔK play a main role in creation of hazardous conditions (MI). Let us take couple of these parameters and investigate two-dimensional parametric separation in such case. Fig. 1 shows such separation for T_{max} and ΔP. Fig.3 shows confidence and efficacy of this separation. The confidence is a number of patterns which belong to hazardous area. The efficacy shows relation of number of hazardous and normal samples in the hazardous area.

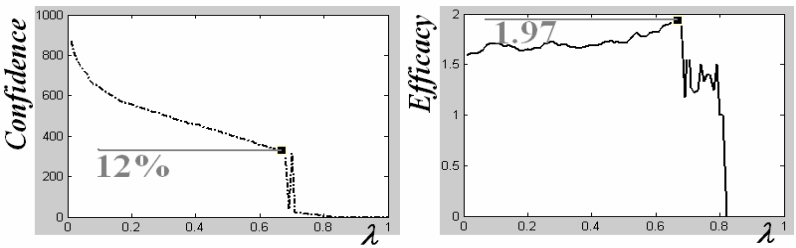
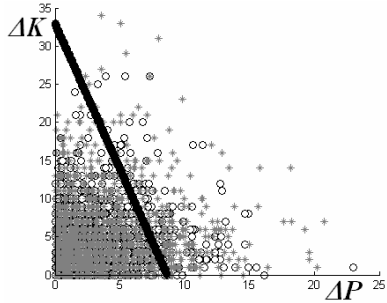


Fig.3. Dependence of confidence and efficacy from λ – ratio of weights of errors of first and second types. First type error is a wrong classification of normal patterns. Second type error is wrong classification of hazardous patterns.

The confidence is decreasing with λ because increases requirements of right classification of normal conditions. Simultaneously the efficacy is rising. Optimal λ can be found from compromise between maximal efficacy and confidence. Fig.3 shows that 12% myocardial infarctions (MI) from 2800 days with measurements belong to hazardous conditions (belong to

region behind the separatrice at Fig.1- to right side). Among these samples 67% were hazardous (MI) and 33% were normal patterns as it follows from efficacy 1.97 at Fig.3.

Fig.4. Separation of pattern for ΔK and ΔP



As far as ΔK plays important role as impact factor (see Fig. 3 right), comparative with ΔP, we present at Fig.4 and Fig.5 separation pattern, confidence and efficacy for ΔK and ΔP. Obviously ΔK and ΔP give 13% confidence from 2800 cases, i.e. 380 cases witch belong to hazardous region, i.e. maximal among studied by us in this paper. Earlier similar percentage of MI for Moscow in dependence of geomagnetic activity had been obtained. Ratio of hazardous and normal days behind separatrice appeared to be about 1.8.

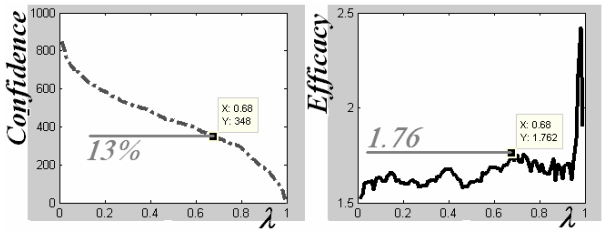


Fig.5. Dependence of confidence and efficacy from λ.

Using data from Fig.2 (right side) we will estimate relative input each of participating weather factors (see Table)

P	ΔP	K	ΔK	Tmax	Tmean	ΔT
0.04	34.29	1.66	18.05	22.72	20.89	2.33

Percentage input of each factors easy to obtain summarizing values related to parameters belong to each factors. Finally we will have: P : K : T = 34% : 20% : 46% or: **P : K : T = 7 : 4 : 9.** Atmospheric pressure and temperature variation give a relatively larger input in medico-biological effects than geomagnetic activity.

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Full list of publications comprises more than 120 titles of papers published in journals and presented at scientific meetings since 1977.

Role of Space Weather Factors in Health Status of People with Cardiovascular Pathology

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Abstract: In 2003 a long duration of hot weather in Europe led to 27-40 thousand deaths. Another space weather factor which affects cardiovascular system and works the same way as meteo-factor is geomagnetic disturbance – geomagnetic storm. Simultaneous action both of these factors might have an additive biological effect and negative consequences.

In this work, we hypothesized that rapid or sharp variations of meteorological or geomagnetic conditions should affect the probability of development of acute cardiovascular events: myocardial infarctions (MI) and brain strokes (BS). The available data set consisted of 2833 registered MI, which occurred between 01.08.1994 and 31.03.2002 and 1096 cases of BS, which occurred between 01.01.1992 and 28.12.2005. We will define heat waves as a high temperature >+ 25°C duration from 1.5 to 5 days; cold waves - when T < (-) 16°C from 3 to 5 days. Results: We obtained that heat waves led to 23% increase of MI in comparison with average value, while cold waves - to 37%. We predicted of BS morbidity for 100 days by taking into account simultaneous action of atmospheric temperature and pressure and Kp – index of geomagnetic activity.

Introduction

Analysis of the climatic conditions' impact to the morbidity and mortality has been provided up to now in many cities in Europe, USA and Japan [1-4], but daily difference of temperature T, atmospheric pressure P and level of geomagnetic activity (GMA) Kp -index have not been taken into account. A. Chijevsky in Russia (1927) compared sudden cardiac death with solar activity and showed its correlations with Wolf' sunspot number. Similar

influence of solar activity on acute cardio pathology has been demonstrated by M. Faure and G. Sardou in France (1927), B. and C. Dull in Germany (1937). In 2003 a long duration of hot weather in Europe led to 27- 40 thousand deaths [1-3]. Another space weather factor – GMA which affects cardiovascular and blood system - works the same way as meteo-factor and affects the same target. In this work, we hypothesized that rapid or sharp variations of meteorological or geomagnetic conditions should affect the probability of development of acute cardiovascular events: myocardial infarctions (MI) and brain strokes (BS.).

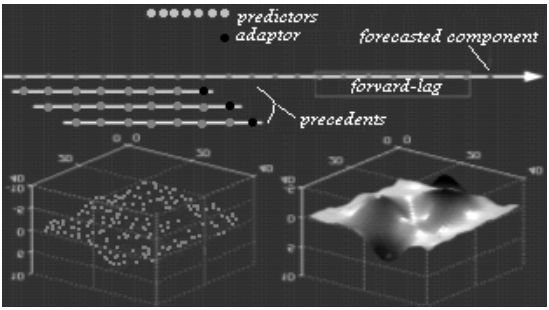

Fig.1 Upper graph: Division of initial time series (possible a few) into precedents. DDR teaches predicting module on the basis of first half part of available time-series of GMA and morbidity.
Then comparison of morbidity prediction's accuracy with and without taking into account GMA was done. Bottom: the visual image of the recovered dependence for the case of 2-dimensional predictor

Material and Methods

Materials: To reveal the relationships between geomagnetic activity, weather and morbidity, we analyzed only cases with established date of acute attack of diseases. The available data set consisted of 2833 registered MI and 1096 cases of BS. The geomagnetic activity data were provided by the IZMIRAN.

Methods: Methodical approach consists of two stages: 1) Long-term forecasting, 2) Statistical hypothesis proving.

We will describe methods

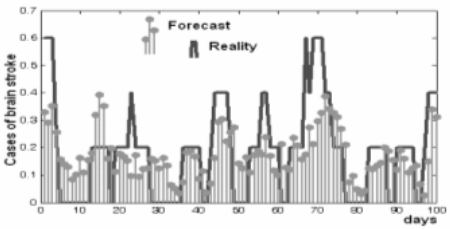

Fig.2 Prediction of brain stroke morbidity for 100 days taking into account simultaneous temperature, atmospheric pressure and Kp-index time series

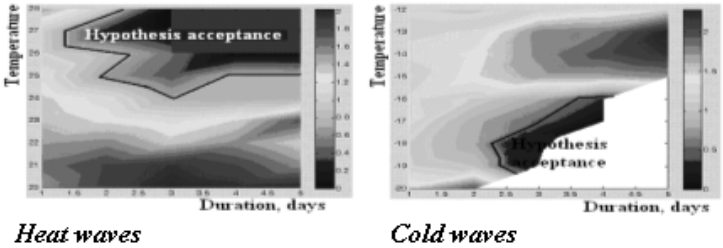

Fig. 3 Temperature wave effects on MI. Void region means absence of data. Black regions show "Yes" regions where MI increases due to temperature waves

together with results for the sake of better understanding mathematical methods.

Results

Results of long-term forecasting

We have employed Direct Dependence Recovery (DDR) method to explore the multi-parametrical connection between space and usual weather parameters and morbidity values.

DDR learns part of existing time series aiming to reveal functional dependence of forecasted variable on independent ones (namely: morbidity plays role of dependent variable (adaptor) while space weather parameters plays roles of independent variables (predictors)) (Fig.1).

Then an answer the question whether time series are confident or used

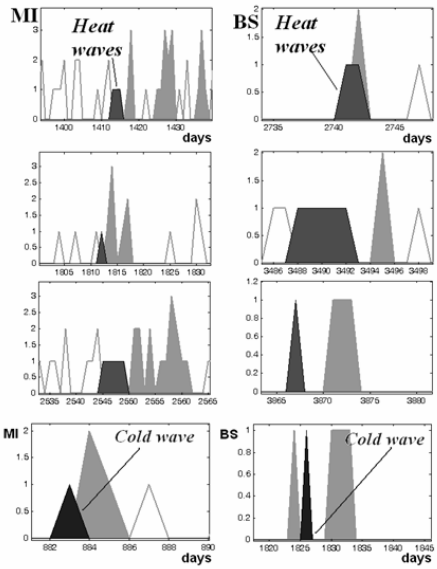

Fig.4 Heat and cold waves (black areas) and sharp increases of myocardial infarctions (MI) and brain strokes (BS) number in Moscow two clinics (grey areas). Empty triangles at figures show usual number of MI and BS

algorithm will loose its validity while extends out of boundaries of learned part of time series had to be obtained. For this purpose we use cross-validation method [4]. It was done for sake of testing temporal stability of revealed dependence. Stability of revealed dependence allows us to perform forecasting of morbidity based on simultaneous variation of all three factors: T, P, Kp (Fig.2).

As we can see, prediction is reasonably describing reality.

Results of statistical Hypothesis Proving

We will define heat waves as a high temperature >+ 25°C duration from 1.5 to 5 days; cold waves - when T < (-) 16° C from 3 to 5 days. Temperature waves were parameterized by two variables – duration of temperature increase/decrease and peak temperature. Then we have introduced parameter "Yes/No" – a hypothesis whether the wave arises significant increasing of morbidity above its mean level or not, expecting effect is in case if Yes to No is larger than unit (Fig. 3). We show also at Fig.4 heat and cold wave action on people health, when number of MI increases after such waves.

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T. Breus

Yury I. Gurfinkel

Some New Possibilities for Noninvasive Measurements of Environmental Influences on Cardiovascular System

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Abstract: **Investigation of microcirculation system under environmental influences is an important objective because capillaries plays a critical role in cardiovascular function. Our investigation of microcirculation parameters revealed a high dependence between capillary flow and geomagnetic activity. Using specially designed device for noninvasive evaluation of pulse wave velocity (PWV) and endothelial function (EF), we performed pilot study for understanding possible influence of temperature, atmospherics pressure and geomagnetic activity (GMA) on PWV and EF. It is shown that correlation between the level of GMA and PWV is positive and significant (p <0.01). In those days, when recorded PWV values were increased (over 9 mps), the level of GMA was significantly higher than in a neighboring days.**

As a computer capillaroscopy, measurements of PWV and EF are not specific techniques for detection environmental influences. Most likely they detect sympathoadrenal system activation as a result of environmental impacts on human organism. Indeed both devices can be used for data collecting and transmission to a telemedicine network.

Keywords**:** computer capillaroscopy, pulse wave velocity, endothelial function, environmental impacts.

Introduction

Objective information on developing pathological processes plays a key role for understanding of mechanisms for adaptation and a resistance of a human organism to an environment. Especially it is important for patients suffering coronary heart disease (CHD). Development of new diagnostic techniques should satisfy the following conditions:

1. To possess high sensitivity for maximal objective and reproduce information in under time. 2. To be minimal invasive or better still, noninvasive at all. 3. To not depend or in minimal degree to depend on the

operator. 4. Devices can be used for possible wide application in out-patient practice and for multiple-factor screening.

Computer capillaroscopy study

Investigation of microcirculation system under environmental influences is an important objective because capillaries plays a critical role in cardiovascular function as the point of nutrients and waste products exchange between tissues and circulation creating favorable conditions for effective metabolism.

In our previous study of microcirculation in patients with coronary heart disease (CHD) we used vital TV-capillaroscopy. A total of 144 patients with CHD (89 men and 55 women) were tested during 10-14 days at fixed time and ambient room temperature. We evaluated in arbitrary indices several parameters of microcirculation, including perivascular edema, erythrocyte aggregation, and blood velocity. Microcirculation data were compared with daily values of geomagnetic activity (A-index), three-hour-range indices (K) and atmospheric pressure obtained from IZMIRAN, Troitzk, Moscow region. The investigation revealed a high dependence between capillary flow and geomagnetic activity.

Values distribution of factor of correlation between a total capillary index and Ap in groups of patients with myocardial infarction on consecutive days of geomagnetic storms presents in the Fig 2. Fig. 2 clearly shows that deterioration of a capillary blood flow begins for two day prior to the beginning of a magnetic storm [1]. However the maximal deterioration a capillary blood flow parameters comes in a day of a geomagnetic storm. For comparison Fig. 3 presents the distribution of daily average cases of myocardial infarction (n=1537) on consecutive days of a geomagnetic storms in Central Clinical Hospital JSC “Russian Railways” in 1992 – 2005. Mitrofanova et al. [2] quantified the relationships between geomagnetic activity and a morbidity of patients with acute myocardial infarction (aMI) and show rising quantity cases of aMI at the first days of geomagnetic storm with maximum on the second days and reducing on the third days. Thus, it is possible to see evidently, that the maximal deterioration of a capillary blood flow precedes growth of MI patient’s quantity for one day.

The appearance of new computer technologies and resources of programming allowed developing a new type of devices for noninvasive measurements tiny processes in human tissue and in a blood. New computer capillaroscope with high resolution (AET, Russia) permits to perform measurements using quantitative assessment of capillary diameters, blood flow velocity as well as the perivascular area size (Fig.1) and some others

parameters with resolution 0,5-1 μm. It gives possibility for automatic assessment of capillary blood velocity in six capillaries simultaneously.

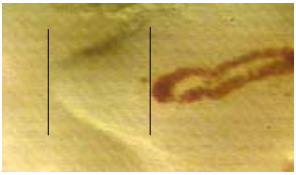

Fig.1. Measurement of the perivascular area size

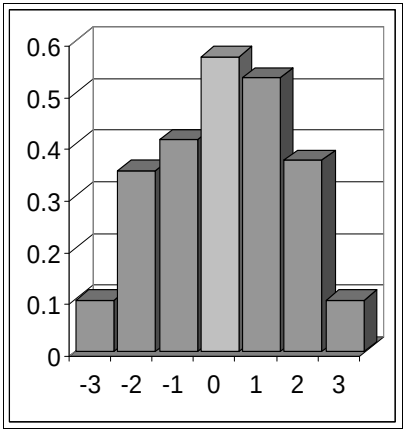

Fig. 2. Distribution of values of correlation factor between a total capillary index and Ap in groups of patients with myocardial infarction on consecutive days of geomagnetic storms. Zero on the picture means first days of geomagnetic storms. [1]

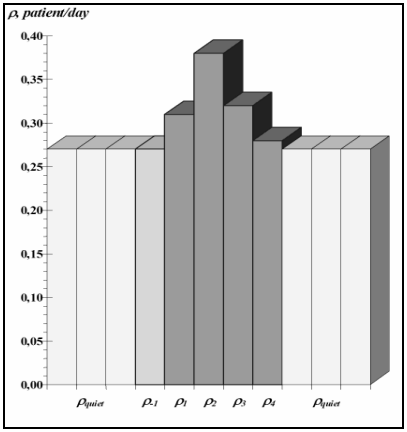

Fig. 3. Distribution of daily average cases of myocardial infarction (n=1537) on consecutive days of geomagnetic storms in Central Clinical Hospital in 1992 – 2005. Days with quiet geomagnetic conditions marked as "ρ_{quiet}", days with geomagnetic storm indicated as "ρ_{1-4}". The day before beginning of a geomagnetic storm marked as "ρ_{-1}".

Pulse wave velocity and endothelial function measurements

Investigation of pulse wave propagation as an index of vascular stiffness and vascular health dates back to the last century. However the role of endothelium in regulation of a vascular tone has been found out rather recently. The endothelium has a powerful effect also on blood flow, adjusts coagulation and plays an important role in the development of cardiovascular disease. But only recently measurement technique of pulse wave velocity (PWV) were improved and combined with endothelial function (EF) measurement.

Using specially designed device (AMDT, Russia) for noninvasive evaluation of PWV and EF, we performed pilot study for understanding possible influence of temperature, atmospherics pressure and geomagnetic activity on PWV and ED. Analysis PWV dependence on external factors (the level of geomagnetic activity and temperature) was performed by several statistical methods - correlation and variance analysis, as well as a method of superimposed epochs. All three methods gave consistent results. It is shown that correlation between the level of geomagnetic activity (GMA) and PWV is positive and significant ($p < 0.01$). In those days, when recorded PWV values were increased (over 9 mps), the level of GMA was significantly higher than in a neighboring days. Thus, there has been a reliable PWV increase in the days of geomagnetic disturbances. At the same time, a specific response to abrupt changes in temperature was not found.

As a computer capillaroscopy, measurements of PWV and EF are not specific techniques for detection environmental influences. Most likely they detect sympathoadrenal system activation as a result of environmental impacts on human organism. Indeed both devices can be used for data collecting and transmission to a telemedicine network.

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Space Weather Changes and Human Cardio-Vascular Health State in Middle Latitudes

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Abstract: **This study reviews results concerning the potential effects of space weather changes on morbidity and mortality from acute myocardial infarctions in two geographical regions (Sofia, Bulgaria and Baku, Azerbaijan) situated at middle latitudes but at different longitudes and sudden cardiac deaths in Baku. Analysis of results provides information about the potential influence of space weather variations on cardio-vascular diseases in general, at middle latitudes. Similar trends were found in the Sofia and Baku data, and differences in the effects during the solar activity cycle were revealed. It is suggested that geomagnetic storms caused by different phenomena affect the human cardio-vascular system in different ways.**

Introduction

"Space weather – human health" relations have global implications for humanity. Nevertheless, relevant research at different latitudes is also important for human beings [1]. Unfortunately, limited comparison on the possible effects of solar activity (SA) and geomagnetic activity (GMA) on humans exists between studies conducted in high, middle and low latitudes. Knowledge about the relationship between SA and GMA with human health would allow to get better prepared beforehand for any future space weather event and its impacts anywhere. There are signs that abrupt changes in the heliogeophysical situation and variations in cosmic ray activity could be a destructive factor in respect to the vital activity of biological systems including human beings, particularly, their cardio-health state [2, 3]. The individual state is very important to physiological stability of the organism.

In this study we review results of collaborative investigations concerning the potential effects of space weather on the morbidity and mortality from acute myocardial infarction (AMI) in two geographical regions (Bulgaria and Azerbaijan) situated at middle latitudes (between 40-43°N) but at

different longitudes (between 23-50°E) and the number of sudden cardiac deaths (SCD) in Baku [4, 5]. Possible effects of geomagnetic disturbances of various strengths, estimated by different geomagnetic indices and geomagnetic storm type (those caused by magnetic clouds (MC) of solar origin or those by high-speed solar wind stream (HSSWS)) were investigated. Due to the limitation in the length of this paper only major results are given and the reader is referred to the reference list for more details.

Data and Methods

Bulgarian medical data covered the period 01.12.1995-31.12.2004 and concerned the daily distribution of patients admitted in the hospital with AMI diagnose (in total 1192 cases) from the Sofia region. The number of patients dying after admittance was 175. Azerbaijani data concerned pre-hospital incidences and contained 4479 AMI incidences, 440 AMI mortality cases and 788 SCD cases for the period 01.01.2003-31.12.2005 covering the declining phase of solar cycle 23. Data were collected from emergency and first medical aid stations in the Grand Baku Area (including Absheron Economical Region with several millions of inhabitants).

The statistical method ANalysis Of VAriance (ANOVA) was applied to the data to check the significance of the influence of different GMA indices (Ap, Am, Kp and Dst) and the effect of the type of solar phenomena causing the geomagnetic storm on the number of the registered cardiac events. The effect of geomagnetic storms up to three days before and three days after their development on considered cases was investigated by applying ANOVA and superimposed epoch analysis. Correlation analysis was also applied and relevant coefficients were calculated.

Acute Myocardial Infarction Mortality and Morbidity

A positive statistically significant correlation between AMI morbidity [4] and mortality [5] and GMA indices for Sofia data was obtained. With increase in GMA an increase in the number of AMI incidences and lethal outcomes was observed. Peak increments of AMI mortality and morbidity were revealed on the days before, during and after geomagnetic storms with different intensities. Additionally, it was obtained that the considered cardiac events were relatively high also on days with low GMA during the descending phase of SA cycle 23 (2003-2004) when HSSWSs prevailed.

Results showed a negative correlation for monthly averaged AMI morbidity and mortality in Baku and GMA indices for the considered period of descending phase of SA cycle period [5]. It was established that AMI morbidity and mortality in Baku increased both on days with highest

geomagnetic field intensity and on days with low GMA [5, 6] as well as on days before and after geomagnetic storms with different intensities [5].

Observations suggest that different types of geomagnetic storms affect the cardio-health state of humans in different ways. MC-caused geomagnetic storms were related with a significant increase of AMI morbidity and mortality both in Sofia and Baku for all of the considered periods in comparison to the considered HSSWS-caused storms and geomagnetically quiet days. There was a trend in these different observed effects even on the day before and after the storms [4, 5].

Sudden Cardiac Death

Our studies have shown that GMA variations can potentially affect the number of SCD incidences. Results revealed a strong negative correlation between the monthly averaged GMA indices (Am, Km-sum, Ap and Kp-sum) and the averaged monthly number of SCDs for the considered period.

It was established that the SCD number increased on days of low GMA, on days when major and severe geomagnetic storms were developing and on the second day after the mentioned severe storms ended.

SCD incidences increased on days when storms were caused by HSSWs and remained at high level up to two days after they finished.

Discussion and Conclusions

Our collaborative investigations have provided more convincing observational data related to the possible influence of GMA on people – both healthy and ill. The degree of this influence depends on the individual physiological status.

The studies performed on data from two middle-latitude locations enabled us to obtain more suggestive evidence about the influence of space weather variations on cardio-vascular diseases in general at middle latitudes. Results revealed similar trends for Sofia and Baku data and differences in distinct SA cycle stages. It was obtained that both low and highest GMA levels are related to an increase in the number of the considered cardiac incidences and fatal outcomes.

It is possible that some of the electromagnetic field changes, which accompany geomagnetic storms, have favorable and stimulating effects. At the same time the possible adverse effect of very low GMA on cardio-vascular diseases should not be neglected. It has been shown that AMIs increased both on days with lowest and highest levels of GMA [5-7]. It is suggested that the role of environmental physical factors becoming more active during low GMA, like cosmic ray (neutron) activity should be the object of further studies [6].

The obtained results possibly indicate that different types of geomagnetic storms, through their different parameters, can affect in different ways living organisms, including the human health state and the cardio-vascular system. Different pathophysiological mechanisms of the varied cardio-vascular diseases should be considered as well, i.e. SCD and AMI are defined by diverse conditions. Long-period and detailed studies must be carried out in the future for confirming and clarifying the results obtained in our studies and for establishing possible mechanisms of the space weather influence on cardiac events.

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The Dynamical Properties of the Human EGC in the Light of Tele-Communicational Helio-Medical Monitoring ("Heliomed")

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Abstract: **The report introduces some results of the distributed tele-communicational helio-medical monitoring. The project developed in the joint collaboration of the Ukrainian National Academy of Science (IMMSP, Kiev) and the Russian Academy of Science (IZMIRAN, Moscow). The experiment is conducted simultaneously in Moscow, Yakutsk, Kiev and Simferopol. The aim of the project is exploration the influence of the external environmental parameters on the functional states of the human organism. The human functional state is controlled via the daily measurements of the number electro-cardiogram (ECG) parameters.**

Introduction

The project of the tele-communicational helio-medical monitoring "Heliomed" (**http//geliomed.immsp.kiev.ua)** is the spatially distributed network of the scientific centers which is designed for the long-time monitoring of the human physiological parameters. Our experiment is based on the daily measurements of the number electrocardiogram (ECG) parameters. The measurements were started at 2002. The exploration involves the scientific centers in Moscow, St.-Petersburg, Kiev, Simferopol and Yakutsk. For the time being, we collected the dataset including more than 20 000 measurements. These data reflect both the temporal and the spatial dynamic of the human cardiac processes in the different regions of Russia and Ukraine. The principal components of the experiment can be summarized as follows:

1. The unified equipments and data gathering methods are in use for all scientific centers that took part in the experiment;
2. All the data are registered on-line. They are gathered to the unit database at our server **http//geliomed.immsp.kiev.ua;**
3. Exploration involve the functionally healthy people;
4. The data are collected on the base of the daily measurements of the cardiac parameters. The every member of the monitoring group is examined at the 4 functional states. They are as follows: in

cessation; after a psychological test; after the Roufie probe; in cessation , 10 min later the Roufie probe;

5. Participants in the monitoring are the same all over the time.

Data and observation

The technology of the data processing is shown on the Fig.1. The cardiac data of the investigated person are collected with help of the original complex of the hard- and software equipments «Fazagraf-M» which proceed the data as follows.

The procedure starts with measurements the cardio signal at the I lead (left arm). Then, the signal is projected to the phase space with coordinates that measure the signal and its derivative. Finally, «Fazagraf-M» produces the standard cardio-cycle in the phase space. The basic procedure is described in detail at [1-2].

The long-term tele-monitoring has been carrying out more than 6 years

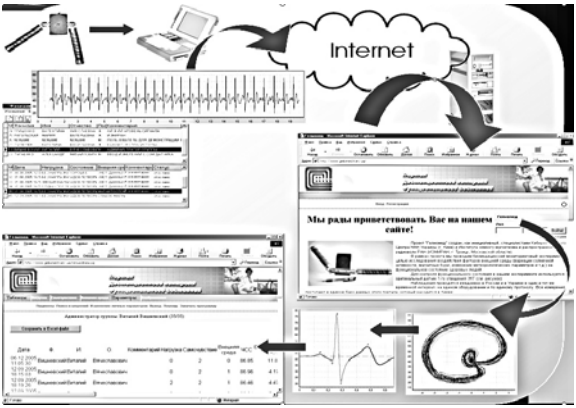

Fig.1 An example of the typical procedure for ECG measurements processing with «Fazagraf-M» that is the original complex of hard- and software equipments to process and explore the features of the human ECG under different external conditions

starting from 2002. The results of the long-term monitoring provide the evidences for the standard cardio-cycle to be an individual invariant that reflects the individual features of the cardiac activity of the investigated person. Moreover, it can serve as a good physiological proxy for the abrupt changes in external environmental conditions. The observational evidences can be briefly summarized as follows.

- The standard group of people, which were preliminary picked up on result of monitoring, show the changes of the standard cardio-

cycle properties in response to the geomagnetic perturbations. This is a collective effect which is observed in the all monitoring group. It goes in 2-3 days ahead of the main phase of geomagnetic storm.

- The statistical analysis shows that the changes of the cardiac activity parameters occur in the same direction for the all members of the monitoring group. The effect is observed in the all monitoring centers. We find that more than 50 % members of the each monitoring group simultaneously (within 1 day window) demonstrate the abrupt changes in the structural properties of ECG

The above results suggest that the human organism can belong to the class of open nonlinear dynamical systems.

The dynamical models of ECG

To understand the origin of the standard cardio-cycle changes we use the reconstruction of the dynamical model of the individual cardiac beat. The general approach to the cardiac beat reconstruction is given at [4]. Our analysis [**3**] suggests the existence of the following dynamical properties of the individual ECG beat. Firstly, the positions of the stationary points of the typical attractor of ECG are found in vicinities of Q and T waves. Secondly, we find that the stiffness of the beat is important for the general stability of ECG. This may explain why the main impact of the external perturbation is observed in structural change of the cardio-cycle and not in the variability of the R-R interval.

The typical length of ECG record in our monitoring includes the samples in 20-30 beats. The reconstruction reveals that the typical evolution of the cardiac rhythm includes the drift of attractor in the embedding space and the sudden change between a few basic patterns of attractor. However one of pattern is always dominating. These several pattern of ECG beat attractor can be ascribed to a several states of the system. In experiment we found that the alternative states disappear if the external stress (e.g., the psychological test or Roufie probe) is applied to the system. These properties are demonstrated on the simple dynamical model. The model is constructed as follows. Suppose we have two principal components that are responsible for the system dynamics. Let it be the signal $\mathbf{a}$ and the quantity which is functionally related to the its derivative $\mathbf{b}$. Using the ideas of the stellar dynamo we derive the model for the simple nonlinear oscillator with the parametric excitation. It reads as follows

$$\dot{b} = \Omega\left(\sin^2(t) - \frac{4}{5}\right)a - kb, \quad \dot{a} = \sin^2(t)a - ka - a^3$$

The parameters Ω can be identified as power of the driving force, while

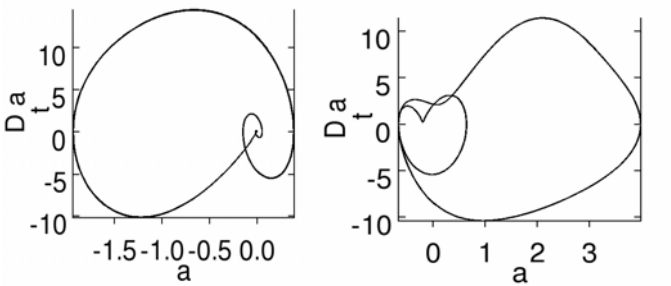

Fig.2 Two kind of attractor of the nonlinear model, one is for higher diffusivity (left). It has a higher excitation threshold and more stable under external perturbation. Another is for low diffusivity. It has a low excitation threshold and less stable.

k is to take into account of diffusion processes in the system. The given model demonstrate a few kinds attractor that shown on the Fig.2. The model demonstrates the different kind of attractor for the internal different parameters of the system. Thus, the observable changes of the ECG structure can serve as a good proxy for the internal cardiac functioning process.

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Typology of Typical Reactions on the Space and Usual Weather Variations for Patients Suffering From Hypertension and for Healthy People

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Abstract: **Individual analysis of the results of arterial blood pressure (ABP) long-term monitoring for 33 patients with diagnosis "hypertension of the 1st and 2nd functional classes" (Moscow) and for 42 healthy volunteers (Moscow, Simpheropol) have been performed. ABP has been measured three times with time interval 2-3 min only ones per day however in the same time in each case. Comparison of ABP dynamics with meteorological factors (atmospheric temperature and pressure) and with level of geomagnetic activity (Kp-index, GMA) shows that for group of healthy volunteers sensitivity to each of these three external factors is approximately equal in 40% cases, while the patients are the most sensitive to the variations of temperature (62%), then to GMA (55%), and then to the atmospheric pressure (30%). These results are in relative agreement with theoretically estimated inputs of these three factors into dynamics of increase of acute transgression of blood circulation in brain and myocardial infarctions, observed in Moscow clinics, namely: ΔT:Kp:P=9:6:4.**

Introduction

It has been shown in numerous papers that human cardiovascular system is sensitive to geomagnetic storms [1, 2 and references there]. Recently, the input of geomagnetic and meteorological factors into dynamics of stroke and infarctions, registered in two Moscow clinics, were compared. It was revealed that they have a commensurable contribution [3]. However, population average information can not reflect the individual degree of risk and features of reactions of ill and healthy people. This problem can be solved only by comparative analysis of long-term time series of individual physiological parameters and meteorological and geomagnetic indexes.

The aim of this paper is a detection and classification of typical reactions of healthy and ill people to meteorological and geomagnetic factors.

Materials and methods

Individual analysis of the results of long-term monitoring of arterial blood pressure (ABP) has been performed for:

- 33 patients (age 56±8.4) of A. L. Miasnikov Centre on Cardiology, Moscow, with diagnosis "hypertension of the 1st and 2nd functional classes"
- 42 healthy volunteers: 25 from Moscow, age 41±5.7 yrs and 17 from Simpheropol age 19±1 yrs.

ABP has been measured three times with time interval 2-3 minutes, once per day, at the same time of the day. Patients made their ABP measurements at home and send the results by e-mail to doctors.

Results

Comparison of ABP dynamics with meteorological factors (atmospheric temperature and pressure) and with level of geomagnetic activity (Kp-index, GMA) shows that in the group of healthy volunteers sensitivity to each of these three external factors can be observed for 40% of people. Hypertensive patients are mostly sensitive to the variations of temperature - 62%, then to GMA - 55%, and then to the atmospheric pressure - 30%. The results obtained for patients are in agreement with theoretically estimated inputs of these three factors into dynamics of increase of acute transgression of blood circulation in brain and myocardial infarctions, observed in Moscow clinics, namely: $\Delta T:Kp:P=9:6:4$ [3].

In both groups, healthy volunteers and patients, the most typical is sensitivity of the organism simultaneously to two out of three factors. The contributions of meteorological and geomagnetic factors can be separated, since dependence the ABP from GMA is expressed in coincidence of high-frequency (daily) variations. Meteorological factors and ABP reveal synchronous variations as slow waves with the periods in several days. This is illustrated in figures 1 and 2.

Fig.1 shows the example of synchronicity of systolic blood pressure (SBP) and atmospheric pressure (AP) variations (left) and cross-correlation function for these time-series (right) typical for both patients and healthy volunteers. In both groups we have observed cases of positive (rise of SBP) and negative (decrease of ABP) reactions to AP increment, but the characteristic feature of all these dependences are wide extremum of cross-correlation function.

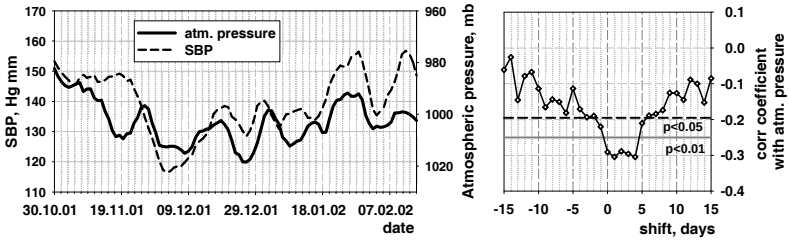

Fig.1 Typical illustration of synchronous dynamics and cross-correlation function of variations of SBP and atmospheric pressure, patient - woman, 68 years old, AH of the 2nd class, duration 2 years, medication – indopamil-retard 1.5 mg

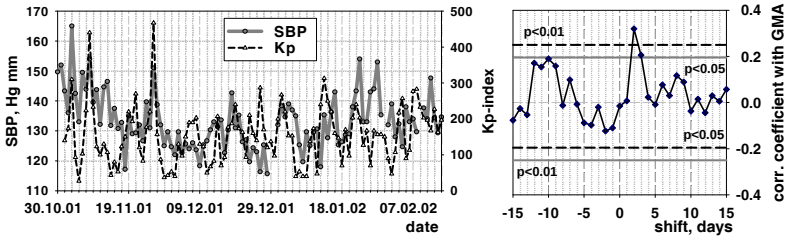

Fig.2 Typical illustration of synchronous dynamics and cross-correlation function of variations of SBP and Kp-index for the same patient as in figure

Fig. 2 shows the case of synchronicity of SBP and Kp-index variations for the same patient as in Fig.1. It is well presented on the right part that the correlation is significant ($p<0.01$) only at shifts 2 and 3 days, i.e. ABP reaction lags behind for 2-3 days with increases of GMA. This delayed response is inherent for people with cardiovascular pathology.

The position of the maximum correlation ABP with Kp-index can vary from zero up to about three days for patients' distributions (Fig.2). This position is usually equal to zero for healthy people (Fig.3).

In Fig.4 correlation of SBP and temperature T is presented for both patient and healthy people. It is negative: ABP is increasing while temperature decreases, and long «relaxation period» had been observed. It is visible that correlation remains significant up to shift in 6 days. In certain cases communication between the ABP and the temperature became more expressed for negative temperatures and weakened for the positive.

Combination of two unfavorable factors - geomagnetic storm (large Kp-indexes) on a background of the lowered temperature can strengthen each other and result in cardiovascular catastrophes.

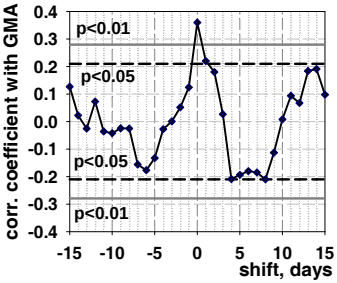

Fig.3. Correlation coefficient of DBP and Kp-index for young (19 years old) healthy volunteer

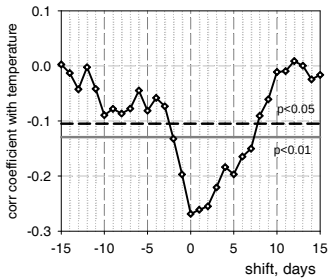

Fig.4. Correlation coefficient of SBP and atmospheric temperature typical for patients with arterial hypertension and for healthy volunteers

It is presumably possible to explain enhance of biotropic effect of magnetic storms in the winter and a maximum in seasonal distribution of myocardial infarctions and strokes in winter time [4].

Conclusions

1) Magneto- and meteo- sensitivity meets for patients and healthy people practically in commensurable proportions; 2) Magneto- and meteo-sensitivity differ by durations of physiological reactions: magneto - sensitivity generates a reaction during one day, while meteo-reactions take place as slow long period (3-6 days) waves, i.e. with periods practically equal to characteristic time of atmospheric cyclone duration; 3) Typical reactions of ABP on meteo-factors for patients and for healthy people are identical: in 90% of cases sensitivity correlation with temperature is negative, and with atmospheric pressure for different people correlation can be both positive and negative; 4) ABP of healthy people reacts on GMA variations synchronously, while for patients there can be a delay of physiological reaction from 0 to 3 days; 5) Combination of action of two unfavorable factors - meteo and GMA can increase amplitude of reaction.

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T. Zenchenko

T. Breus

Session 18

Pan Asian Collaboration for Evidence-Based eHealth Adoption and Application (PANACeA)

A Systematic Review of Current ICT Applications in Disasters – The Potentials of Integrating Telehealth

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Rationale

In the last few years, South Asia and South East Asia regions have been experienced a number of different types of disasters, such as: earthquakes, tsunami, typhoons, cyclone, floods, land-slides, mudslides, volcano eruptions and some man-made disasters.

During a worst case scenario, most healthcare, telecommunication, public utility, and transportation infrastructures will not be available. A number of different types of efforts/responses and technologies (that include Information and Communication Technology) have been implemented in response to such disaster cases. ICT has especially been used at different stages of such disaster and emergency cases, i.e. before, during and after the disasters. In general, this research will focus on the following steps:

- Systematic review of current ICT applications in disasters
- A limited number of prioritized specific disaster types will be focused by each participating country (India, Indonesia, Philippines)
- Special attentions are to be dedicated to the ICT applications in at least three different stages of disasters (before, during, and after disasters)
- Careful analysis will be conducted to the acquired information from the three respective countries as well as additional information from other countries and various sources
- Important significant conclusions and outcomes are expected on the best practices of ICT applications in response to disaster stages and the potentials of integrating telemedicine in disaster cases.

Technology/Intervention to be tested

In general, the following interventions will be tested:

- ICT applications used in different types of disasters and at various stages of the disasters.

- Key factors in implementing successful ICT applications in disaster.
- Potentials of improving healthcare delivery using telemedicine/e-health in different stages of disaster.
- Specifications of the disaster telemedicine systems to be suggested.
- Framework for implementation of e-health interventions in national and/regional disaster management programs.

Research methodology

The research activities will be grouped into seven main activities and to be conducted within 12 (twelve) month period of the project.. These activities are briefly described as follows:

1).Research Design (2 months [*])

- The research design consists of improving the detailed design activities during the whole project activities.
- Improved preliminary survey, inventory, and analysis on recently existing disaster cases. Basically survey will be conducted not only based on the existing information available in each country, on-line (internet) search has been (and will be continued) as well.

2).Literature Search (2 months [*])

- The activities 1 and 2 are to be conducted in the same two month period. They consist of both detailed research design and literature search on the existing information related to the recent (last two to five years) disaster situations or cases that happened in the three countries (India, Indonesia, Philippines).
- Special attention should be given to the healthcare activities using ICT and/or telemedicine systems.

3).Information Collection (5 months [#])

- Each of the three countries (India, Indonesia, and Philippines) will focus on one to three particular types of disasters in our respective countries. The selection criteria to be used can be: frequency and impact, evidence on any form of ICT applications and/or e-Health response, for example, India will focus especially on tsunami, floods; Indonesia will focus especially on earthquakes and tsunami; Philippines will focus especially on typhoon, landslides.
- Successful implementations and/or lessons learned from other countries should also be collected. Lessons learned and best practices from Japan, Thailand, European countries, the USA, as well as from Pacific countries
- Data collection and analysis on existing infrastructures (public utility, electricity, telecommunication, ICT facilities, transportation)

- Grey literature will be collected through various means, for examples: from websites, interviews and discussions on experiences from early adopters, first responders, officials at respective national disaster management centres, related departments/ministries, free lance disaster health relief workers and/or volunteers, NGOs, press releases from international aid agencies, telecommunication service providers.

4).Systematic Review & Extract of Information (5 months [#])

- The activities are planned to be conducted in overlap with the information collection, as soon as complete information on particular topics are obtained. The study review on different types of information will be conducted in different countries, for each area and specific purposes.

5).Dissemination/Publication

- Dissemination/publication of different types of information related to the project activities and results should be conducted during the course of the project activities, as well as at the final stage of the project

Outcomes

Short term:

Awareness, active involvement of the government, community, NGOs and private institutions to this initiative

Midterm:

Preliminary results of the preliminary study on disaster types, disaster stages, the applications of ICT (that include telemedicine) in response to specific stage of disasters

Long term:

When the short and medium term outcome have been obtained, as well as their associated recommendations have been implemented, it is expected that better response in future disaster situations (when it happened) will be responded much better and in timely manner.

Anticipated results

Policy recommendation to various government and non-government healthcare institutions (from health offices, hospitals, to the department of health) involved in coping with different types of disaster situations.

Community Based eHealth Promotion for Safe Motherhood: Linking Community Maternal Health Needs with Health Services System

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MMR is used to measure the quality of a health care system of a country. Immediate causes of maternal mortality usually stem from the mother's failure to receive adequate medical management of major maternal complications.

Rationale/Research Question

- How to utilize the many benefits of ICTs in improving promotion of public health services like use of EMOCs (Emergency Obstetric Care)facilities of the safe motherhood program?
- Will integration of ICT in current Safe motherhood Program Behavioral Change Communication (SMP e-BCC) initiatives be more effective in promoting utilization of EMOCS by pregnant women as compared to traditional SMP BCC approach? What components in the SMP BCC can be promoted using ICT?
- Is SMP e-BCC initiative cost-effective to operate than the traditional SMP BCC?

Technology/Intervention to Be Tested

- A SMP model municipality implementing SMP e-BCC will have higher EMOC clientele than SMP model municipality implementing traditional SMP BCC strategies.
- SMP e-BCC is more cost-effective than the traditional SMP BCC strategy.

Study Design/Methodology

This study will employ a mixed method design.

The study will be implemented in 3 Stages: the Formative Stage (first 6 months after Needs Assessment), Implementation Stage (12 months), and Research Analysis and Evaluation and Research Result Dissemination Stage (remaining 6months).

The study site will employ e-health technology, a mobile phone with SMS application incorporated into the existing BCC strategy in promoting behavior change among target clientele. The comparison site shall be implementing the same BCC promotion strategy but not using the mobile phone with SMS application. An SMS server shall be installed in the municipal health service center, or in area strategic to both BEMOCs and CEMOCS facilities. This SMS Messaging Server is an SMS messaging framework that enables the rural health unit (RHU) to send, receive and process SMS to its clientele. The SMS framework is designed to support virtually any scenario where low-and high volume SMS messaging is required. The SMS server in the rural health unit shall process safe motherhood BCI scenarios identified during the project formative phase. Software is required in processing BCI scenarios. Both the Philippines and Indonesia have companies to customize the framework and software to be used for this research. Pakistan counterpart shall do canvassing of IT companies that can customize the SMS server design.

Outcomes

- Increased births delivered by skilled attendants
- Increased ante-natal care attendance
- Increased proportion of clientele accessing health information and obtaining response from server
- Increased amount of health information received at a given time

Anticipated Results

1. An SMS Server, installed in the rural health center/BEmOCS that serves as hub and repository of information between clients, agents and the health center.
2. Number of traditional birth attendants and members of community based organization trained to refer/submit pregnant women to health centers for prenatal check-ups, childbirth and postnatal services using SMS.
3. Trained in-house personnel to manage the SMS server set to connect health centers to agents and clientele
4. Number of different sets of standardized tools produced for data collection, data analysis, and source codes for the database system.
5. Pool of researchers with enhanced research skills and capacity to implement e-health projects

6. Installed shared online repository of research designs, data collection tools, tools for analysis for sharing among project partners

Development of Simple eHealth System for Tuberculosis Management at Community Health Center Level in Indonesia

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In this paper, we describe a preliminary development of an Internet and mobile phone-based e-health system for Tuberculosis (TB) management in a Community Health Center (CHC) or hospital. A standard DOTS (Directly Observed Treatment Short-course) strategy is applied to support the diagnosis and therapy of the TB patients in Indonesia. To assist the TB patients, in general, each CHC usually has simple laboratory unit, with limited medical personnel and medicine facility. Unfortunately, the number of TB prevalence is still relatively high, perhaps due to the relatively high percentage of patients with uncompleted therapy. Such cases are caused by several factors, for example: "healthy feeling" before completing the therapy, not taking regular medicine as required, not attending regular medical visit, and possible drug side-effects. The development of our ICT-based e-health system for TB management is expected to increase the number of TB patients with completed therapy.

Basically, the TB management e-health system under development includes measurement, recording, evaluation, reminder and reporting functions. The system consists of: personal computer (PC), simple digital microscope, patient database software, SMS (Short Message Services) gateway software, and telecommunication module. The simple digital microscope has been built from an analog microscope, digital camera and PC with appropriate image processing software; it is used to detect the Acid-Fast Bacteria and to capture patient's sputum in digital form. The digital data is saved in the web-based patient database for further information retrieval and education purposes to improve diagnosis quality of TB. The system can also be used to report to the Health Office Centre through the Internet to inform medicine supply and the epidemic in the covered area of the CHCs. From this information, the Health Office Centre can make an appropriate effort immediately. The system can also send 16 SMS reminders to the patient for taking the medicine or attending medical

visit during 6 months. Moreover, the patient can do remote TB consultation through her/his mobile phone using the SMS facility.

Moreover, the system can also be further developed for tele-consultation to a Pulmonologist or other medical specialist in the referral hospital. Therefore, the Internet and mobile phone-based e-health system for Tuberculosis management is expected to increase the number of TB patients with completed therapy and to improve the quality of their health services.

Keywords: e-Health, Tuberculosis, Community Health Center, Indonesia

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Hendi Handian Rachmat, born in 1977, graduated from Electrical Engineering of Institute Teknologi Nasional Bandung in 2000, and obtained his Master degree from Biomedical Engineering, Institute teknologi Bandung in 2005.

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Does Current Evidence Support Use of Telehealth in Asian Countries?

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Introduction

Telehealth has been defined as the delivery of health related services and information via telecommunications technologies [1, 2, 3]. Telehealth has been used for bringing health care to rural and remote areas of these countries which contain few doctors and other health care workers and also bring cost effective and high quality health care to urban areas[3]. Telehealth has been divided into real time (synchronous) and asynchronous. Real-time telehealth, involves the use of audiovisual equipment to enable a patient and a remote health professional to communicate synchronously over a videoconference link, whereas Asynchronous telehealth involves the capture and delivery of digital clinical samples by family physicians, community-based nurses or trained members of the public for assessment by specialists in remote locations, transferred electronically [3, 4].

These techniques have been used and reported in Western countries, especially North America, Australia and Europe, where a substantial body of literature has emerged about their successes and failures. However this literature cannot be generalized to the Asian region which has demographics and issues different from other regions. Moreover, the Asian literature on telehealth is scant when compared to the literature of the West[1]. The main objective of this study was to conduct a thorough and current state of the science review of telehealth applications, with specific emphasis on telehealth in Asia. This systematic review was conducted as part of PAN Asian Collaboration for Evidence based eHealth adoption and Application (PANACeA's) Common Thematic Activity[5].

Methodology

We conducted a systematic review[7] according to the steps outlined in Cochrane Handbook[6]. The review was performed in five steps:

Stage 1: Selection criteria for studies and the literature search

The Medline database was searched using the PubMed search engine for the period January 1997 to June 2007. Three telehealth related journals

were searched by hand: *Journal of Telemedicine and Telecare*, *Telemedicine Journal and E-health* and *E-health International Journal*. The inclusion criteria included articles in English, with humans as subjects, published between January 1997 and June 2007, and related to any sort of telehealth applications *involving at least one Asian country where the intervention took place.*

Stage 2: Review of the abstracts (Level 1 review)

Each abstract was reviewed independently by two reviewers. The selection of relevant articles was based on the information obtained from the study titles and the abstracts, according to a set inclusion criteria mentioned. We also confirmed that the research had been conducted in one or more Asian countries.

Stage 3: Review of the complete articles (Level 2 review)

The same reviewers extracted data independently and where there were disagreements, the differences were resolved by consensus. The search and selection process is summarised in Figure 1.

Stage 4: Quality assessment

The quality of each study included in the review was assessed using the nine-level classification of Jovell and Navarro-Rubio.

Stage 5: Syntheses of data and analysis

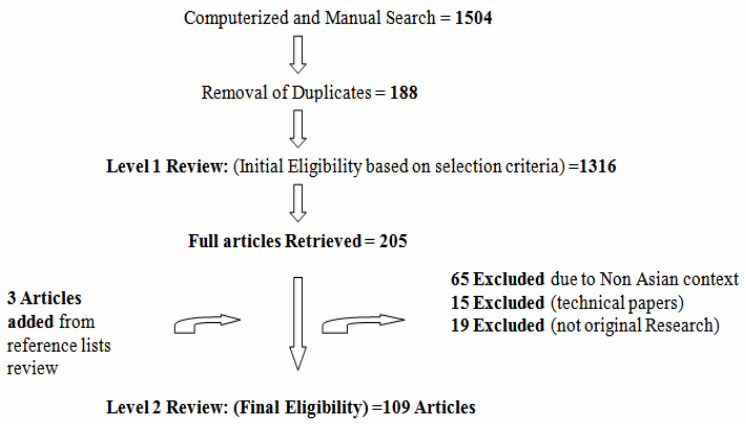

Figure # 1: illustrating the search and selection process

The data was synthesized in three sections:

(a) Descriptive information

The descriptive information comprised of study settings, medical specialty, modality, technology used.

b) Methodological characteristics

The methodological information comprised of sample size, study design and quality of study.

c) Outcomes/content analysis

The review categorized the outcomes into three groups, patient outcomes (i.e. increase access to health care services, improved quality care) economic outcomes and health systems outcomes (management and policy).

Results

In total, 109 articles on telehealth in an Asian context were reviewed. The results of the review are presented in the following three sections:

(a) Descriptive information

The result of the ten year systematic review of literature (1997-2007) on telehealth in Asian context indicates that peer-reviewed publications on different telehealth initiatives in Asia are on a rising trend. Among the Asian countries, Japan has taken the lead, as most of the studies (35%) were conducted over there. Our results showed that majority of the studies were hospital based (45%); with teleradiology (involving images from neurology, orthopedics and dermatology) being on the top of the list among medical specialties (12%), followed by home telehealth (12%). Interestingly nearly all of the home telehealth studies took place in Japan (12%).

The review also showed real time telehealth modalities due to their high cost were conducted more in developed countries, as out of 39 real time studies 35% of the studies belonged to countries like Japan, South Korea and Israel. The most used telehealth system was store and forward (42%), which were used by both developed and developing countries pretty fairly, suggesting that developing countries still prefer store and forward technologies, being low cost and easy to use, and requiring much lower bandwidth. Cross analysis of different countries and the use of technologies further weighted this debate, illustrating that most of the developing countries still preferred Plain old (POTs) telephone and ISDN lines for connectivity. Satellite connections were only used for remote and rural areas where communication infrastructure was not well-developed, despite high cost associated with such connections. None of the studies in the developing countries of Asia used any broad band or wireless connection.

b) Methodological characteristics

The methodological characteristics of the studies in general were found incomprehensive, and the quality level being poor in majority of the cases, when judged according to the already set criteria. This might not come as a surprise as field of telehealth in Asia have just gained some recognition and momentum. Most of the studies were descriptive in nature (57%) not specifying any particular study design, followed by case reports (36%); only 7% of the studies using any independent control groups, comparing telehealth cases with those receiving the usual orthodox care.

c) Outcomes/content analysis

A) Patient outcomes

a) Improved quality of care

Approximately 40% of the 109 studies mentioned improving the quality of health care provided. Telehealth was useful for providing high quality care to patients through consultation, diagnoses, on-time hospitalization, changing patient care, increasing patients' knowledge and maintaining good health, but not for curing disease. Some of the reports, however, did not draw definite conclusions, and recommended further studies involving larger samples and longer duration of investigation.

b)Improved access to care

About 20% of the studies *[22/109]* mentioned improved access to health care and health care services, i.e. decreased travel, time saving to obtain the required quality care or gaining access to a specialist.

Store-and-forward techniques were found to be easy to implement and all necessary images for discussion could be transferred easily and quickly. Real-time technologies like videoconferencing were found to be expensive, although the costs involved in any project were small in relation to the potential health benefits.

B) Economic outcomes

Cost effectiveness/minimization

Although most studies mentioned cost, only 13 of them (12%) assessed explicitly the effect of telehealth on resource utilization and cost. In real-time telehealth, higher costs were associated with videoconferencing compared to audio conferencing. Most of the studies concluded that for telehealth to enter into widespread use, its benefits must be proven in monetary terms. The question about who should bear the costs of a telehealth service was largely unresolved. A study conducted in Japan

addressed the question as follows: if the effects give rise to individual benefits, then the individual users should be willing to pay. On the other hand, if telehealth affects society more generally, then society should bear the cost.

C) Health systems outcomes

a)Management issues

Six percent of the 109 studies discussed the management and the change management issues hurdling telehealth implementation. The review found that success of a telehealth programme depended not only on good technology but on effective management of human and organizational change.

b) Policy issues

The review found that only 4% of the 109 studies mentioned policy matters related to telehealth in particular and eHealth in general. Telehealth is a relatively new field for many Asian countries and policy development was found to be slow. However, there were countries like China, Indonesia, Malaysia, Singapore, South Korea, Taiwan and Thailand where national policies were designed to include telehealth as a component of larger development objectives. The impact of these policies has not yet been evaluated, since they require time for implementation, with regular revisions and refinement.

Discussion and conclusion

The overall findings of the present review provide a generally optimistic picture of telehealth in Asian health care settings. Studies on telehealth applications have been useful, but there is a lack of good quality studies and in some cases the generalizability is limited to specific settings. The literature demonstrates the value of telehealth applications to decision makers, in developing countries generally and in Asian countries in particular. To appreciate the outcomes of any telehealth program or project, ample time is required for conceptualizing, planning, and assessing the needs of any telehealth intervention on small or large scale, along with appropriate emphasis on change management. All these issues should be given a proper place in our health system; only then definitive outcomes of improved, accessible and cost effective quality of care would be seen. The results also tell us that telehealth programs cannot work in isolation; it needs to be a concentrated effort from the professionals, departments, institutions and the governments. Sustainability of an eHealth or telehealth project would come only if at the end of the any project time, the processes are

integrated in the existing health care system. If not telehealth will remain alien to our health care system, jeopardizing its benefits and longevity.

Acknowledgements

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Economic Evaluation Framework of Computerization in Hospitals

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Rationale

In the health sector hospitals play a critical role in providing health services. In large hospitals more than 1000 patients visit the hospital daily. A large hospital has more than 20 departments with each looking after a specific specialty. In addition the hospital is supported by extensive diagnostic facilities. To ensure effective management the hospital is supported by the administration which looks after the personnel, budget, accounts, transport, kitchen, security, engineering and maintenance etc. The management workload is huge in a hospital and requires proper system and procedures for effective management. Most hospitals in the developing countries like Sri Lanka, India and Pakistan have manual systems in place. However, the process of computerization has been initiated and efforts are being made by the hospitals and the Governments to automate the various processes. A major difficulty in obtaining funds for computerization, is that the governments and donors are not convinced about the benefits of automation. Such questions are no longer valid in the developed countries where automation is considered as a necessary requirement. In view of the above this project focuses on comparing the cost and benefits in three hospitals i.e. one which is automated and one which is not automated. Such study is usually not undertaken in developing countries. Hence this study will be a pioneering effort and will assist in obtaining further grants and financing for hospital automation and allaying the apprehensions of governments and donors towards computerization of health facilities in developing countries.

Three countries are proposed to be included in the study i.e. Afghanistan, Philippines and Pakistan. The project attempts to address the following research questions:

- Is there any cost savings in automation for the patient?
- Is there any improvement in the quality of service and patient care?

- Is there any improvement in clinical and management accountability?
- Is there an improvement in systems and procedures after automation?

Technology / Intervention to Be Tested

The cost-benefit analysis of hospital computerization and to compare it with a non-computerized hospital.

Study Design/ Methodology

The goal of this research study is to develop and trial an economic analysis tool that can be used to explore the cost benefit of hospital computerization in the developing country context. To achieve this goal a **mixed methods approach** has been adopted. A client and stakeholder based participatory research and an iterative tool design process will be used to develop the cost analysis framework. The quantitative economic evaluation will identify the resource impacts (costs) and outcomes (benefits) of computerization of key hospital processes, and compare these to the impacts and outcomes in the non-computerized settings.

To assess these outcomes and resource impacts a balance sheet approach will be adopted which emphasizes the equally important intangible benefits and costs of computerization. Three countries will contribute to the design of a framework for the cost benefit analysis of computerization in the hospital context. Once developed and validated, the framework will be implemented in six hospitals i.e. 2 hospitals (one computerized – study institution; one not computerized but equivalent – control institution) in three countries Pakistan, Afghanistan and Philippines. These have already been identified. Data will be collected prospectively for twelve months after which data analysis and reporting will follow

Major Outputs

- A generic framework for measuring the cost and the benefit of computerizing hospital information services in developing countries;
- Provide a tool that will help hospitals determine if there is benefit exceeds cost in computerization.

Outcomes

- If cost exceed benefit
    - Avoid wasting resources through unnecessary computerization.

- If benefits exceed cost
    - Better patient care due to improved efficiency brought by computerization.

Anticipated Results / Benefits

- More informed hospital administrators and clinicians;
- Less wasted resources;
- Improved efficiency and transparency;
- Data easily available for decision making.

About the Authors

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eHealth -The Panacea for Asian Health Care

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Rationale

eHealth can be defined simply as the use of Information and Communication Technology (ICT) in healthcare. eHealth solutions can be applied in many domains including prevention and surveillance, administration, clinical settings, education and health research. .The main uses of eHealth in developing countries have been to improve access to healthcare services, and enhance the quality of care by making patient data and other relevant information available to the healthcare providers at the point of care. In the developing country context there are specific challenges such as difficulties in communication between healthcare providers working in remote areas and those working in tertiary care hospitals, information transfers at different levels of care, and professional isolation of healthcare providers working in rural areas. eHealth can provide a medium to address these challenges by providing economically and socio-culturally appropriate technology solutions available at different points of care. The biggest problem at this time is the lack of scientific evidence to convince the decision-makers at the institutional and government levels about the benefits of eHealth in the local context, and to prove if one technology is better than the other to address the same problem. PAN Asian Collaboration for Evidence-based eHealth Adoption and Application (PANACeA) is an initiative to generate evidence in the field of eHealth within the Asian context, by forming a network of researchers from developing Asian countries.

PANACeA will find answers to the following four core research questions:

1) Which eHealth applications and practices have had the most beneficial outcomes on the health of individuals, communities and the improvement of health systems?

2) What are the best ways for ensuring that beneficial outcomes can reach the segment of the population that still doesn't have adequate access to health services?

3) What is the potential of using new pervasive technologies such as mobile phones / PDAs as tools to make the delivery of health services or information more effective?

4) What types of technologies / applications are best suited to help prepare for, or mitigate the effects of disasters, pandemics and emerging and re-emerging diseases?

The goal of the project is to undertake collaborative research that promotes evidence-based adoption and application of technologically and socio-economically appropriate e-health solutions within the PanAsian (South Asia, East Asia and Southeast Asian) contexts. In addition, PANACeA has following specific objectives:

1. To support a set of multi-country research activities to address the four core research questions;
2. To create a theoretical model for evaluating good practice in e-health programs in Asia;
3. To build research capacity amongst Asian researchers to evaluate and adopt appropriate e-health technologies and practices and influence policy and decision-makers;
4. To disseminate research findings widely in the regional and international research communities.

Methodology

The driving principle behind PANACeA is to use a network modality such that the sums of the individual research activities are greater than its parts. In order to meet the objectives set for PANACeA, the AMT decided to support small-scale multi-national research projects, which can generate evidence for technology use for different purposes and in different situations. Each researcher is participating in one or more of the research projects but the results of these projects will benefit all the network members in addition to being widely disseminated outside the network. It was also decided that to enhance the impact of these projects, a number of cross-cutting issues (PCTAs) would need to be addressed. Following methodologies were used to develop these projects:

Selection of Research Projects: Research projects for PANACeA were developed during a workshop in Clarks Field, Philippines on Jan 30-Feb 1, 2007, where participants were invited from different Asian countries. During this workshop, participants developed several research projects from which eight were selected for further development. One AMT member was

assigned for each project to review the proposal and suggest necessary changes to make the project methodologically sound and robust.

Each research proposal has developed an initial research methodology to achieve their objectives that will be improved during the needs assessment period with the assistance of the AMT. Common conceptual and methodological principles in each project are the use of mixed methods (quantitative and qualitative research methods; evaluation research to identify and measure proximal, intermediate and to the extent possible distal health outcomes of the eHealth solution; focus on sustainability, particularly knowledge transfer and policy influence; examination of change management issues; and consideration and analysis of gender and socio-cultural factors.

Looking at the differences in gender inclusion and status of the population in different countries of Asia, it is important to include gender analysis as an important consideration for PANACeA. Each research project will be required to ensure that the benefit of their interventions reach both the genders, with more emphasis on women. Gender consideration would help in reducing digital divide by ensuring that the technology is used by both the genders to their benefit, and no one group takes undue benefit of advances in eHealth.

The projects have also put high emphasis on the end-users and the issues faced by them, rather than on introduction of high-tech devices and technology. The researchers will also try to make technology applications simple and useable for the end-users. This aspect will be especially considered during the needs-assessment phase to ensure that the simplest technology is chosen to address the health issues of a community. This consideration will also address the sustainability and replication of the projects in future.

Each project partner will obtain ethics approval from their own institutional or regional ethics committees. The project partners will themselves be responsible for implementation of research projects in their countries and manage the data.

The projects agreed on conducting a detailed needs and situation analysis in the first six months (Phase I), followed by two years of project implementation and research (Phase II). This will be followed by six months of evaluation and reporting (Phase III). Three workshops are planned during the course of the project to discuss project related issues and plans.

Results Achieved

The progress of PANACeA in the first year focused mainly on team-building and networking, and conducting needs assessment for the research projects. Progress seen in achieving each of the objectives is described below:

To support a set of multi-country research activities to address the four core research questions;

PANACeA made substantial progress in bringing researchers from different Asian countries to work together on the eight projects for building evidence in eHealth. The main purpose of involving multiple countries in the same research was to encourage knowledge sharing, test scalability, and ensure generalizability. Table 2 shows involvement of researchers in different projects.

Table 1: Table showing the eight research projects and the partners involved in these projects:

Projects	Partners
Economic Evaluation Framework Of Computerization In Hospitals	Dr. Haroon Khan (Pakistan)-Lead Dr. Alvin Marcelo (Philippines)-Co Lead Mr. Anees Alam-Afghanistan
Portable System for Telemedicine and Health Information in Rural and Remote Areas	Mr. Jayson Tan Boon Teck (Malaysia)-Lead Dr. Mohan Raj Pradhan (Nepal) Dr. Palitha Gunawardena (Sri Lanka) Ms. Shainoor Khoja (Afghanistan)
Improving maternal health care services by using ICTs for remote consultation and education	Dr. Amarsaikhan Dashtreen (Mongolia)-Lead Ms. Irma Saligumba (Philippines)
eHealth in Primary Health Care: Development and Validation of a framework for service providers	Dr. Prashanth NS (India) Lead Ms. Emilyne de Vera (Philippines) Co Lead Dr. Soegijardjo Soegijoko (Indonesia) Dr. Shabina Raza (Pakistan)
Intervention Research on eHealth for the Visually Challenged	Mr. Debobroto Chakraborty (Bangladesh) Lead Dr. Prashanth NS (India) - Ms. Emilyne de Vera (Philippines) Co Lead
Online TB Diagnostic Committees for Clinically Suspect Sputum Negative Patients in the TB-DOTS Program	Dr. Alvin Marcelo (Philippines)-Lead Dr. Zafar Fatmi (Pakistan)
A Systematic Review of Current ICT applications in Disasters: A potential for integrating TM	Dr. Soegijardjo Soegijoko (Indonesia) Lead Mr. Jai Ganesh (India) Co Lead Ms. Irma Saligumba (Philippines)
Community-based e-Health Promotion for Safe Motherhood: Linking Community Maternal Health Needs with Health Services System	Ms. Irma Saligumba (Philippines) Lead Dr. Soegijardjo Soegijoko (Indonesia) Dr. Shabina Raza (Pakistan)

To create a theoretical model for evaluating good practice in eHealth programs in Asia;

Each of the PANACeA research projects has adopted sound methodologies to conduct their research. These methodologies will form an important part of the model for evaluating eHealth programs, along with the outcomes selected for each intervention. The eHealth outcomes will be emphasized further through the PCTA, starting in year 2, and will be lead by Dr. Richard Scott.

To build research capacity amongst Asian researchers to evaluate and adopt appropriate e-health technologies and practices and influence policy and decision-makers;

Building research capacity of PANACeA partners is an ongoing objective of this initiative. Capacity building is targeted in two areas: i) Research techniques; and ii) eHealth. Informal learning in both these areas comes through regular discussions of research partners with their mentors, and among their own teams. Annual workshop in December 2007 in Kuala Lumpur was also used as an opportunity to enhance partners learning in research methodologies and eHealth technologies. This practice will continue in future as well. Knowledge in eHealth will also be enhanced through certificate program being initiated by University of Calgary by December 2008.

To disseminate research findings widely in the regional and international research communities;

Since, the first year focused on networking and needs assessment, this objective was not achieved to a greater extent. The concept of PANACeA and its objectives were presented at various meetings, such as: Universitas 21 meeting in Hong Kong in September 2007, Global knowledge III meeting in Kuala Lumpur in December 2007, Global eHealth meetings in Bellagio in August 2008, and Canadian Society of Telehealth meeting in Ottawa in October 2008.

Following publications were also used to achieve this objective:

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Improving Maternal Health Care Services by Using ICTs for Remote Consultation and Education

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Rationale/Research Questions

There are significant differences in the health issues affecting pregnant women throughout the world. The maternal mortality ratio (MMR) is up to 200 times higher in developing countries than in developed countries.

The underlying causes of maternal mortality are extremely complex – poverty, low income, low level of general education, lack of knowledge on health, and domestic violence all contribute to maternal mortality. Although there are many factors affecting health of rural Mongolian nomads, health services do play a critical role and can contribute significantly to reducing maternal mortality. The same can be said for women in the rural Philippines, where there are higher rates of maternal mortality: it is highest in the ARMM and Northern Mindanao, where it is between 200 to 300 deaths per 100,000 live births, while it is lowest in Metro Manila and Southern Luzon**.**

In Mongolia, ill-equipped rural facilities, weakened communications infrastructure, and underlying disease all contribute to high maternal mortality. In the Janes study, 70% of mortality cases were associated with an underlying disease. In this sample, the top 3 contributing factors to maternal mortality were: (1) poor antenatal care; (2) “inadequate skills” of doctor or midwife; and (3) long distance from medical care facilities.

This project is focused on improving health services for one of the most vulnerable social groups, pregnant women in rural communities. In Mongolia, these women are mostly nomadic or semi-nomadic, and poor. The situation in the Philippines is similar, with poor rural women most in need of improved health services.

Can teleconsultation of maternal health care for health providers reduce of MMR in rural areas?

Can e-learning assist to improve knowledge and clinical skills of midwives and medical doctors in rural areas

This research will have particular relevance to countries with high maternal mortality and disadvantaged rural populations. As such, this work will have both academic and practical relevance.

Technology/Intervention to Be Tested

Conceptual framework: There are two main aspects to the conceptual framework:(1) A decrease in maternal morbidity and mortality can be achieved through improved referral and antenatal care, and early detection of pregnancy-related risk factors; and (2) Computer-facilitated consultation can be used by rural physicians to improve antenatal services and to increase early detection of pregnancy-related risk factors.

Study Design/Methodology

This is a mixed methods study utilizing both qualitative and quantitative methodologies.

Study sites:

- 2 intervention communities: Mongolia - Gobi-Altai and Govisumber provinces; Philippines - Quezon, Quezon and Kasibu, Nueva Vizcaya.
- 2 control communities: Mongolia – Dornogobi and Selenge provinces in Mongolia and Perez, Quezon, Nueva Vizcaya in Philippines

In this project, the intervention communities will be provided with teleconsultation facilities and associated training. Control communities will not be provided with teleconsultation facilities and associated training, and will be matched to intervention communities based on the following characteristics: maternal mortality indicators, population numbers, and region. These will be the KAP Questionnaire (it will be pre-tested), plus focus group discussions and interviews using semi-structured guides. Please refer to the focus group discussion guide and KAP questionnaire.

Study population

Direct users will be medical professionals who provide pregnant women with maternal health services; indirect users will be pregnant women who use the maternal health services. Data will be collected from both direct and indirect groups.

Data collection

The 3 types of data to be collected in this project are:

(1) *Survey Data*. KAP (Knowledge, Attitude, and Practice)

(2) In-depth, semi-structured interviews with rural health professionals and interviews with pregnant mothers. Specially targeted direct group

interviews will be conducted as a part of the initial needs assessment, and again after deployment as a part of the formative evaluation process.

(3) Pregnancy-related health statistics. Historical baseline data will be collected in the intervention and control municipalities / soums. During the implementation phase of the study, these data will continue to be collected for comparative purposes. Additionally, detailed system usage data will be logged at the municipalities/soums and province/aimag levels.

Data analysis

Given the national declining trend in maternal mortality over the past years in both the Philippines and Mongolia, it will be necessary to select control municipalities/soums for data comparison. It is expected that, in the absence of ICT-enabled education, maternal mortality and morbidity will continue to decrease, albeit slowly. The control municipalities/soums will be used for comparing data from the KAP survey and from the maternal health indicators. Qualitative interviewing will only take place in intervention municipalities/soums. Statistical significance testing will be used to compare KAP scores and maternal health indicators from intervention and control municipalities/soums. The data will analyzed by using SPSS 14, providing descriptive statistics, correlations, and Chi square tests.

Major Outputs/Outcome

(1) Improvement in the delivery of health care services at the primary and secondary level, (2) Reduction in the maternal morbidity, (3) Reduction in the maternal mortality

Results of the Project Will Be Presented in the Following Four Ways:

1. Presenting findings in international, peer-reviewed journals and conferences.
2. Two national seminars, to discuss the most recent results of the project and policy implications. These national seminars will involve stakeholders from the selected provinces, as well as decision-makers at the national level.
3. Meetings between partner organizations in the Philippines and Mongolia. Meetings will be held remotely on a quarterly basis. A single face-to-face meeting will be held at the halfway point of the project.
4. Developing and maintaining a project website.

Online TB Diagnosis (SS-ve) to Improve Case Detection in the TB-DOTS Program

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Introduction

Tuberculosis (TB) is a curable disease that kills two million people every year. In Asia TB is the leading cause of death among infectious diseases. The inability of health systems to screen people before they develop active TB largely accounts for system delay. Problems with the quality of services range from poor interpersonal communication of health care providers to infrastructural deficits.

Rationale

1. To measure the sensitivity and specificity of face-to-face TBDC (Tuberculosis Diagnostic committees) online TBDC against a gold standard (TB culture)
2. To compare the consensus statements of the face-to-face TBDC with that of the online TBDC
3. To compare the presentation-to-decision time lapse of the online TBDC with that of face-to-face TBDC
4. To enumerate the social determinants that influences the TB diagnostic committees.

This study intends to test following interventions:

- Is an online method of diagnosing clinically positive but sputum negative TB patients as accurate as the conventional face-to-face method? (accuracy study)
- Is an online method more efficient than the conventional face-to-face method? (operations study + cost-benefit analysis)

Answers to these questions will be answered in the Philippines primarily and in India, and Pakistan secondarily.

Methodology

The technical aspect of this study is divided into two:

1. An accuracy study: TB Consultant or Pulmonologists will be given a chance to diagnose known cases using the face-to-face (F2F) method

and the online method. The chosen gold standard is TB culture.

2. An operations research study: The efficiency of the face-to-face TB diagnosis by TB Consultant will be compared to that of the online TB diagnosis by pulmonologist through a prospective controlled trial

Social Aspect-*Context Analysis:*

1. The delay in diagnosis of patients with TB subject to the evaluation of the city or provincial TB diagnostic committee can be understood from an ecological framework describing factors that act upon the individual, interpersonal, organizational, community and government levels.
2. Introducing a technology solution to address specific health issues cannot be successful by itself alone. This research is based on the premise that approaching the problem from an ecological perspective, recognizing and introducing steps that address social issues – at individual, interpersonal, organizational, community and government/ policy levels should be embarked on in order to sustain the posited benefits of a technology-based innovation.

Output

- Situational Analysis: Qualitative research data describing the socio-cultural context using an ecological framework
  - Gender analysis of TB patients and TB services
  - Cost benefit analysis of face-to-face and online TB services
  - Feedback from stakeholders
  - Plans for implementation of improvements based situational analysis
  - Process documentation of outcomes of initial implementation of improvements
- Web portal
- Training program (including Training Manual)
- Time motion data on online and F2F groups
- Evidence showing that online TB diagnosis is faster, cheaper, and as accurate as F2F TB diagnosis
- Dissemination of project results through relevant forums

Outcomes

- Systems to improve aspects of socio-cultural context of TB services, including gender-fairness, in place;
- Policy to implement systems to improve aspects of socio-cultural context of TB services, including gender-fairness, discussed and articulated;

- On-line TB diagnosis as a preferred methodology practiced among target TB physicians;
- Possible policy to scale up on-line TB diagnosis discussed, drafted.

About the Author

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Portable System for Telehealth and Health Informatics in Rural & Remote Areas

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Rationale

Malaysia, Nepal and Sri Lanka still have large areas of the country without broadband telecommunication coverage. The health care workers are unable to utilize tools that could make use of the high bandwidths available to their counterparts in the urban environment. The advances in technology have brought down the price of smart phones to affordable levels.

Technology/intervention to be tested:

The intervention consists of adapting a client server based Electronic Medical Records System (EMR) to use narrowband cellular telecommunication (GPRS).

Study Design

The study design would be a **Pretest-posttest comparison**. Each of the three countries will have at the minimum one experimental/intervention site and one control site (without any intervention).

All the relevant statistics would be collected from the participating test sites before the commencement of the tests. Pre-test opinions will be obtained from the stakeholders using questionnaires, to obtain their views and feelings on the *status quo*.

After the one-year test is completed, the statistics of the same parameters will be collected for comparisons and analysis. The data can be obtained by data mining the application servers. Post-test feedback from the stakeholders, using questionnaires will provide the qualitative results of the research.

Depending on the health departments of the countries involved in the testing, comparisons with control sites i.e. without the intervention would be used where possible. Post-test parameters will also be collected before

the commencement and after the completion of the tests, to ascertain the correlation of the outcomes due to the intervention made.

Major Outputs and Outcomes

The outcomes the research *inter alia* is targeting are:

- Reduce the mortality rate of children under 5 (MDG 4);
- Improve maternal health - reduce maternal mortality ratio and achieve universal access to reproductive health (MDG 5);
- Reduce the communication delays in reporting communicable diseases.

As the testing phase for the research is only for duration of 12 months, outcomes for the medium and long term cannot be determined effectively.

Anticipated Results/Benefits

The project was designed to be replicated beyond the research countries, as a cost effective solution for nations that do not have extensive broadband coverage (such as 3G networks). It rides upon the convergence of the latest ICT technologies - utilizing the ubiquitous smart phones, which is affordable, making it viable even in the poor countries.

Role of eHealth at Primary Health Care: Development and Implementation of a Framework: Piloting in Four Asian Settings

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Rationale

The basic functional unit of the public health care delivery system in the member countries (India, Indonesia, Pakistan and the Philippines), is primary health care. This includes curative, preventive, promotive and rehabilitative components. The delivery points (variously called Primary Health Centres – PHCs, or Basic Health Units – BHUs etc.) are plagued with various issues leading to poor service delivery and access. This impacts the whole community in general and leads to poor quality of care in rural areas where these centres operate. This is further compounded by the disparity in 'technology' solutions between urban and rural areas and many e-health solutions presently focus on tertiary care/hospital management rather than primary health care.

This research is being introduced in four resource limited countries simultaneously and will help identify those gaps which have to be dealt with before introducing an eHealth application. The four countries identified are India, Indonesia, Pakistan and the Philippines. These countries are in various states of health care delivery and the challenge faced by this research project is to incorporate these differences and still identify a common tool that can be used by health administrators, policy makers and international donors.

The two research questions are:

- How eHealth can improve Primary Health Centre activities – processes, outputs and outcomes
- What are the barriers/gaps for implementation of eHealth at PHC?

Methodology

An initial Needs Assessment phase identified field sites for implementation in 4 countries.

A Facility survey & Focus Group Discussion to document existing health care delivery structure, gaps in service delivery and attitudes/perceptions towards eHealth in Primary Health Centers (PHCs) will be undertaken. A detailed literature survey of scientific and grey literature to understand experiences with eHealth in primary health care in developing country settings will be undertaken. An eHealth intervention identified based on the facility survey and FGD for 10 PHC locations in India, Indonesia, Pakistan and Philippines will be implemented. eHealth readiness of all the PHCs will be assessed before the intervention. A pre-post study at each site will enable us to understand the impact of the intervention. The analysis of the pre-post study and the detailed literature survey will be used to build a framework putting together in a matrix the possible eHealth interventions and the evidence available to help decide on appropriateness of the intervention for that component of service in primary health care.

Outputs

1. Number of Trainings/orientations sessions held of primary care providers on basic computer applications, data management and health information systems;
2. During the implementation phase leaflets/booklets to be brought out to raise awareness about the role of e-health in a primary health care setting;
3. Installation of number of computers in implementation sites with hands on training and troubleshooting skills;
4. Data management tools/software for day to day administration activities in primary health care setting;
5. Validated tool to assess ehealth needs at primary health care level;
6. A comprehensive framework identifying gaps at primary health care level.

Anticipated results/ benefits

1. Change in attitude and perceptions of primary health care staff regarding eHealth;
2. A good referral systems/networks for e-consultation;
3. Health management information systems at primary health care level for data management and day to day administration.

Major outputs

The following three major outputs have been identified

- A tool to identify eHealth needs at the primary health care level in developing country settings
- Training and orientation of PHC staff on role of eHealth
- Testing of four interventions in PHCs in the partner countries

Anticipated Results/benefits

One of the major outputs of the study will be the development of a framework to identify eHealth interventions based on evidence as well as appropriateness. The tool will be tested for face validity and internal validity and reliability. The tool will be based both on evidence gleaned through literature as well as direct experience through evaluating the interventions. The FGD with service providers in four developing country settings will also help improve the identification of appropriate technology solutions through the framework.

The study will also produce important learning about four different context-specific interventions implemented in partner country PHCs. The staff at the PHC will be trained in implementing the intervention. The study will be important at two levels. At the micro level, the development of the tool to identify appropriate eHealth intervention at primary health care level will be an important tool for PHC practitioners, doctors, district health program managers and the like. At the macro level, the study will be one of the first inter-country studies looking objectively at eHealth interventions in primary health care without assuming automatic improvement in service delivery by mere technological packages.

What Can eHealth Do for Visually Challenged Population: An Intervention Study

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Rationale

Clinical health information and services currently available for visually challenged individuals in Bangladesh, India and the Philippines are limited. This study aims to examine, analyze, and derive evidence with respect to the challenges arising as a result of the absence of clinically relevant information and services to meet the health needs of the visually challenged people of Bangladesh, India and Philippines. Specifically the study aims to: identify priority health issues faced by the visually challenged individuals and the current health programs and services available to meet them; to design and evaluate strategies and programs that can deliver the greatest health benefits to the blind population; to implement three (3) clinical trials/pilot interventions and analyze factors influencing eHealth accessibility and utility by the visually challenged patients and the health professionals; and to use all research findings to make recommendations on the planning, design and implementation of eHealth interventions for the visually challenged population of both countries. The project attempts to address the following research questions.

Research Questions

i. What are the three (3) priority health needs of the visually challenged people of Bangladesh, India and Philippines according to the people themselves?

ii. With respect to the three (3) priority health needs identified in each country, what are the existing traditional health solutions available to address them?

iii. Is there any existing eHealth solution available (nationally and globally) to address the priority health needs identified in Bangladesh, India and Philippines? If so, how relevant, reliable and affordable are these solutions to the context of these three countries?

iv. With respect to the three priority health needs identified in each country, what kind of eHealth intervention can be designed for the project sites?

v. How does the introduction of new eHealth applications into an existing service delivery system for this priority health need effect on acceptability and quality of life of its beneficiaries?

Technology/Intervention to be tested

Technology to be tested under the project is yet to be defined. Out of the twenty (20) month project duration, first four (4) months will be spent to identify the priority health needs of the study subjects. Based on these identified needs, one (1) eHealth amenable health needs will be identified at each intervention site. Then the project will review existing ICTs/ eHealth interventions/innovations practiced nationally/globally that can be utilized to address the identified eHealth amenable health need and design country specific pilot interventions.

Study Design/Methodology

Due to the absence of baseline data regarding health service provided to the visually impaired, contributing factors and operational definitions of variables, an exploratory mix method (qualitative and quantitative) study type is proposed for the particular research. In addition, considering the action-oriented nature of a pilot intervention, the study type can be further defined as an 'intervention study'. It employs a mixed method approach for data collection using mainly individual interviews, FGDs and secondary literature review. The research will be focused on young and adolescent girls and boys falling within the age group twelve (12) – twenty four (24) years. Justification behind selecting this age group is, this group is more receptive to changes and more likely to require services. Visually challenged subjects of this age group are more vulnerable, dependent on external support and have less access to quality health care services. In Bangladesh and Philippines, subjects will be selected from a captive group. This group will come from blind schools and colleges, NGOs, hospital/clinics and other government/non-government institutes. In India, subjects will come from primary health care units. The study will be further limited within subjects who are completely visually challenged (total blindness – both congenital and acquired). Here complete blindness is divided into those who were blind before one year of age and those who developed complete blindness before the last five years.

Research site: Bangladesh (Dhaka City), Philippines (Metro Manila), India (Mysore district)

Implementation Plan

Planned Activities	Duration	Timeline
Survey and literature review	3 months	March – May, 09
Data compilation, analysis and reporting	1 month	June 09
Project design	1 month	July 09
Pre-test (including data compilation, analysis and reporting)	2 months	August – September, 09
Intervention (with mid-term evaluation within)	9 months	October 09 – June 2010
Post test	2 months	July – August, 2010
Data compilation, analysis and final reporting	1 month	September, 2010
Final evaluation and results dissemination	3 month	Dec, 2010
Total Project Duration	**22 Months**	**March 2009 – December 2010**

Major Outputs/Outcomes

- Understanding of context specific priority needs of visually challenged people and documented evidence.
- Evidence of success or failure of context specific eHealth intervention
- Improved knowledge base of evidence based and clinically relevant eHealth applications for visually challenged population

Anticipated Results/Benefits

- A list of three (03) priority health needs of the Visually Challenged (VC) study group of Bangladesh, India and Philippines identified.
- One (01) priority eHealth amenable health need of the VC study group of Bangladesh, India and Philippines identified.
- Level of awareness of assistive and health technology among the VC study group and care givers; realized and documented.
- To which extent the existing eHealth interventions cover the identified eHealth amenable priority health need realized and documented.
- Context specific eHealth interventions for prioritized health needs designed and deployed.
- Prevalent condition of the visually challenged people of project location understood and documented
- Acceptability and effectiveness of newly introduced eHealth applications to it’s beneficiaries will be revealed and documented.

- Knowledge, attitude and practice towards eHealth of caregivers and service providers of study subjects increased.
- Change in quality of life after eHealth intervention assessed and evidence documented.

Session 19

eHealth in Support of Mental Health

Evaluation of Internet Addiction and Depression by Telepsychiatry

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Abstract: **The aim of the study was to evaluate the relationship between depression and Internet addiction (IA) by Telepsychiatry service. METHODS: A total of 80 Bosnian clients were studied. Internet Addiction Test (IAT), Beck Depression Inventory (BDI), and the Zung Depression Inventory (ZDI) was used, by Telepsychiatry service, to assess state measures of symptom severity. First, they were evaluated for their severity of Internet addiction with consideration of their behavioral characteristics and their primary purpose for computer use by IAT. Second, we investigated Depression by Telepsychiatry service with BDI and ZDI scale. Third, we investigated correlations between depression and Internet addiction. RESULTS: The symptoms of IA had been founded at 47(58.75%) and 33(41.25 %) of patients had no IA. Symptoms of depression had been found at 36(45.00 %) patients. Internet addiction was significantly associated with depressive symptoms; IA and depression had been found at 33(41.25 %) patients (P<0.01).CONCLUSIONS: This study reveals a significant association between Internet addiction and depressive symptoms. The data suggest the necessity of the continued examination, evaluation and follow-up evolution of IA by Telepsychiatry service of the potential underlying depression in the treatment of IA.**

Background

With the growing importance of the Internet in everyday life, more and more people are accessing various on-line resources each day. The World Wide Web is informative, convenient, resourceful, fun, but also pottentially way for internet addiction.Specially computer-internet addiction is a combination of signs and symptoms that fit a dependency model, an impulse control disorder model, and are often co morbid with other psychiatric diagnoses. This behavior has variously been called Internet addiction, pathological Internet use, problematic Internet use, and a mere symptom of other disorders. Telepsychiatry and e-mental health services primarily involve videoconferencing over high speed (broadband) networks

to enable natural interactions between patients and providers. The term "telepsychiatry" refers to the use of telecommunication technologies with the aim of providing psychiatric services from a distance TELEPSYCHIATRY, AS A BRANCH OF TELEMEDICINE, MAY BE DEFINED AS THE DELIVERY OF PSYCHIATRIC TREATMENT REMOTELY, USING LIVE TWO-WAY VIDEO-TELECONFERENCING EQUIPMENT.Psychiatric treatment via telepsychiatry can be as effective as when delivered during traditional outpatient appointments. In the past, these services have been offered primarily by large academic centers due to the enormous cost of setting up bulky and expensive telepsychiatry equipment in remote locations. Today, the equipment necessary for high quality live two-way video-teleconferencing is available in a laptop computer, thereby allowing for a level of convenience, efficiency, and privacy unmatched in traditional outpatient psychiatric treatment.

Services for telepsychiatry provided include: Mental health Consultation services, Medication Review, Follow-Up Visits to Monitor Patient Progress, Individual and Family Therapy, Emergency Consultation, Patient Care, Medication management without travel, Employee Assistance Program. Telepsychiatry offers professional medication management for depression, anxiety, addiction, and other forms of mental illness. Patients access the physician - from home, using home-based video-teleconferencing equipment and software, such as Skype for PC or iChat AV for Mac OS X. Internet addiction is currently classified by mental health professionals as an Obsessive Compulsive Disorder (OCD), a mild to severe mental health condition that results in an urge to engage in ritualistic thoughts and behavior, such as excessive hand washing or, in the case of the Internet, Web surfing. The aim of the study was to evaluate the relationship between depression and Internet addiction (IA) by Telepsychiatry service. We suggests that 'internet addiction' a serious public health issue despite the fact that no-one yet has suggested anything that uniquely distinguishes it from its use as a tool or a source of entertainment. Here are the components as evidence that someone can become addicted to the internet: 1) *excessive use*, often associated with a loss of sense of time or a neglect of basic drives, 2) *withdrawal*, including feelings of anger, tension, and/or depression when the computer is inaccessible, 3) *tolerance*, including the need for better computer equipment, more software, or more hours of use, and 4) *negative repercussions*, including arguments, lying, poor achievement, social isolation, and fatigue Apart from the fact that these and most other supposed criteria make no distinction between using the internet and what the person is using the internet for, it's easy to see that they don't describe anything unique to the net. In fact, 'internet addiction', however it

is defined, is associated with depression and We found this to be a causal connection. In one side, fact that only longitudinal studies on the general population found that internet use is generally associated with positive effects on communication, social involvement, e.t.c.In other side, the internet is a communication tool and people use it manage their emotional states, like they do with any other technology. Of course there are some people who are depressed who use the internet.

Methods

A total of 80 Bosnian clients were studied. Internet Addiction Test (IAT), Beck Depression Inventory (BDI), and the Zung Depression Inventory (ZDI) were used, by Telepsychiatry service, to assess state measures of symptom severity. Internet addiction is not recognized as a formal mental health disorder. However, mental health professionals who have written about the subject note symptoms or behaviors that, when present in sufficient numbers, may indicate problematic use. These include: Preoccupation with the Internet: User often thinks about the Internet while he or she is offline. Loss of control: Addicted users feel unable or unwilling to get up from the computer and walk away. They sit down to check e-mail or look up a bit of information, and end up staying online for hours. Inexplicable sadness or moodiness when not online: Dependency on any substance often causes mood-altering side effects when the addicted user is separated from the substance on which he or she depends. Distraction (Using the Internet as an anti-depressant): One common symptom of many Internet addicts is the compulsion to cheer one's self up by surfing the Web. Dishonesty in regard to Internet use: Addicts may end up lying to employers or family members about the amount of time they spend online, or find other ways to conceal the depth of their involvement with the Internet. Loss of boundaries or inhibitions: While this often pertains to romantic or sexual boundaries, such as sharing sexual fantasies online or participating in cyber sex, inhibitions can also be financial or social. Online gambling sites can cause addicts to blow more money than they would in a real-life casino because users never actually see their money won or lost, so it is easier to believe the money is not real. Chat rooms can incite users to reveal secrets they would not reveal in face-to-face or phone conversations because of the same separation from reality. Also, addicted users are much more likely to commit crimes while online (e.g., 'hacking') than non-addicts. Creation of virtual intimate relationships with other Internet users: Web-based relationships often cause those involved to spend excessive amounts of time online, attempting to make connections and date around the Net. Loss of a significant relationship_due to Internet use: When users spend too much

time on the Web, they often neglect their personal relationships. Over time, such relationships may fail as partners simply refuse to be treated badly and break off from relations with the addicted individual. First, they were evaluated for their severity of Internet addiction with consideration of their behavioral characteristics and their primary purpose for computer use by IAT. Second, we investigated Depression by Telepsychiatry service with BDI and ZDI scale. Third, we investigated correlations between depression and Internet addiction.

Results

The symptoms of IA had been founded at 47 (58.75%) and 33 (41.25 %) of patients had no IA. Symptoms of depression had been found at 36 (45.00 %) patients. Internet addiction was significantly associated with depressive symptoms; IA and depression had been found at 33 (41.25 %) patients ($P<0.01$).

Discussion

As noted with other addictive disorders, our findings suggest that increased levels of depression are associated with those who become addicted to the Internet. This suggests that clinical depression is significantly associated with increased levels of personal Internet use. CONCLUSIONS: This study reveals a significant association between Internet addiction and depressive symptoms. The data suggest the necessity of the continued examination, evaluation and follow-up evolution of IA by Telepsychiatry service of the potential underlying depression in the treatment of IA.

Research in the addictions field has shown also that psychiatric illnesses such as depression are often associated with other drug addiction.

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Locus of Control and Clients' Attitudes Towards Virtual Psychological Consultations

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The presentation focuses on results of a survey addressing the influence of locus of control at clients' attitudes towards Internet psychological consultations. It is a part of ongoing project OHN 1514/2005, funded by National Science Fund, Bulgaria.

Locus of Control is considered to be an important aspect of personality. It refers to an individual's perception about the underlying main causes of events in our life and may significantly influence our decisions. Locus of control is conceptualised as referring to a unidimensional continuum, ranging from external to internal.

Locus of control shapes individual healht decisions and choices. That's why all information about localization of control and attitude towards psychology concelling is of extreme practical importance.

The objective of this presentation is to report how internal and external locus of control changed clients' attitude towards virtual psychology care, toward various communication channels, reimbursement of consultations, etc. Data are based on survey conducted September – November 2008. Locus of control personality test to assess the extent to which an individual possesses internal or external reinforcement beliefs was applied.

Keywords: locus of control, e-psychology, remote consultations

Personalised Ambient Monitoring (PAM) for People with Bipolar Disorder

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Abstract: **This paper presents the architecture and preliminary trial results of a monitoring system for patients with bipolar disorder containing environmental and wearable sensors.**

Introduction

Almost 2% of the UK population have bipolar disorder, a group who, in their lifetime, will typically go through several episodes of manic or depressive behaviour. During such episodes a person's lifestyle and behaviour can change both rapidly and markedly leading to serious consequences. Many such people have well-developed self–awareness that is an important factor in the management of this condition with early recognition of symptoms of particular importance. If formalised, such assessment is usually diary based although PDA-based implementations are now also becoming available.

The aim of the Personalised Ambient Monitoring (PAM) project is to develop a support platform for people suffering from bipolar disorder. This platform will help patients to self monitor their mental state and also provide their care providers with accurate and informative data without compromising their privacy (at a mutually and previously agreed level.). Key research areas of the projects are: the development of a flexible sensor network providing data about patients' activities and behaviour; algorithms to process such data that can detect changes in patterns characterising a given patient; software to integrate these elements into a flexible platform alerting patient's clinicians and carers; and models of the above in relation to a sufferers mental health in order to assess the information content of the data collected and optimise the healthcare provision [1].

A flexible sensor network able to monitor activities that can be highly affected by bipolar disorder is key to the project. Requirements of these sensors are that they must not compromise patients' privacy and must be simple, both to implement and to use. The sensors can be divided into two groups: wearable and environmental. Decisions on the types of sensor to be

deployed were made following discussion with a clinical psychologist and other experts in this field. The first group includes those carried by the patient throughout the day (e.g. location, activity, audio environment sensors). A component of this class is a mobile phone used as a sensor, data logger and communications channel. The second comprises ambient sensing units incorporated into the patients' home environments (to monitor audio environment, movement within the home, electrical appliance usage etc.).

This paper will present the sensor configurations used in the preliminary technical trial of PAM on volunteers with no history of bipolar disorder, along with the results obtained.

Sensor configurations

As described before, the target sensor configuration can be divided into two main groups: wearable and environmental. Sensors for both groups were selected based on their possible effectiveness in detecting activity changes in areas known to be influenced during the course of bipolar disorder (e.g. bed occupancy sensor for detecting lack of sleep in both depressive and manic episodes [2]). The following paragraphs describe sensors selected for the preliminary trial in both groups.

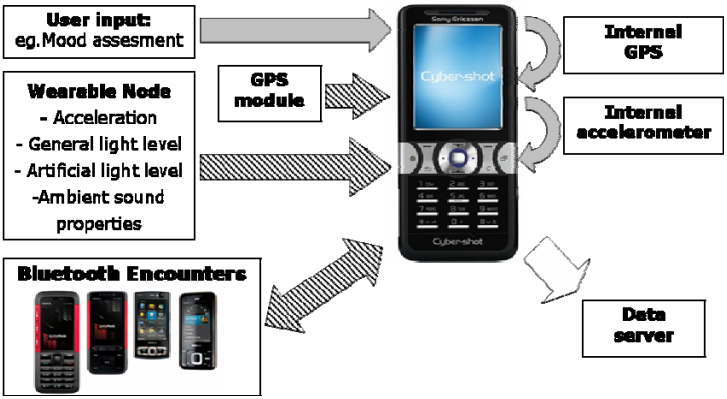

Figure 1 Wearable sensor set (Bluetooth links are shown with striped arrows).

Wearable sensors

As seen in fig. 1, the main element of the wearable sensor set is a mobile phone a common appliance capable of: connecting to local RF devices using Bluetooth; processing data streams; and transmitting data packets

using protocols such as GPRS or HSDPA. This functionality is accessible even in mid-range phones from all suppliers. Additionally, depending on the device, a mobile phone can give access to internal resources that could be utilised as a sensor input for monitoring activity (e.g. built in GPS or tilt-sensing accelerometer). The mobile phone used for Personalised Ambient Monitoring is equipped with an application operating in the background which performs communication with other wearable devices, implements pop up self-assessment questionnaires and if needed can perform basic processing on incoming data prior to storage. Additionally it performs scans for other Bluetooth-enabled devices in range (especially other mobiles) which can correlate with the current social environment [3]. In order to maximise compatibility the application was developed using universal Java interface which should work on all Java-enabled phones, regardless of brand.

Using the phone as a processing and storage node resulted in utilising Bluetooth as a main wireless connectivity standard for the other wearable devices used in the design. These are: an off-the-shelf GPS unit (which is an option for phones without built-in GPS module) and a custom made belt-worn device that incorporates a microphone acquiring basic features of ambient sound (e.g. zero crossing rate) that it is possible to process to infer the profile of surrounding environment [4]. Another sensor included is a light detector able to determine both ambient light level and whether it is from a natural source. The device also incorporates a three axis accelerometer for monitoring users' activity [5].

Environmental Sensors

The second group of sensors selected for the technical trial consist of mostly off-the-shelf devices for indoor monitoring. The list includes: Passive Infra-Red motion detectors, wall-mounted camera, bed occupancy mat, and a custom made set top device with sensors for monitoring light levels, ambient sound (as in the wearable unit) and additionally appliance remote control activity.

Initial experiment

During the initial testing particular parts of the system were tested on volunteers with no history of bipolar disorder, the aim being to validate the technology before the full trials.

For preliminary tests the participant carried some or all components of the wearable set during the day with sensor data recorded on the phone. The emphasis of this initial trial concerned the reliability of the sensors,

suitability for long-term monitoring (including operating duration) and their acceptance by the users

Discussion

The tests showed that system is reliable and can provide all-day activity monitoring. Despite increased power consumption, due to maintaining Bluetooth connections, it is possible to use the mobile phone on a normal basis recharging it approximately every 24 hours. Even simple combinations of results (e.g. Bluetooth encounters with position record) show emerging patterns which is promising for further tests and research.

Future work will focus on further integration of platform elements, capturing behaviour patterns from acquired data and attempting to build a reliable model of the conditions progression. Software will be enhanced using a dynamic rule engine to enable firmware changes without supervision and reprogramming of the whole system.

Acknowledgment

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About the Author

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Preliminary Evaluations of Internet-based System for e-Psychology Applications in Indonesia

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Abstract: **This paper describes the development and preliminary evaluations of different types of PC-based systems for e-psychology applications in Indonesia. Among e-psychology applications are preliminary psychology consultations, general consultations, educational related consultations, and distance consultations in psychology.**

Introduction

e-Psychology (also called Cyber-Psychology, e-Psychology, Tele-Psychology, Virtual Psychology) is a relatively new area that applies electronics, computer, information, and telecommunication technology (which is usually known as ICT, Information and Communication Technology), for the psychological information exchange (in the form of alphanumeric text, audio, static and/or dynamic images), for the purpose of information collection, consultation, analysis, diagnosis and/or treatment purposes in psychology.

In e-psychology, where remote location does not necessarily involved, it may consist of psychological information collection, such as "history taking", data collection and analysis. Relatively simple PC-based system with the required software (but without any telecommunication infrastructure) can be used for this particular case.

e-Psychology can also be considered as an alternative of the existing telephone counseling. In simple terms, counseling by telephone may be defined as a service whereby a trained counselor works with a client, or a group of clients, by telephone, to enable the client(s) to explore personal situations, problems or crises in a one-off or in an on-going longer term therapeutic relationship [1]. In general tele-psychology, where remote distance is involved, a more complex tele-health system will be required to provide the psychological information exchange between at least two different PC-based systems through a telecommunication infrastructure.

Stand Alone PC-based System

The PC-based system is basically consists of a general purpose PC with a specially developed software package installed, that depends on the intended applications. For a specific application, such as “history taking” or preliminary consultation, a dedicated software package could be developed. A student working with the PC that has the installed software package could complete/answer a series of questions (or questionnaire) at a given time. The person (or client) involved should identified manually, before she or he is allowed to start the “e-psychology session”. In this case, the psychological information consists mostly of “alphanumeric texts”. Being a pre-recorded type of an e-psychology system, the completed questionnaire will then be evaluated by a psychologist at another time.

e-mail consultations were also used at first, however the time delay sometimes resulted in the frustration of the clients. This may cause premature terminations of the clients. These lead to internet-based on-line text communications. In this research, we use open source internet software, which are facebook© chat and Yahoo! ® messenger.

System Configuration

A simple e-Psychology internet-based system (Fig.1) is basically composed of a number of “PC-based e-psychology stations” inter-connected through the internet. Each e-psychology station consists of a PC with the required general purpose software packages, an internet telecommunication interface (such as ADSL modem, dial-up modem, GSM modem, GPRS), a head-set and a webcam. Since the e-psychology is relatively new in Indonesia, only limited applications have been examined using mobile phone, pre-recorded text communications (e-mail, e-mail and attached files), on-line text communications (chat sessions) and on-line audio visual communications (using audio, or audio and images).

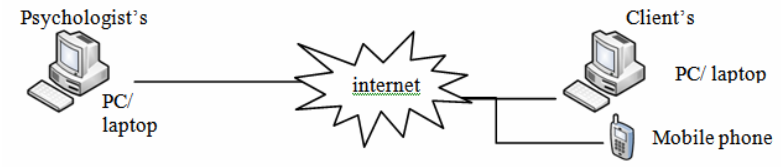

Fig. 1 Block diagram of the e-Psychology internet-based system

Basic Application Examples and Experimental Results

Four e-psychology remote consultations will be highlighted in this experiment: one was using facebook© chat and three others were using Yahoo!® messenger. Among those, one was using a PC and dial-up modem, two were using laptops (both were using GSM modem connections), one was using cell phone GPRS. The clients are in the age of 18-25 years old, university students or university graduates. The consultations were initiated by the clients according to the accessible media at the time being. Three were consulting on personal problems, and the other one was on an academic problem.

The general phases in each session were the problem statement phase with lots of inquiry and probing, discussion for solution phase, and closing/termination phase.

In all cases, we found that the tensions were reduced after the clients stated their feelings related to their own problems. One even ended the session before getting a solution, as the client said that she was already felt relieved, and this was what she wanted.

One important thing to consider is that all four clients are acquainted with the counselor. Trust has been built, as well as the rapport between the counselor and the clients. This condition was beneficial for the counseling process. Different process may happen in anonymous consultations. Another thing we should note is that as they are university students, they are familiar with computers, internet, and they have the necessary typing skills. This could be a problem for other people; however it can be eliminated by using head-sets and web cameras.

Evaluation

The system requires some improvements for future application. There were some common problems which occurred during online chat were the delays due to typing speed, typographic errors and misinterpretation of messages/sentences due to lack of proper punctuations, or the use of slang. However, these could be solved and anticipated by doing some adequate inquiry, probing, and perception checking from time to time. An advantage that was discovered from the online chat sessions was the possibility to post links via facebook© chat and Yahoo!® messenger. This could provide the client with references, other than just information from the counselor. Another advantage from the use of certain version of Yahoo!® messenger is that it provides emoticon which sometimes useful for the clients to express their emotions.

Head-sets and web cameras have not been used much, due to the internet connections speed and quality. Usually clients prefer telephone lines or

mobile phones if they need to speak, however this is rather expensive. Internet was more economical, therefore clients prefer chatting.

Conclusion

Although only limited number of experiments has been evaluated, encouraging results have been achieved. More people are getting more familiar with the internet; therefore e-Psychology is an option worth considering. The positive evaluation results suggest further improvements on the ICT-based system as well as the application procedures. It is expected that e-Psychology could be further developed and implemented in Indonesia, where conventional face to face method is not always possible.

Acknowledgment

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Session 20

eHealth Solutions for Home Care

Home Health "Technocare": Transforming Home in Hospital?

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Abstract: **Home health care is creating a lot of interest among the different actors of our health care system (patients, families, professionals and the society). They all consider they can benefit from it. Technologies are becoming increasingly important in home health care. It is therefore necessary to fully evaluate the implications of such changes in habits. The aim of this article is to address some issues related to these developments.**

Introduction

The development of home health care is growing thanks to the interest of all actors in our health care system, who thinks they can benefit from it. The increasing use and degree of complexity in technologies used for health care at home lead us to distinguish simple traditional medical home care and sophisticated home technocare.

The notion of home health care

The variety of home health care

Different categories of patients can benefit from staying at home and getting medical care (patients with chronic diseases, patients in recovery after an operation, elderly people,…). Those medical cares take different forms such as visits by health professionals or use of technologies in different levels of sophistication (the use of thermometer is considered as low-tech technology while parenteral treatment is high-tech device).

Differences between health care at home and at the hospital

At first sight, we can differentiate health care at home and at the hospital by the following elements : the place where the care is performed, the identity of the care provider (who is professional or not), the way the care is given and received (at home, the patient is in control of everything while at the hospital he has to adapt himself to the organisation of the hospital), and the way decisions are made (at home, the decision-making capacity can be shared by family members and professionals while, at the hospital, only trained professional take decisions). It seems however important to

understand that these differences tend to disappear and that health care at home and at the hospital are becoming increasingly similar.

Meaning of "home" and "hospital"

What makes a house a home and why do people want to stay at home to get health care?

"Home" is a complex notion with various meanings. Legally it is the place where an individual has his principal establishment (Civil Code, art. 102) and is protected against arbitrary interference (Universal Declaration of Human Rights, art. 12). In the reality, it is commonly conceived as a place of intimacy, integrity, security, independence and comfort and a place where the person is in control of everything. The home is also a "private" place shared with the person's family (spouse, children,…).

"Hospital" is a public or collective place where experts provide secured health care in infrastructures specially designed for it. However, hospital is often perceived negatively: it is an unknown, impersonal place, which is a breach from everyday life, where the patient has no control and finally a place where everything reminds you that you are a sick person.

Factors contributing to the development of home health care

First, it is usually assumed that home health care can decrease overall costs by reducing the frequency and the length of hospitalisations. However, one must add that the reduction of costs comes partly from the fact that care is provided by family members and not by paid professionals.

Secondly, we can observe the development of long-term care: the population is ageing and chronic diseases become more frequent, which means that care has to be provided daily and during the whole patient's life.

Third, our health care system becomes more patient-centred: his desires and wishes (such as improvement in the comfort and quality of life by getting care at home and a more active participation to the management of his health) are more taken into consideration.

Technological developments are a fourth element: they permit the creation of devices which are smaller, easily transportable and tending to be easier to use.

The implications of the development of home health care

Invasion of home by professional caregivers and technologies

Home health care can provoke an invasion of the patient's home by professional caregivers and technologies and transform it in a workplace for them where medical technology is predominant. The traditional meaning of home disappears: the patient's house "cease to be a home" [1].

The level of the quality of health technocare

The quality of health care must be identical wherever it is provided, at home or at the hospital. Different conditions have to be fulfilled. First, one needs to have competent (professional or not) caregivers who know what to do and how to use the technology. This means that these people get a proper training and can handle the emotional burden of such a responsibility, but also that the technologies are not too complicated to use. Secondly, one needs to have a home that is suitable for health care and needs to use secured technologies.

Disruption in relations and competencies

We will identify different changes in the relations between the various actors of the home health care: on one hand, family life can be modified because heath care is provided at home and some family members become caregivers. This may require a complete reorganisation of the family life. On the other hand, the diversity of caregivers (professionals and family members) and the transfer of competences and responsibilities can create difficulties in the continuity of the care process and in the decision-making.

Ethical reflexion on home health technocare on the basis of the four fundamental principles of bioethics

The need for reinterpretation

The traditional interpretation of the well-known principles of bioethics (autonomy, nonmaleficence, beneficence and justice) developed by Beauchamp and Childress [2] does not seem adequate for home health technocare. We therefore need to re-interpret these four principles.

Autonomy

The principle of respect for autonomy applies to the patient but has to be extended to all family members. It means that the decision to provide health care at home has to be the object of a free and informed consent. This can be questioned: Do family members really have the choice to accept or refuse to collaborate to care? How can their consent be really informed? Who has to inform them? How can family members realize what this care means in the long-term? Should their consent be provisional and be reviewed regularly? Should patients have the “right to leave home” [3]?

Nonmaleficence and beneficence

The principle of nonmaleficence implies that health care professionals have the obligation to not inflict harm to the patient while, according to the principle of beneficence, they have to contribute to his welfare, to promote

what is good for him. These concepts should apply to patients but also to family members involved in the therapeutic project.

This leads to questions when a quality home care for the patient becomes a “physical and emotional overburden” [4] for the family. The transfer of responsibilities from professionals to family members can also be difficult to manage and, finally, be harmful for them. A good communication between the patient, his family and the health professionals could prevent such problems.

Justice

According to the principle of justice, care providers have to act fairly and, in case of short supply, they must allocate scarce resources fairly. This principle refers to the questions of the access to care and its financing.

The question of access to care is particular in the context of home care: one the one hand, the patient and his family should not decide on the basis of financial consideration but on what is best for them. This leads to the question of the role of the society to offer access to home health care. And, on the other hand, everyone does not have the same choice because there are differences between “those who have the required social and physical environment and those who do not” [5].

Conclusion

The establishment of a system of home health care must be carefully discussed between the patient, his family and health professionals with the purpose to decide whether it is the best solution. (The role of each person, the duration of the “contract”, the possibility to cancel it,… are some of the elements that need to be discussed). Getting care at home may indeed not always be the best solution and it has to remain one option among others.

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Integrated Video Assistance Solution for Elders (IVAE)

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Abstract: **Integrated Video Assistance Solution for Elders (IVAE) provides a set of tools for care providers to deliver and enhanced care service making use of telecommunications networks. This paper describes the different features of IVAE and how they have been build from three points of view: users, business models and supporting technology thanks to Attentianet project.**

Introduction

Today 495 million people are older than 65 and this number will double in 2025 (aging growth rate of 5%). At the same time there are 860 million people with a chronic disease and this figure will also growth as long as people leaves longer.

Communication is one of the aspects more valuable for users. Human being need contact and need to share with others. Isolated people tend to leave less than people with strong relationships.

With those premises, IVAE introduces mobile communications and broadband to create advanced tools to enhance the social care support and in this way to allow elderly to stay at home longer than today, improving their socialization and their feelings of security and loneliness.

The initial step: Attentianet.

IVAE has been build based on the Attentianet (Advanced TeleassisTance convErgent NeTwork for chronIc diseAse patieNts and Elders) project.

Between 2006 and 2007 Attentianet performed a market validation for an advanced Teleassistance service with 40 user in Barcelona (Spain) and 40 users in Oostende (Belgium). This project was funded by the European Commission within eTEN program. The project was performed by companies and organizations that represented the complete value chain in a teleassistance service: Alcatel-Lucent, ONO, Orange Spain, CHC, Sabia, i2cat, LCM, CM Oostend, Androme and Belgacom

Its main objectives were:

1. Technology analysis.

Validation and adjusting of used technology and processes to support it (installation, operation and maintenance, performance, quality of service, scalability).

2. Market and organizational model:
   Analysis on the potential market, segmentation, organizational model and business case; Study on implications of having an integrated service for social and health care;
3. End users usability and feedback analysis;
   Feedback from users on usability, confidence, perceived quality and impact on their day to day life;
   Feedback from social carers supporting the service in the VAC in order to adjust service processes.

Attentianet main achievements were:

- The project allowed to refine the technical solution with:
  - Selection of the right terminals;
  - Definition of the installation and maintenance processes;
  - New features added to the solution to allow remote maintenance and automatic device reset in case of problems;
- The business model was completed defining the roles, responsibilities and money flow for the different actors. The market analysis was done and the marketing strategy was defined;
- End users. Many of the evolutions done in the current technical solution and in the different processes and procedures for service deployment have been based on the feedback got from end users during market validation in Spain and in Belgium.

Features provided by IVAE to the care provider.

IVAE provides a set of features that will allow care providers to deliver a tele-care service, i.e., a care service in the end user home. IVAE allows it in an open way; for that, it provides a set of application enablers (open APIs) that can be integrated with the care provider existing IT systems in order to delivery the service.

IVAE features are:

- E2E solution validation. End user devices (special mobile phones and set top boxes), communications, application servers and video call centre are validated.
- Video Telephony. Video telephony allows to set up video calls between the end user an a call centre agent or a relative.
- Video Call centre support. The solution has been created taking into account the integration needs with call centers.

- Multi video conference. Once the call has been set up with the call centre agent, the agent can set up a three party call involving a relative or a caregiver. Future extensions will allow creating video chat sessions between elders.
- Teleassistance TV portal for reminders, information, content and other applications. The teleassistance service provider will have tools to create TV portals based on templates were he will be able to integrate textual information, images, video and also the video conference calls. This will allow, for example, the creation of specific portals with service provider related information, reminders or the possibility to push information on the TV during video calls.
- Mobile Telephony. The user will have an special mobile phone designed for this type of services with features like GPS, low battery alarm, falling alarm,…
- Intelligent location system. The location has been designed with a quite innovative system that uses a combination of different location systems to maximize accuracy and to minimize cost.
- Location presentation using maps. The location is presented to the call centre agent or to the relative using a map.
- Home zone tracking. Users can be tracked to trigger an alarm when they are getting out from a predefined home zone.
- Home caregiver tracking. Caregivers providing home service can be monitored using RFID technology. In this way it can be registered when they arrive and when day leave the user's home.
- Relatives care support. Relatives (and also volunteers) can be part of the service.
- User profile management and provisioning.
- Mobile device and STB remote management and configuration. The operation and maintenance of end users devices is a critical factor for service success. It is very important to have the tools to solve problems to have the right user experience and also to minimize the associated maintenance costs, otherwise the business model will not be sustainable.

Business models

Tele-Care services represent the combination of care services provided through telecom resources. That means that new actors are introduced in the value chain; these new actors are Telecom Providers and IVAE Enabling broker. Depending on the model we can found two different cases:

1. The care service is provided by an entity that cannot be tied to a specific Telecom Provider. In this case it is needed that the IVAE Enabling broker provides two different functions: a set of application enablers that allow care providers to manage IVAE features in a simple way and a brokering function with the different Telecom Providers in the area where the service has to be deployed.
2. The care service is provided by an entity that relies on a single Telecom Provider. In this case the IVAE Enabling broker only needs to provide the application enablers that the care provider will use to deliver the service.

Case 1 is typical from public services that cannot impose a Telecom Provider to the end user, while case 2 could be a private insurance company that has an agreement with a service provider.

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Personalized Dietary Counseling for Tele-care using Evolutionary Programming and Ontological Reasoning

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Abstract: **The paper gives an overview of the MenuGene dietary counseling system and its planned application in the ALPHA tele-care framework. Our results show that a considerable part of dietary counseling can be supported by a combination of ontology based modeling and genetic algorithms.**

Introduction

Tele-care and remote monitoring systems have a big potential for providing cost-efficient healthcare solutions. The ALPHA system, currently under development by a research consortium in Hungary, provides various remote monitoring and expert system services that use a network of intelligent sensors and appliances, either mounted in the home, or worn on the body, of the patient. The sensors monitor the patient's physical activity and other physiological features. All data are transported wireless to a

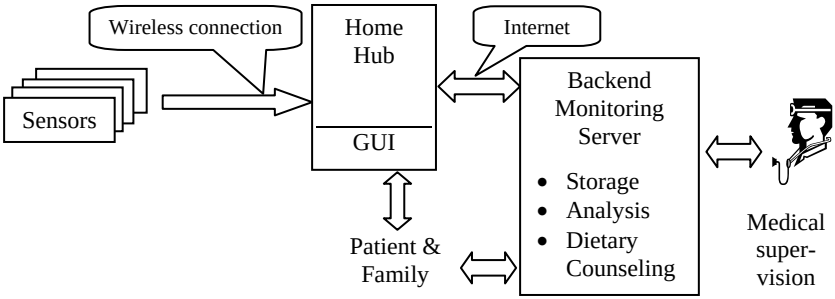

Fig. 1 Overview of the ALPHA system with the dietary counseling component

Home Hub which is connected to the remote back-end center with advanced analysis, healthcare counseling and data storage services. The system is run

under a 24-hour medical supervision. The touch screen of the Home Hub also serves as a simple GUI for the end users (Fig. 1).

The whole functionality of the ALPHA system is beyond the scope of this paper, we will focus instead on the dietary counseling subsystem called MenuGene.

Dietary counseling in a Tele-care setting

The dietary services of the tele-care system can be grouped as follows.

- *Logging*. The user can enter her/his daily meals on the touch-screen GUI by specifying either a concrete dish or the type of dish (s)he consumed. The more precise is the specification, the more accurate will be the log analysis. This record is considered in conjunction with the physical activity measured by the ALPHA sensors.
- *Analysis* of the log for the user and the expert dietetician, with respect of diet composition and completeness (e.g. personal food pyramid, specific nutrient contents etc.)
- Personalized *menu proposal generation* to satisfy user-defined criteria and goals. We generate a personalized weekly menu based on the log and other medical data (age, gender, etc.), such that the menu should conform to accepted dietary guidelines as well as a specific target of the user, e.g. lose 5 kg in two months.

The first two functions require less computational intelligence, but they need a comprehensive and up-to-date food composition and recipe database. We use the USDA SR 20 reference nutrient database [1] and a Hungarian cookbook with 891 recipes, aligned with the USDA food-base. The third function, menu generation, requires special tools and methods.

Personalized Menus: the MenuGene Architecture

A good menu must satisfy numerical constraints on nutrient contents, and also rules on harmony. Computer-aided menu planning is a traditionally hard problem since it is characterized by

- A *very large search space* of the various meal combinations, observing numerical constraints. For each patient and setting, we apply general nutritional guidelines to compute these constraints, which can be overridden by the dietetician. Constraints can be applied at weekly, daily, etc. levels. An example constraint is the daily minimum, optimum and maximum value for total carbohydrate content.
- Hard-to-formalize *expert dietary knowledge* on the harmony assessment of a menu. These rules have either a scientific, common-sense or cultural origin and normally refer to the co-occurrence of specific or general food groups, e.g. “avoid a breakfast meal that

contains milk *and* spicy dishes". The (often fuzzy) classification of meals, dishes and foods into *sets* is the core of the expert knowledge.

For the first problem, i.e. constrained search, we apply multi-level, multi-objective genetic algorithms. For the second, we model a part of the expert knowledge in a dietary ontology of concept sets, and use a simple mechanism for enforcing harmony rules. The data flow is shown in Fig. 2.

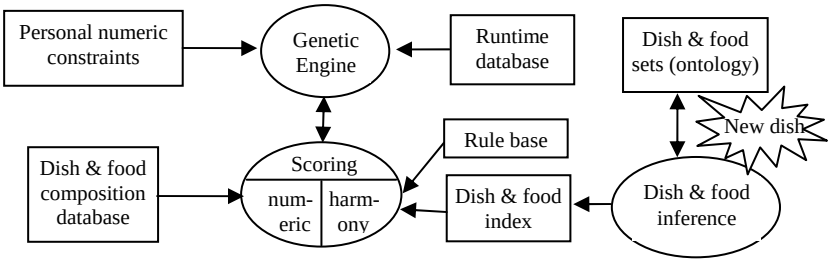

Fig. 2 The MenuGene architecture (agents in ovals, data in boxes)

Our genetic algorithms (GA) compile a weekly menu plan, trying to simultaneously satisfy all these objectives as much as possible. Weekly menus are modeled as multi-level hierarchies, each level representing a partition of the problem: weekly plan, daily plan, and meal plan. The sub-problems are handled and solved independently of each other on the same level. The harmony assessment is combined into the numerical scoring of each solution considered by the GA. For the details of the Genetic Engine, see [2]. A similar approach without an ontological base is reported in [3].

Ontology for the classification of dishes

The dietary ontology is the basis of the harmony rules, and also numerical constraints may reference a set, e.g. "a lunch must contain minimum one, maximum two *desserts*". There are several dietary taxonomies developed for various scientific or commercial domains, and also the USDA database contains a rough taxonomy of foods. MenuGene contains the USDA set indexes (for all foods available in the USDA database), and several additional sets that support the harmony rules. For example, in order to implement the above rule on breakfasts, we need to define a set for "spicy dishes". Our ontology surpasses taxonomy since it contains also the formal definition of the sets in the OWL-DL language. For example, we may define the concept of "spicy dish" based on its recipe (available in the dish composition database). When a new dish is added to the database, we run a standard reasoner, Pellet, over the ontology to classify it according to the set

definitions [4]. The reasoner is also used to compute class subsumption among existing sets. Results are stored in the dish and food index.

Classification based on the composition (recipe) has its limits. There is no way to infer the taste, color, price, culture, seasonality etc. of a food or dish item. Therefore, all foods and dishes need to be classified in such sets manually by an expert, if rules referring to such sets are to be supported.

Results

Experimental results show that strict numerical constraints on any nutritional level can be satisfied by this GA-based method. We have also shown that harmony scores can be used to control the GA [2]. Currently, we are building the dietary ontology and rule base.

Conclusions and Future Work

The paper presented the dietary subsystem of a planned tele-care system. According to our plans, the first prototype of the ALPHA system will be functional by Sept. 2009. We are also developing a flowchart-type recipe editor to support deeper, operation-level reasoning on dish types. For more information on MenuGene, see [5].

Acknowledgments

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Report of Pregnancy by Short Messaging System (SMS): A Strategic Data Point in the Philippine National Health Information System

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Abstract: **The national health information system is an important resource in any country. It is the basis for many decisions and interventions by ministries of health often amounting to millions of dollars and affecting a wide sector of society especially the poor. Like in any developing country using manual paper-based systems, the Philippine national health information system suffers from accuracy and timeliness issues. It is also plagued by the inevitable bloat in data that are collected from the various vertical programs of the government. This paper proposes the promulgation of a strategic data point (SDP) in the national health system that is easy to collect yet is powerful enough to influence several programs. The report of a pregnancy is one such SDP. It is a single data point that can inform several programs: maternal care, child health, the expanded program on immunization (EPI), the local civil registry, and the Department of Education to name a few. This paper describes how a single data point such as a pregnancy report submitted by short messaging system (SMS) can be leveraged cost-effectively by the national government to support informed decision making nationally and locally.**

Keywords: strategic, data, national, maternal care

Background

The Philippine national public health information system has evolved from a simple management information system from the 1980s to a complex Field Health Surveillance Information System FHSIS 2008. Over the years, new indicators have been added and old ones revised. In the interim, the political milieu has shifted from a centrally-run health system to one that is devolved to local authorities. This devolution further caused a data flow gap worsened the already delayed publication of critical national health indicators.

The weaknesses of the current system are the following:

Paper-based and manual: A carry-over from the twentieth century when computers and mobile phones were either too expensive or non-existent, health information systems in developing countries in general are paper-based and manually driven. This means raw data are collected on paper (e.g., patient demographics) and then transferred to a tally sheet every week or every month (to generate a report, for example, on the number of patient visits per month). Inasmuch as paper documentation is the default method for recording services rendered, the modality does not make it easy to generate statistics needed for decision making. The resulting data from the tally sheets are also transmitted by courier to the higher levels (from village to province) causing significant delay. By its very nature, manual-driven paper-based reports create delays in the flow of data in the national health information system.

All-or-none phenomenon: the all-or-none reporting phenomenon occurs when a single political unit is composed of several sub-units. For example, a municipality will be comprised of several barangays. The all-or-none phenomenon describes what happens when data from one of the sub-units do not come on time for consolidation and submission to the higher levels (municipality to the province). When one or more sub-unit data are lacking, the municipal health officer would often refuse to forward data to the higher levels because their consolidated data (from those sub-units who submitted) do not reflect the true, complete data for their town. It is either all the data are in or no data are submitted to the higher levels. The all-or-none phenomenon is notoriously practiced around the country and is the main culprit for the lateness of data of the national health information system. It is so strategic such that only one out of the forty-thousand villages in the Philippines needs to be delayed to delay the whole national data.

Hierarchical flow: The hierarchical flow of data dictates that data from sub-units must pass through the next level and that it cannot bypass that level to go to the next. This protocol was meant to assure that more local health officers are knowledgeable of their health status even before the data is submitted to the higher levels. This is appropriate since local officials are the first responders to any outbreaks or anomalies in their local health system. A hierarchical flow however deprive higher levels of the timely integrative perspective that they can get when they merge lower level data (municipality) and view them at a higher perspective (province). Hierarchical flow of data also allow for more opportunities for honest consolidation errors as well as for deliberate manipulation and fabrication (see target-based reporting).

Target-based reporting: In most villages in the country, health workers are given targets to meet and are expected to report data on these indicators.

This practice is both counter-productive and manipulative. It is counter-productive because health workers are pressured to deliver a certain number of services (e.g., prenatal care, vaccination, family planning services), and using paper-based systems, they can easily manipulate the data to reflect that they have met their targets. It is also manipulative because the health workers are cued as to how to fabricate their data in a way that will please their superiors. Instead of quality data, there is now an ocean of fabricated data which eventually become basis for national policy decisions.

Disintegrated and Paradoxical Vertical Programs: The Department of Health delivers various vertical programs such as maternal care, child care, family planning, TB, malaria, leprosy, and the like[1]. Using paper forms and logbooks, a pregnant woman with TB and an injury would possible appear three times in one day in one logbook: in maternal care, in the national tuberculosis program logbook and in the general services logbook. This happens because each program has its own obligatory reporting system and logbooks creating a tedious system for health workers and contributes to the erroneous reporting of statistics (this patient may be reported thrice when there is only one). There are even vertical programs that are have paradoxical targets such as the maternal care program that expects a certain number of pregnant women to be reported (given the annual expected growth in population) versus the target for women using contraception (which are also expected by the program to increase). These paradoxes confuse the health workers and tacitly compel them to fabricate either data to get into the good graces of the higher authorities.

Data cemeteries: Visit any health center and they will show you their towers of logbooks accumulated over the years. These are data cemeteries where old archived data are unused for planning and for predicting outbreaks. Data on paper prevent health workers from reviewing their performance for past months and years and they miss out on the potential for using past data to predict potential problems in the future.

Proposal

Given these problems, it is clear that fixing the current national health information system needs to be a set of integrated policy changes that work together to contribute to more accurate and timely data from the field to the central offices.

However, one particular policy change is most strategic of them all. This is the simplification of the reporting requirements by asking health workers to simply report all pregnancies electronically. Although the pregnancy report will not cover the needs of other programs such as tuberculosis, malaria, and leprosy to name a few, it has the ability to predict and

extrapolate for other data points which can help with managing a local health system.

The Pregnancy Report as a Strategic Data Point

The report of pregnancy triggers the start of the maternal care program. By collecting patient demographics and last menstrual period, it can predict other data points without the need for further data collection. For example, eight to nine months after the LMP the following resources will be needed – a birthing facility, a trained birth attendant, a dose of Vitamin K, newborn screening examinations. Ten months after LMP, they can already predict the need for a dose of BCG. Eleven months later, oral polio vaccine and diphtheria, pertussis and tetanus. So forth and so on until at five years after LMP, a chair in the local public school can be predicted.

Even after birth, the single data point can advise the local civil registrars that they should expect a child to be registered in their logbooks. Failing to do so can be interpreted at least two ways: one, that the child had died, or two, that the child had not been registered yet and should be sought out for that purpose. Either way, it is a reportable condition. With a single data point, therefore, several performance indicators are preset and the local health officers are informed of their deliverables at certain points in time.

Benefits: There are numerous benefits for defining such a strategic data point. First, this will simplify data collection. Health workers can focus on a very simple data element and give all their attention to the quality of the collection. Second, it informs the system of what resources need to be in place and when. Third, the data can provide a ruler for measuring performance as the pregnancy progresses until after delivery and so on.

Challenges: The challenges will be the method by which the strategic data point, in this case the report of pregnancy, will be collected so that its value can be maximized at the local, regional, and national levels. This benefit can be appreciated if the data is submitted via short messaging system (SMS) using a mobile phone.

A sample message may look like this:

BIRTH Angela Rivera/33/2008-Jan-01

(legend: KEYWORD<space> name<slash>age<slash>last menstrual period)

This short data set seems innocuous enough but it presumes several pre-requisites. One, that the mobile phone submitting the data is registered and that it submits data specific to a locale. Two, that the mobile phone user is authentically the health worker authorized to submit that information. Three, integration software that collects all the data and feeds back information at several levels will have to be created.

Another important challenge is mandating the health workforce to commit to the use of the system. Lastly, the cost of sending the SMS must be borne by an agency so that the health workers are not burdened by the additional expense.

Conclusions

Health information systems in developing countries are difficult to change. There are many process inefficiencies that cause inaccurate and delayed data to flow to higher levels of the health information system. This paper defines the report of pregnancy as a strategic data point which can assist local health units to collect data accurately and timely that will allow them to plan for the needs of their local units as well as inform higher levels of resource requirements that can be addressed at the regional or national level. Although the technology is simple, a strong policy framework for such a system needs to be installed to make the system successful.

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Telemonitoring for Obestity Therapy

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With the AiperMotion activity sensor, Aipermon has developed a new medical measuring instrument that enables the long-term measurement, assessment and motivation of the user's physical activity – under workaday conditions.

The AiperMotion can be integrated into programs with medical/specialist supervision for weight reduction suited for everyday situations which are becoming increasingly important for the growing number of people who have obesity or diabetes.

For the participants in programs, there is a considerably wider range of support, with improved quality, with high motivation through everyday care, and the assurance of knowing that you are doing the right thing - in the right amounts. The possible success of such a coupling of telemonitoring and long term coaching shows a family study for weight reduction conducted by the Medical Department of the University of Magdeburg.

Other relevant vital parameters, such as weight, blood pressure or others, can be measured, sent and evaluated additionally, thus shown in the study "Partnership-for-the-Heart" by Charité University Hospital of Berlin.

The newest launch of Aipermon's activity sensors is the "Balance Coach" which includes among burned calories also the energy consumption and gives the supervisor a round picture about user's energy balance.

This new device for the first time provides the chance to observe the engery balance and measure physical activity continually and in the long term.

Keywords: Telemonitoring, Activitymonitoring, Obesity, Diabetes

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The Concept of a Platform for Remote Monitoring Patient's Health State

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Abstract: **This paper presents a concept of platform for developing medical web-services. The goal is to improve the interoperability of eHealth systems in Luxemburg. The idea is to define different levels of designing and propose interfaces to connect. The architecture of the platform is based on SOA (Service Oriented Architecture) concepts and adapted to e-Health needs.**

Introduction

In a digital society, the concept of services has changing and words like e-service and web-service enforce their place in the market. In this new context, RESIST project contributes to transform the current medical system into a more adapted *e-service based system* supported by technologies from the ICT domain. The main goals of this project are:

(a) The identification of needs from medical sector in order to implement home monitoring services;

(b) The selection of a set of technologies that can be used to implement these services;

(c) The definition of an architecture that promote interoperability between medical applications;

(d) The implementation of a case study that validate the proposed concepts.

This paper presents the last three goals, the first goal was presented in [1]. The definition of the platform had to take into account the existing infrastructure of Luxembourg. HealthNet is an example of this infrastructure. It is a secure telematic network for health care professionals in the Grand-Duchy of Luxembourg. All hospitals and the majority of Laboratories are connected via HealthNet and they can safely exchange medical data. It is also opened to healthcare professional and the number of adherents is increasing.

This scenario has driven RESIST team to propose different solutions according to the category of potential users of the platform. For remote

monitoring purposes, the users were classified into: Patients, Healthcare Providers and System Managers. Each category of user will have an adapted system to connect to (and exchange data within) HealthNet:

(1) Patients will use the *home monitoring system* (MSY). It is composed of a set of sensors and a central unit (e.g., PC, PDA, etc.) that collect patients vital signs, store them (locally or not) and send them to EHR (Electronic Health Record) servers. We adopt the hypothesis that EHR servers are managed by hospitals and distributed over the country;

(2) System Managers will use the *monitoring center system* (HMC), normally placed in hospitals. It has the role of mediate communications between the other users of the platform. It can also manage the access writes of users, store and exchange medical data, publish web-services (e.g., UDDI registry), configure and make the maintenance of equipments, manage urgent alarms, etc;

(3) Healthcare providers will use the *medical terminals.* They are access points for medical data and can have specialized applications that support their activities. For example, it can have macros in Excel® that read EHRs from the HMC database and present the patient's health state or it can be part of a more complex application (e.g., GECAMED® if the user is in a private cabinet or a HIS if he is using the hospital application) to access and manage the patient's EHR.

Combining these three sub-systems to compose a Remote Monitoring System is a hard challenge. It requires an interdisciplinary knowledge as well as, Interoperability, Security, Legislation, Web Standards, Medical Standards, etc. Without an appropriated coordination, the relations between users, services providers, public administrations (e.g., Social Security, certification authority, etc.) can quickly become very complex and drive the system to chaos.

RESIST contributes to reduce this complexity acting over two weak points: the coupling of functionalities of the platform and the designing process.

In the first case, the functionalities of the platform will be performed by small pieces of softwares with relative autonomy that cooperate to perform more complex activities. In other words, the platform is base on SOA (Service-Oriented Architecture) concepts and each sub-system is composed of a set of web-services. The communication between web-services is done by messages exchange and web-service technology is well known by their loose coupling properties and the facility of maintenance.

In the second case, RESIST proposes to split up the designing process into 5 different levels where each level requires a sub-set of knowledge. The

levels were grouped into 2 layers: one for business designing and the other for services designing.

Separating both layers gives more flexibility and dynamism to the system. In the upper layer, business process experts can easier specify rules and constraints or define new business combining services throughout a standardized language, like BPEL. In the lower layer, experts on specific domains can improve the quality of the system by updating, deleting or added new services. This lower layer is used, for example, by computer scientists to design (and implement) web-services. Each new service is published in an internal registry and used by the upper layer. A BPEL engine is used to connect the two layers. It can dynamically choose the web services available in the internal registry and use them to execute a set of specific tasks requested by the business. As shown in Fig. 1.

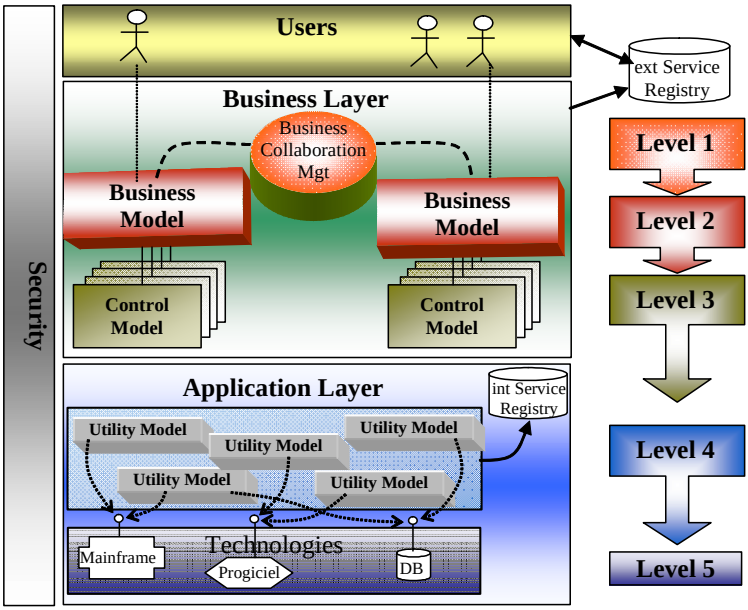
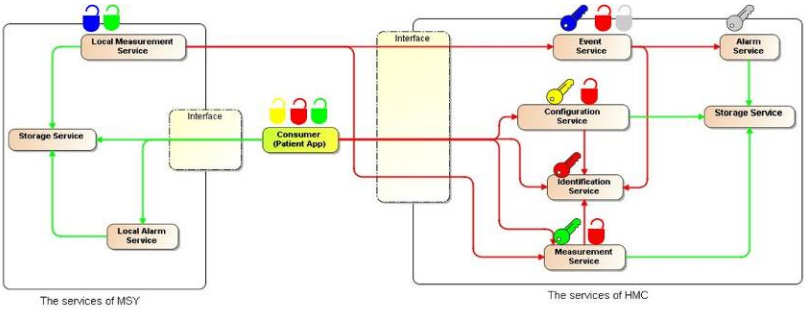


Fig. 1: RESIST conception levels for services designing

A practical example of this strategy can be seen when a healthcare professional decides to define a clinical treatment. If all pieces of the treatment exist already (as web-services) then the healthcare professional only needs to select them and define the rules to perform it (association, sequence, timing, etc.). However, if new functionalities are necessary, then

he/she can request it by defining the properties of the functionalities and send this information to the lower level. In a second phase, computer scientists use this information to design and implement the web-service.

The implemented case study is composed of 2 sub-systems and 9 web-services (see **Fig. 2**). The patient has at home the MSY sub-system and can measure the vital signs throughout the patient application. This application has an adapted interface (according to the disease or the age of the patient) and executes a BPEL code. Each measurement is done by the Local Measurement Service and stored by the Storage Service. The synchronization of local and remote data follows the set up of the system (continuously, periodically, event-driven). The remote database keeps the history of the patient while the local database keeps only recent information. All messages are encrypted and the identity of the users is checked every time that the connection is requested (a watchdog limit the connection time), for security, a session key is generated after the connection. Thus, a national certificate authority is mandatory (represented here by the Identification Service). In the hospital, the HMC sub-system will receive the patient request (Measurement service or Configuration service), check the identity and, if successful, perform the request. 3 types of requests were



implemented: Configuration update, Data Storage and Alarm.

Fig. 2: RESIST case study: Remote Monitoring System

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The Creature of the United Electronic Registry of Private Medical Clinics

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The development of the private health sector in Uzbekistan led to need of establishing a register of private medical clinics. However, the development of information and communication technologies in the health sector has enabled the creation of an electronic register. Electronic register of private health clinics is part of the Unified information system of health care. Electronic registry implies the existence of a database of all the necessary information about the medical clinic, such as location, area, building, equipping the necessary equipment and technology, including medical, availability of personnel.

In accordance with the current legislation the clear terms and requirements are presented to activities of private medical clinics, such as the buildings and premises sanitary rules and norms, the availability of modern including high-tech medical treatment and diagnostic equipment and instrumentation. The high requirements as to working in private medical clinic workers. It is imperative that health care workers have high qualification and continually improve their skills, trained in the leading educational and scientific-practical centers.

In this regard at the stage of collecting the documents to obtain licenses, for implementing medical activities of the Special Department of the Ministry of Health, dealing with the licensing and supervision of the quality of health services provided by private medical institutions, all the data entered into the electronic database, which is formed the electronic register.

The presence of electronic register will allow having an objective picture of the level equipment and provided health services in existing private health clinics. In addition, this will have an overall picture of health status; have greater rates of negotiability and morbidity. Ultimately, this will have a positive impact on improving the quality of medical services provided in private medical clinics.

The Telemedical Network - MONTE

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The telemedical network MONTE is to establish connections between individual patients and a leading doctor, a doctor presently on duty or an expert centre in order to monitor the patient's health status.

MONTE permits an automatic computer analysis of the standard ECG recordings by the method NURSE-ECG determining the electric activity of particular fragments of the cardiac muscle.

NURSE-ECG (the high signal resolution electrocardiography) is a new method of cardiology diagnosis. The method is based on digital electrocardiography and permits a numerical linear enhancement method of the ECG signal resolution, leading to a significant extension of the diagnostic possibilities of the standard electrocardiogram. The method allows detection of relatively small changes in the electric activity of individual fragments of the cardiac muscle caused by e.g. ischemia, the effect of a drug, rehabilitation of infarct, undetectable by the standard electrocardiography.

The results of the NURSE-ECG analysis are displayed on a histogram and in a table with data on electric activities of particular fragments of the cardiac muscle, accompanied by the information on the process of depolarisation and malfunctioning areas in the cardiac muscle. The analysis is performed automatically using the network MONTE.

The network MONTE is expected to ensure the following:

- Teleconference and telemetric sending of some data on the health of patients being out of hospital, e.g. at home.
- Fast transfer of information about patients and telemetric data from diagnostic apparatuses between different medical centres in order to:
  - Consult the results with specialists from different centres to establish a more accurate diagnosis and methods of treatment;
  - More comprehensive analysis of the data from diagnostic apparatuses by the use of special or unique methods.

The internet network MONTE permits an interactive preliminary assessment of some faculties e.g. the sense of hearing, eyesight etc., in people who have access to the internet.

Keywords: telemedicine, signal processing, electrocardiography

Session 21

eHealth: Ethical and Sustainable

A Dilemma in the Delivery of Telecare and Telehealth at the Health and Social Care Interface

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The development of a wide range telecare and telehealth technologies now mean that it is possible for greater support to be given for people's health by social care staff. This creates a dilemma for countries like the United Kingdom where health and social care domains are separate. The dilemma relates to the extent to which social care staff should be engaged in ways that underpin the pursuit of healthcare objectives. This paper argues for increased support for health by those in social care. With this taking place it is considered that a much needed new service approach, supported by telecare and telehealth, will emerge.

Introduction

Policies and practices relating to the delivery of services to people with health and social care needs are changing. This is both a consequence of demographic change and the imperative that seeks financial savings for what are increasingly cash-strapped health and welfare services.

The way in which the changes are taking place differs, of course, from country to country [1]. But a theme that is emerging is that which relates to a growing call for people to take greater responsibility for their own health and well-being. By taking such responsibility, the argument affirms that better lifestyles will be adopted and the call on public funds to assist in the event of later health or social care needs will be minimised.

The context is one where the focus of attention is shifting from questions about what the traditional service providers do for patients and service users, to questions about what people do for themselves. In answering the latter, people increasingly see the need for providers to address health and social care agendas together rather than separately.

Those professionals putting forward the argument for change in this way reflect a 'people perspective'. Interestingly they allude to telecare and telehealth technologies as a key means of service reconfiguration. At the same time more professionals are concerned with health services that pursue both clinical and well-being outcomes by virtue of which, 'health' becomes the equal and legitimate concern of those working in social care.

Telecare and Telehealth at the Health and Social Care Interface

With regard to telecare and telehealth, three main areas of technology and their application are notable in the UK. Each can be subdivided according to the extent to which the people decide for themselves when and how the technologies are used. The three areas are currently concerned with:

- responses and event recognition devices (using simple social alarms, fall and seizure detectors);
- medication compliance or concordance (using pill dispensers, pagers, etc.); and the
- monitoring of well-being (using simple timers through to activity and vital signs devices; and telephone support).

The issue of 'who decides?' is very important insofar as some patients and service users are cognitively impaired and (subject to necessary provisos) it is appropriate to provide services *for* them. The matter is equally important, however, in the context of the lifestyles of those who are cognitively able but who are, or could become, intensive service users.

Some issues arise for all people where there is a 'lifestyle risk'. We can note a range of initiatives that, for different groups, are prompting and motivating people to encourage behavioural (lifestyle) changes. Telecare and telehealth technologies frequently provide some of the tools by which such changes can be effected and monitored. The practitioners who deliver such services are to be found within both health and social care agencies.

Changing Behaviour for Better Health and Wellbeing

For people with long-term care needs there are particular challenges in all EU countries. In the UK different service approaches are being tested with a view to reducing hospital admissions (and length of stay) and improving personal well-being. A high profile initiative is that of the 'Whole System Demonstrators' operating in three regions (with related initiatives established elsewhere) by the Department of Health.

The 'demonstrators' will provide robust evidence of the merits and demerits of telecare and telehealth interventions for large numbers of people with long-term support needs (see www.wsdactionnetwork.org.uk). Key parameters for outcome measurement include the extent to which wellbeing and independence are enhanced; and the cost and clinical effectiveness of the interventions. And while the project frameworks affirm some differences in the approaches between social care and health care, it is arguable that those differences are reducing. It is not clear, as yet, the extent to which the demonstrators will address people's behaviour.

There is, however, a range of (other) initiatives in the UK focused on lifestyles and behaviour change. These engage health and social care staff in

similar ways, for different user groups. This paper notes three initiatives - motivational coaching, well-being support and health training.

Motivational Coaching

Motivational coaching is being promoted as part of an initiative for people with long-term conditions (notably Chronic Heart Failure) in Birmingham. The first phase, now being 'mainstreamed', found positive outcomes in relation to people's progress towards key health and wellbeing targets [2]. The service is nurse-led with contact to patients taking place through regular telephone calls.

Well-Being Support

Well-being support programmes are being promoted in various parts of the UK for people with severe mental illness. They respond to the frequent association of poor mental health and poor physical health (reflected in obesity, high blood pressure and inappropriate lifestyles). The support programmes are nurse-led with progress being monitored through patients attending up to six consultations over an 18 month period [3].

Health Training

With a broader focus (for people with a range of physical and mental health problems) is the health training programme in Bradford. Health trainers are recruited from a variety of backgrounds (with few from healthcare). The trainers 'provide support to enable people to adopt healthy lifestyles'. Initial outcomes are positive, insofar as many service users have 'clearly' demonstrated appropriate behavioural changes [4].

The key point from these examples is that an approach to supporting people is developing that requires a new range of skills among the practitioners concerned. Importantly there is a prominent role for interpersonal skills that can help to motivate people. Providing the motivation to help attain goals associated with lifestyles does not, however, necessarily, require nursing or clinical knowledge.

Changing Behaviour, Telecare and Telehealth

There is a link between the different approaches and the contribution made through telecare and telehealth insofar as the latter have their application for the patients and service users in ways that can relate to behaviour change.

Key contributions can be (or are being) made with regard to medication compliance and the monitoring of well-being through vital signs monitoring. The active and appropriate use of telecare and telehealth in such contexts, however, may well be assisted through 'motivational' support to

effect behavioural change. Social care practitioners should, and will necessarily, have a growing role in this regardless of the fact that some of the benefits will be measured in health outcomes.

Conclusion

With the changes in technologies in the home and with the advent of service approaches concerned with behaviour change, a dilemma arises with regard to the role of social care staff. It is clear that there are crucial health agendas that require to be addressed. But the delivery of these is increasingly linked to the appropriateness of people's lifestyles.

Insofar as this is the case, and given the ongoing developments in the technologies associated with telecare and telehealth, the role of social care practitioners stands to increase. The context is one of substantial opportunity to develop new kinds of service that are more attuned to people's needs. The accommodation by health practitioners, of the greater role of social care, will help in their development.

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Ensuring eHealth Solutions are Sustainable

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Abstract: **Sustainability' can be considered the Holy Grail of eHealth, yet it still eludes all countries. Factors contributing to this state of affairs are many, and include a lack of holistic perspective, a lack of focus on sustainability from the conceptual stage, a lack of focus on developing eHealth specific strategies and policy, and a lack of focus on demonstrating value.**

Countries are the architects of their own e-health environments. Good architects don't begin with pre-conceived ideas or just design a rudimentary structure – they take the time to understand the environment and what is required, and then create an entire setting that satisfies the identified functional as well as aesthetic needs. Before investing in e-health solutions, it is critical that the holistic picture be seen and only 'culturally sensitive and technologically appropriate' solutions designed that align with health and policy needs and an established eHealth strategy.

But even if a sound strategy is developed, is 'sustainability' a desirable goal? In its simplest sense, sustainability is the capacity to be maintained indefinitely. Maybe that is not appropriate in an eHealth environment that becomes more and more challenging as the complexity of problems and the rate of change increase! If the sustainability paradigm is accepted, the concept espoused by the Bruntland Commission regarding 'sustainable development' would suggest a sustainable ehealth solution is one that 'uses ICT resources to meet the health needs of the present, without compromising the ability of future generations to meet their own health needs'. Alternatively, perhaps striving for 'viable' ehealth solutions is more appropriate, where a viable solution is one that is practicable, is capable of continuing effectiveness, yet has the ability to grow and develop.

Can we expect the situation to change over the next 10 years, and if so – how? A more structured approach targeting implementation of proven ehealth solutions that answer critical health policy needs, align with solid strategy, and are of demonstrated value, will lead naturally to viability. Possible tools to assist in this process will be presented and described. These will include an e-Health Strategy and Policy

Development Framework, an eHealth Specific Business Case Framework, and the Pragmatic Evaluation approach. Finally, 6 guiding principles that describe a viable ehealth solution will be presented.

Introduction

The WHO e-Health Declaration [1] recommends all member nations develop and implement a national e-health strategy as a part of their approach to addressing ongoing health and healthcare dilemma's. Few countries have a true ehealth strategy document. A contributing factor may be the lack of generic e-health tools to provide support and guidance [2].

To assist with this decision-making process, tools have been developed that allow a holistic assessment. A recently proposed 'differential diagnosis' approach for economic evaluation [3] has been taken and adapted to the e-health setting, to create the e-Health Strategy and Policy Development Framework. In addition, an eHealth Specific Business Case Template and a Pragmatic Evaluation process have been developed, which support the Framework.

Differential Diagnosis

This approach assumes that while many countries may have similar signs and symptoms, the final diagnosis – and more importantly the final treatment – may differ. Thus Sachs [3] argued that development economics needs to imitate modern medicine through making an individual diagnosis for every ailing country. The same principle has been extended to e-health.

Many diverse aspects of a country's environment will impact what e-health solutions are feasible and appropriate. Examining this environment therefore provides the needed architectural foundation by providing evidence that guides decisions, or identifies unexpected barriers. For example, information regarding poverty (spatial distribution), physical geography (topography), governance issues (health system structure), cultural barriers (fear of capturing images), geopolitics (relationship with neighbouring countries), resource issues (including human health resources), etc. will each impact decisions regarding which e-health related solutions are most appropriate and most viable.

e-Health Strategy and Policy Development Framework

The framework has been separated into two components: i) Principles and ii) Process, as previously described [4].

The six 'Principles' are: i. A pragmatic approach is best; ii. Leverage existing inter-sectoral infostructure; iii. eHealth solutions may require a balance of Telehealth or Health Informatics interventions; iv. e-Health

solutions should be technologically appropriate and culturally sensitive [5]; v. A clear, broadly accepted vision is required; and vi. A specific goal is required.

The six sequential and synergistic 'Process' steps are: i. Evidence gathering; ii. Holistic Review (Differential Diagnosis); iii. Identifying Solutions; iv. Considering e-Health Solutions; v. Priority Setting; and vi. Strategy Development.

Those e-health solutions selected in step v. (Priority Setting) become the basis for determining the national e-health strategy, which will guide building of the necessary infostructure, processes, and supportive policy environment. At this stage a long term plan of action (the strategy) is prepared to achieve the particular goal of designing, implementing, evaluating, and sustaining the specified e-health solutions. If a business case analysis is performed, much of the information required to prepare the strategy document will be at hand.

eHealth Specific Business Case Template

A business case is a key document, used by management and other decision-makers, to determine whether to proceed with an initiative. The use of business cases to describe and justify alternative e-health options is poor for two primary reasons; lack of an available framework, and lack of discipline. The eHealth Specific Business Case Template [6] (and accompanying e-Health Specific Business Case Guidelines) refocus generic material and provide additional sections and new material considered essential to the sustainability of e-health initiatives, thus ensuring they are recognised and addressed. The template has been successfully applied in Canada, and could offer a suitable tool for elsewhere.

Pragmatic Evaluation

Pragmatic Evaluation applies lessons from the policy, knowledge translation, and health services outcomes literature, as well as solid evaluation approaches, to provide an evidence-based, structured, and systematic approach to evaluation of e-health initiatives. Pragmatic research has five tenets: 1. Ask - and answer – policy relevant questions; 2. Adopt a scientifically valid research approach; 3. Establish a clear outcomes framework; 4. Align with existing strategies; and 5. Get the knowledge to where it is needed (knowledge translation).

Describing a 'viable' ehealth solution

Use of the term 'sustainable' is common, but the term 'viable' may be a more realistic goal for successful 'longterm' implementation of ehealth solutions. Regardless of the term used, crucial characteristics would be, the

ehealth solution must: 1. Address one or more evidence-based health, healthcare, or health-related education or research needs. 2. Improve the quality of human life (individual, community, or population) in an evidence-based manner. 3. Use available resources effectively and efficiently so they will not be exhausted over a reasonable period. 4. Have negligible negative impact on the natural environment. 5. Have a useful 'long term' lifetime. 6. Be adaptable in order to maintain positive benefit in accordance with the foregoing principles.

Conclusion

For viable ehealth solutions to be implemented successfully, it is necessary that they be evidence-based components within a thoughtful strategy designed specifically for the country (or facility) concerned. Collectively, the Differential Diagnosis approach embedded within the e-Health Strategy and Policy Development Framework, plus the eHealth Specific Business Case Template, e-Health Specific Business Case Guidelines, and the Pragmatic Evaluation approach provide tools or lessons with which to develop the necessary strategy.

Acknowledgment

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Environmental eHealth: A Social Responsibility for eHealth Proponents

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Abstract: **Many activities require performance of some form of environmental impact assessment prior to implementation. No such requirement exists for implementation of costly and pervasive eHealth solutions, a rapidly growing health sector activity in rural and urban centres alike, both nationally and globally. Yet preliminary research by the principal investigator, collaborators, and others indicates environmental costs and benefits do exist. This is an entirely new and important perspective, termed Environmental eHealth.**

Environmental e-Health was first described in 2003 by the primary author. Since that time awareness of the associated issues has slowly grown. Given the anticipated global growth of eHealth and the acute awareness of the need for environmental stewardship in all human undertakings, the time is right for research into, and practical application of, Environmental eHealth.

It is ironic that implementation of eHealth initiatives designed to enhance health and healthcare, may also pose a threat. The fast paced expansion and adoption of e-health has already worsened the e-waste dilemma, but what other negative impacts might it have? On the positive side, videoconferencing (for clinical, education, and administrative needs) eliminates travel by road, air, and water, and has been shown to reduce greenhouse gas and particulate emissions. In addition, introduction of direct radiography eliminates acetate sheets and chemicals for film development, ordinarily disposed of in landfills and waterways. Also, storing of vast quantities of health data in electronic records, whether localised or distributed, is recognised to increase annual carbon emissions.

At this time the full scale and spectrum of potential benefits and costs associated with e-health are simply unknown. If e-health is to be implemented in an environmentally sensitive manner, an understanding of the environmental benefits and costs associated with e-health, and modelling of these potential impacts, is essential. This

presentation will frame the current understanding of the breadth and depth of Environmental eHealth, setting the stage for future novel research programs with significant anticipated socio-political, economic, and environmental relevance and impact.

Introduction

As we struggle to capitalise on technological advances to address demographic realities (aging population; declining human health resources), and expand high quality equitable access to healthcare (rural and remote communities), ehealth has become one tool of choice globally.

The pace of change in information and communications technology (ICT), and therefore e-health, is extremely rapid, resulting in new e-health applications and in continual turnover of solutions and associated hardware, and software. The market is expanding rapidly also; e.g. the electronic medical record systems market across Europe alone may treble in the next six years [1]. What environmental and health benefits or costs may arise as a result? The full spectrum of impacts is unclear, and empirical research into Environmental eHealth, first proposed in 2003 [2], is needed to fully describe, model, and quantify them.

However, some impacts are known or can reasonably be extrapolated: e.g. rapid and global eHealth expansion will exacerbate the e-waste problem; clinical and laboratory waste may be reduced or redistributed; commuting, transportation, or residential patterns may be impacted; reduced travel through eHealth will reduce greenhouse gas (GHG) and particulate matter emissions (PME), but will also increase them due to increased energy consumption. Each is briefly described below.

Potential Environmental Impacts

e-Waste (Environmental eHealth Cost)

This is perhaps the largest environmental cost associated with eHealth (in common with other ICT intensive practices), and the global pursuit of eHealth solutions will grow the e-waste dilemma at a rapid rate. This is of particular concern to developing countries.

The United Nations estimates that the world produces ~50 million tons of e-waste annually, most illegally exported to developing countries where virtually none of it is properly handled [3]. An earlier report suggested the US alone could house around 300 million old computers that, if discarded, would contribute about 1 billion pounds of lead, 1.9 million pounds of cadmium, and 400,000 pounds of mercury to the environment [4]. Other

potential pollutants include polyvinyl chloride, polybrominated diphenylethers, and polybrominated biphenyls.

Clinical Waste (Environmental eHealth Benefit and Cost)

The introduction of direct radiography can eliminate the need for original and duplicate preparation of images on acetate sheets. Given the volume of radiographs taken each year, significant reduction can be projected in release of chemicals and metals into the waste water, and the disposal of old acetate sheets into landfills.

On the other hand, some clinical waste may simply be redistributed. Remote consultations transfer the requirement for any physical examination from urban to rural and remote settings. This may result in greater need for clinical peripherals (e.g. otoscope earpieces, gloves) and simply increase the need for transportation of such materials to these centres and for local disposal of the resulting clinical waste, including infectious waste.

Demographic Patterns (Environmental eHealth Benefit)

Healthcare is a crucial factor influencing residential decisions, and is often a major local employer. Might eHealth maintain the socio-economic vitality and viability of rural and remote communities? Ubiquitous deployment of functional and simple eHealth solutions could encourage families and the elderly to remain in their community. They could also ensure the local healthcare personnel are able to provide a high standard of care supported through ongoing continual professional development.

Emissions (Environmental eHealth Cost and Benefit)

The ICT industry is already known to contribute air pollutants equivalent to those of the airline sector – about 725 megatonnes of CO_2 equivalents annually – and this is growing at 6% annually. Much of this is related to networked storage, and management of information in data centers around the world [5], posing a problem for data maintenance [6]. Based on current trends, energy consumption (and associated pollution) by data centres in the US alone will continue to grow by 12% per year [7].

But other evidence shows that e-health applications can decrease the number of visits made by patients to providers, and providers to patients (vehicular and air medi-vacs) [8]. As such, e-health could reduce GHG and PME. Preliminary research by the lead author (unpublished) has shown that if, in Canada, just 36% of home nurse visits were performed using home telehealth, GHG emissions would be reduced by 33.2 kilotonnes per year [9].

Conclusion

To this time there has been extremely limited systematic research to raise awareness or understanding of the extent of the potential environmental benefits and costs associated with e-health. In a world acutely aware of environmental issues, it is inappropriate that a globally pervasive activity such as eHealth is not bound by the same ethical and moral principles, practices, and standards as other human activities.

Against all the potential environmental and health benefits of eHealth, it is now essential to balance environmental and health costs through the entire life-cycle ("cradle to grave") of eHealth related activities.

Environmental eHealth should be considered an essential component of all future eHealth research and implementations. As eHealth proponents, we each hold a social responsibility to become aware of the potential environmental costs and benefits of eHealth and to act as environmental stewards in balancing these newly recognised realities.

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and locally (‘glocal’ e-health). He promotes the application of ‘**culturally sensitive and technologically appropriate**’ e-health solutions, and is pursuing collaborative research, capacity building, and implementation activities with colleagues in European, Asian, Australasian, African, and Latin American and Caribbean (LAC) countries.

Ethics, Qualifications and Liability Issues of Online Mental Health Providers: A Look at International versus US Based Providers

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Introduction

Seeking mental health services online is becoming increasingly common (Chang, 2005; Pollack, 2006), and a literature on the efficacy of online treatment is beginning to emerge (Pollack, 2006; Marks et al. 2003; Stevens et al. 1999). Nevertheless, even though evidence that online therapy is helpful to clients is emerging, little is yet available from professional organizations that gives clear guidance to professionals on how to deliver online services ethically to avoid liability in their practice (Chester, Glass, 2006).

Online Therapy Domain and Licensure Boundaries

Locke (2007), an attorney specializing in the healthcare industry, notes that practice regulatory and liability issues are in need of fine tuning. Similar issues are present in emerging online counseling practice as clinicians in a number of states and members of a variety of professional organizations vie to determine who owns the territory of the world–wide-web. The lack of established laws and guidelines within each state make it difficult for a practitioner to know how to practice online therapy. If there are not enforceable guidelines to follow, or approved training to establish a professional as competent, it is difficult to gauge how ethically an online therapist is practicing (Trepal et al., 2007). Whether or not the client is coming to the office in the state where the professional is based or the professional is doing a house call in another state or country is a question continually debated in the profession, particularly since training and education requirements can vary from state to state and country to country (Blau, 2007). However, regulations beginning to emerge in a few states (noticeably California, in the U.S.) are suggesting that online therapists may be subject to interstate commerce laws. The geographical boundary issues involved in sanctioning provision of online mental health provision is an area yet to be tackled by governing licensing boards and professional organizations.

The most controversial legal issue is territorial state licensure laws. In face-to-face practice, a clinician must have a license to practice in a

particular state. It seems logical that the online practitioner should also be licensed in the state that they practice as well, thereby following all of the laws and ethics of the mental health profession that they are associated with. But what about provision of online services to clients that are not within the state where the professional is licensed, or for that matter, in the same country? As some see it, online therapists are practicing unethically by providing services to clients outside of their licensed state (Blau, 2007). Ragusea, VandeCreek (2003) have pointed out that confusion will continue as long as ethical considerations about domain of practice that are attached to legal questions (that vary from state to state) remain unresolved.

Research Question: Qualifications

Maheu and Gordon (2000) noted that 90% of the practitioners that completed their questionnaire in a study of the qualifications and practice of online therapists stated that they were licensed in their appropriate state or country to practice psychotherapy and all held at least a master's degree in the subject area. Interestingly, although qualifications in the field were high in each state, in another study Mallen and Vogel (2005) observed that 75% of the therapists they surveyed practiced online therapy outside of the state that they were licensed in, a practice not in congruence with ethical standards in traditional therapy. Again, if there are not guidelines to follow, it is difficult to gauge the degree to which an online therapist is practicing ethically or within their scope.

In this study, the majority of participants (81.9%) graduated from a school in the United States. Almost all of these were accredited institutions (only 2.2% of the therapists indicated they graduated from a non-accredited institution). Another 15.9% of the online therapists stated that this question was not applicable because they graduated from a non-U.S. university. International participants were more likely to hold a Bachelor's Degree (15.9%) than domestic therapists (2.4%). The master's degree was the most commonly held degree in both categories with International participants holding 52.4% and the domestic participants holding 59.9% of this degree, respectively. Almost twice as many Doctoral Degrees were held by domestic practitioners (35.8%) than by International therapists (19.8%).

Perception of geographical and territorial boundaries is a key issue in determining how online therapists may be placing themselves at risk for liability. There is no nationally recognized online therapy license in the U.S. However, in order to be in compliance with each state (in the United States) a therapist would have to hold a license in said state to meet the qualifications of the state that they are providing services in. A provider may envision themselves stationary (in one state) while providing services

to clients elsewhere, or they may envision themselves as *virtual* travelers, meeting the client where they are geographically regardless of the actual state laws, which may be misunderstood or an unknown to the provider. If one does not see themselves as providing services outside of their licensing geographical boundary, they would not think to look at laws that apply to interstate commerce, which may include delivery of mental health services. International therapists do not have the same requirements of those who reside stateside, and the possibilities of alternatives to United States requirements were too much to quantify for purposes of this study, but would make an excellent future study.

Table 1. Education

Variable	Frequency	Category Percentage	Cumulative Percentage
Highest Degree[a]			
Doctoral Degree	72	33.0	26.4
Master's Degree	131	60.1	93.1
Bachelor's Degree	15	6.9	100.0

[a]N=218

Anxiety about online practice. Domestic therapists (n=155, *M* = 6.45, *SD* = 2.56) reported higher levels of anxiety about their online practice than international providers (n=59, *M* = 5.78, *SD* = 2.30). This difference approached statistical significance (t(116) = 1.85, p=.07) (see Table 2).

Domicile and Congruence of Online Services with Ethical Standards (Q3)

Awareness of laws regarding practice. On average, domestic therapists (n=136, *M* = 1.15, *SD* = .36) were slightly more likely than international providers (n=49, *M* = 1.12, *SD* = .33) to be aware of telehealth laws that relate to their practice. This difference was not statistically significant (t(126) = 0.43, p=.66) (see Table 3).

Awareness of law restrictions. Domestic therapists (n=135, *M* = 1.29, *SD* = .45) were slightly more likely than international providers (n=46, *M* = 1.21, *SD* = .42) to be aware of restrictions in the law that relate to their online practice. This difference was not statistically significant (t(84) = .98, p=.33) (see Table 3).

Abiding by ISMHO standards. Domestic therapists (n=131, *M* =2.73, *SD* = 0.44) were slightly less likely to know and follow ISMHO's standards than international providers (n=50, *M* = 2.84, *SD* = .37). This difference was not statistically significant (t(98) =-1.64, p=.10) (see Table 3).

Table 2 Domain of Practice (Q2): Means, Standard Deviations and *t* test Results for Domestic and International Providers.

Variable	Domestic (U.S.) Mean	N	*SD*	International Mean	N	*SD*	Mean Dif.	*t*	*p*
Out of state services	1.59	147	0.49	1.52	50	0.50	0.06	0.79	.43
Multiple licenses	1.14	156	0.35	1.12	57	0.33	0.02	3.50	.73
Virtual Travel	1.82	117	0.37	1.95	38	0.23	-0.12	2.33	.02
Online anxiety	6.45	155	2.56	5.78	59	2.30	0.67	1.85	.07

Table 3. Congruence of Online Services with Ethical Standards (Q3): Means, Standard Deviations and *t* test Results for Domestic and International Providers

Variable	Domestic (U.S.) Mean	N	*SD*	International Mean	N	*SD*	Mean Dif.	*t*	*p*
Aware of laws	1.15	136	0.36	1.12	49	0.33	0.02	0.43	.66
Aware restrictions	1.29	135	0.45	1.21	46	0.42	0.07	0.98	.33
Abide by standards	2.73	131	0.44	2.84	50	0.37	-0.11	-1.64	.10
Insurance	1.89	139	0.31	1.79	52	0.41	0.10	0.88	.10
Online coverage	2.22	127	0.63	2.31	47	0.73	-0.10	-0.83	.41

Professional liability insurance. Domestic therapists (n=139, *M* =1.89, *SD* = .31) were slightly more likely to hold professional liability insurance than international providers (n=52, *M* = 1.79, *SD* = .41). This difference was not statistically significant (t(74) = .88, p=.10) (see Table 3).

Professional liability coverage on the internet. On average, domestic therapists (n=127, *M* =2.22, *SD* = .63) were slightly less likely to know whether their insurance covered online practice than the international providers (n=47, *M* = 2.31, *SD* = .73). This difference was not statistically significant (t(81) = -.83, p=.41) (see Table 3).

Summary. Differences for only one item (virtual travel) was found to be statistically significant, with international providers more likely to see that clients were virtually traveling to their office than US providers. Differences for anxiety scores were marginally significant, in that the domestic anxiety rating scores a little higher than scores of their counterparts. All other differences were not significant.

Results of this study will be useful for professional organizations and educational institutions as basis for increasing the level of clarity about ethical practice as well as providing the necessary elements for future trainings, and by regulating bodies to establish consistent standards and develop legal safeguards to guide and protect practitioners in their practice. And finally, information from this study can be used to focus further

research on ethical practice in online therapy and provide a baseline for future studies examining the relationship between the ethics and efficacy of online therapy.

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Evolution of Performance Indicators in a Large Scale Telehealth Center in Brazil

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Abstract: **Performance indicators used in the Telehealth Center at the University Hospital of Federal University of Minas Gerais (Brazil) are described as well their use as management tools to control the two main processes at the Center: implementation and maintenance of a large scale telehealth system which has made above 150,000 ECGs and more than 1,600 teleconsultations, connecting 248 villages in remote and poor areas to five university hospitals. The management system used at the Telehealth Center has permitted its expansion, reducing costs without losing quality.**

Introduction

The Telehealth Center at the University Hospital of Federal University of Minas Gerais, Brazil, started its planning activities in 2001 and in 2004 the clinical activities (teleconsultations) started with a pilot project to support the Family Health Program teams in the capital of the state of Minas Gerais, Belo Horizonte [1]. In 2005, realizing that cardiovascular diseases are the most important cause of deaths in the State, the Teleheath Center changed its focus to telecardiology, implementing the Minas Telecardio Project in 82 villages located in remote and poor areas of the state [2,3,4]. Along the last three years, the project was expanded and by a demand of the Health State Department it became a regular telehealth service covering also other specialties in 248 villages and small towns (December 2008), including assistance in other areas like nursing, dentistry and nutrition. The present assistance activities at the Center are teleconsultations on line and off line (covering all specialties), electrocardiogram analysis and support to urgency clinical cases in cardiology. In view of the large territorial extension of the state of Minas Gerais, the Telehealth Center established a partnership with four other universities along the state and their respective school hospitals: Federal University of Uberlândia, Federal University of Triângulo Mineiro, Federal University of Juiz de Fora and State University of Montes Claros,

establishing a Telecardiology Network in Minas Gerais, linking academia to primary care. Presently the Network expanded to include two other Brazilian states: Ceará, in the northeast region, and Espírito Santo in the southeast region. The objective for the next two years is to reach 500 villages in Minas Gerais and 100 points in those two other states. In order to reach this goal without losing quality and improving the economic result, several indicators related to performance, quality and costs were implemented for maintenance and improvement of the system. The objective of this work is to show how these performance indicators are used to identify any deficiency and to better plan the expansion allowing an optimization of the system, covering an increasing population with higher quality and lower cost.

Performance Indicators

The management activities of the Center can be divided in two main groups: implementation and maintenance. The implementation process starts with the definition of the villages where the system will be implemented, according to criteria such as community population (small villages), HDI (poorest villages) and geographic location (remote villages) [2]. For the selected ones an initial evaluation of the Internet connection quality is done through connection tests. Although the system can operate at low bandwidth, in a few cases are necessary improvements on the connection, under the responsibility of the municipality.. Technical visits are done to these villages in order to motivate the local team and to perform a practical demonstration of the system checking, at the same time, the quality of connection. The last step on the implementation phase is a practical training on the system for the local teams. It is done at the Telehealth Center when the equipments are delivered.

To maintain the system working properly, the maintenance activities are subdivided in three groups: technical maintenance of equipments (network, servers, softwares, etc.), technical support to users (made through a call center) and control of the telehealth activities. The objective here is to describe the last one.

Every telehealth activity is registered by the system, collecting all relevant information such as time, origin, professionals involved, etc. Every day this information is analyzed and it is consolidated weekly. Indicators based on these information are discussed internally with the staff, in all five university hospitals via videoconferencing. The performance of each village is controlled, anomalies are detected and corrective actions discussed and proposed during this meeting. By the end of each meeting, an action plan

with chronogram and responsible is established. The same procedure is made also for the implementation process.

Implementation Performance Indicators

Fig. 1 shows, as an example, the time evolution of the indicators used to evaluate the last process of implementation in 97 villages, from August to December/2008. Such indicators are the number of villages in each stage of the process: contacted, ready for connection test, with connection test appointed, with test done, ready for visiting, visited, trained and finally in operation (active). Once established a chronogram for this phase, this graph helps to make the follow-up and detect any delay or anomaly in the process. A process and cause analysis is done in order to identify the corrective actions, resulting in an action plan.

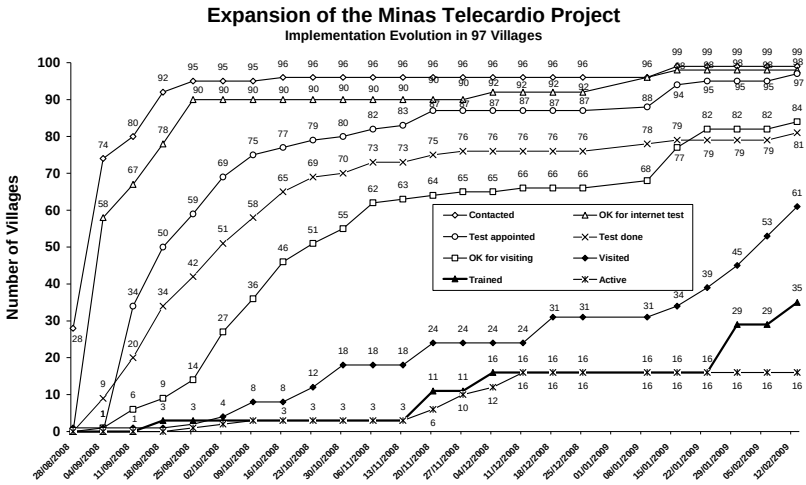

Fig.1 Evolution of Implementation Indicators used to control the process at the Telehealth Center

Activity Performance Indicators

The most important indicators to evaluate the performance are the number of electrocardiograms (ECG) and teleconsultations per village.

The indicators of teleconsultations are deployed according to the specialty, village professional, time spent for answering, diagnosis, etc.

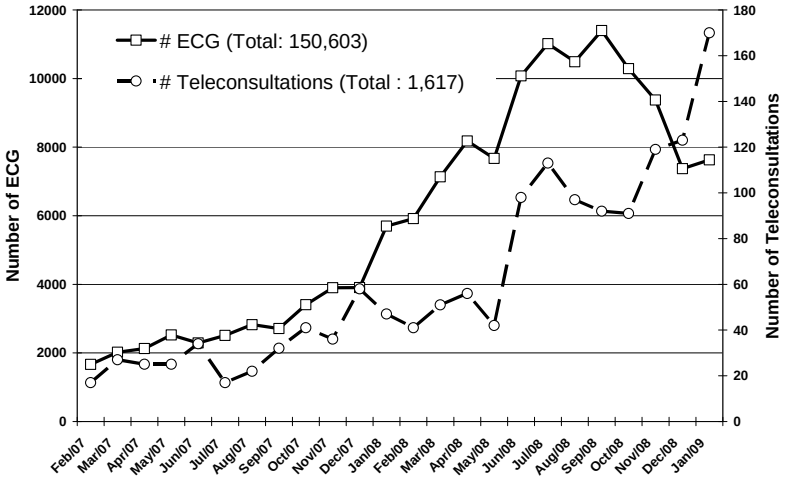

Fig.2 – Monthly number of activities at the Telehealth Center from Feb.2007 to Jan.2009.

Using these indicators any anomaly can be detected. Inactive villages or low active use of the system go to a so called “Black List”. Some of the most frequent causes of “Black List” are Internet or equipment failure and local staff changes. Another important indicator is related to the effectiveness of the telehealth activity (% of avoided referrals).

Discussion

To guarantee the fully operation of such a large scale telehealth system it is necessary to have two different teams to implement and maintain it, since those processes become more complex as the system increases its scale,. At the Telehealth Center the staff follows up daily these indicators to detect any problem. As an example, in October 2008 there were municipal elections in the villages causing a sudden decrease of activities, as shown on Fig. 2. A virtual questionnaire was sent to those villages to investigate the causes. It was evidenced that in 60% of the villages there were political staff changes due to a new administration. Associated to this, usually there is a high rotation of doctors by the end of the year in these villages, period when the specialization courses start. In this case the main cause was identified as lack of training of the new local teams. A retraining program was set up

involving all university hospital partners. As consequence the number of activities starts to come back to normal levels by the end of January/2009.

Fig. 1 also shows an example of the effect of municipal elections. As the initial steps of the implementation did not depend on local teams, the process was developed rapidly. However for the last steps, highly dependent on local teams (visit and training), the process did not proceed until the new administration inauguration (January 2009).

Conclusion

Based in our experience accumulated in the last four years, we could identify what should be the basic requirements to have a telehealth system working properly [5]:

(i) Telehealth systems should be implemented in regions that have a real demand for such services, i.e. remote, isolated and poor villages,

(ii) Patience and persistence are the most important ingredients to convince people to adopt a new way of working,

(iii) Local managers and clinical staff accept the teleassistance when they realize that it will solve their daily public health problems,

(iv) The system operation should be as simple as the local users,

(v) Technology is the way of doing not the objective itself,

(vi) Face to face meetings are necessary activities before virtual ones,

(vii) To keep the results, an efficient management system is essential.

We have observed that even if the six first requirements are fulfilled, other factors impact on the activity of the system. However, to detect the inactivity, the seventh one is essential in large scale systems. The management system implemented at the Telehealth Center is based on the collection of information followed by a process and cause analysis. Identified the cause, an action plan with chronogram and responsible is set and followed up. This methodology has permitted the Telehealth Center to control the processes, increasing the quality and reducing the costs of the service.

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Session 22

eHealth Efficiency

A Qualitative-Quantitative Study of the Professionals Perception about the BH-Telehealth Project Implemented at the Network in Belo Horizonte, Brazil

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Abstract: **This paper reports the qualitative-quantitative study results on the professionals' perceptions in the medicine, dentistry and nursing areas, in relation to the BHTelehealth project, which conducts teleconsultantions and videoconferences, located on 144 basic health units in the city of Belo Horizonte, estate of Minas Gerais, Brazil. The BHTelehealth system has been implemented since 2004, with activities of tele-education and teleconsultation to support family health teams. This telehealth model is low cost and has been developed by the Federal University of Minas Gerais (UFMG) and the Belo Horizonte Department of Health (SMSA).**

The evaluation project formatting followed several steps. It was decided to structure a methodology that would allow qualitative-quantitative analysis, through a semi-structured questionnaire, where the closed answers was used for quantitative study, and the open answers, were subject to content review using free software QDA - Weft.

The open questions were initially read uniformly with the goal of obtaining a global vision. In a second moment the answers were read considering blocks of questions and notes of relevant facts were taken. The careful reading of the two questionnaires led to identification the some recurring themes, which were organized and processed into categories and subcategories. Three hundred and seventy three questionnaires were analyzed. For a presentation and analysis of the results, it was decided to join the quantitative and qualitative dimensions of this study.

Conclusions: 1) The implementation of the BHTelehealth program has been helping and qualifying the care process in Belo Horizonte - 71% of professionals related its importance to knowledge acquisition, 74% said that

program assist the care performance and more than 85% referred to telehealth as a very useful tool to help solving clinical cases, therapeutics conducts and qualified diagnostics; 2)The use of low complexity and low cost technology, replicable in different dimensions has been evaluated positively by the professionals 3) There are still routines difficulties in the care process to be work on for the full utilization of the interactivity and telehealth available but it is promising.

Introduction

The BHTelehealth was designed by the Belo Horizonte City Department of Health (SMSA) in 2003 and implemented in 2004 at Belo Horizonte City, southeastern of Brazil. The establishment of a network geared to support the care and education of professionals of Basic Units of Health (UBS) was possible through the combination of efforts between Belo Horizonte City, the Federal University of Minas Gerais (UFMG), the Ministry Health and the European Union (EU) - by Project @ lis. Through these partnerships, it has structured an integrated network for data, sounds and images transmission creating an environment that offers sustainability practiceof the Family Health Program (FHP) work (1-2).

The BHTelehealth is supported scientific and technological from the following institutions: Medicine College and Scientific Computing Laboratory (LCC) of the Federal University of Minas Gerais, Belo Horizonte City Department of Health (SMSA), Computer and Information Company Belo Horizonte City (PRODABEL).

The main objective of BHTelehealth is to use the Information and Communication Technologies (ICTs) and the telehealth resources to improve the provision of basic assistance in health units in Belo Horizonte and medical, nurses and dentists professionals continuing education, as well as improve ability to diagnosis and care of doctors working in the Basic Health Units of the SMSA of providing access to specialists of the Center for Medical Specialty (CEM-SMSA) or the Medicine College from UFMG trough teleconsultants online and offline, where it is possible to discuss the cases with images and data transmission from medical records of patients (1-2) and videoconferencing.

The teleconsultancy online are made by a prior appointment. The professional may request it to present a clinical case and chosen to receive expert guidance on the diagnosis, therapy, report, or conduct general propaedeutic (2). Teleconsultants off-line are for cases that require only a clarification of specific questions. In this way the professional sends the summary of the case and the expert answer by BHTelehealth system(2).The videoconferences occur through a prior agenda and topics defined with

professionals from UBS and agreed with teachers and experts from the UFMG and SMSA (1-2). The videoconferences are used to update and discussion of issues that are present in the professionals from UBS daily practice. The communication between groups regardless of their geographical locations, using video and audio simultaneously allows the cooperative sharing of information and materials of work without geographic mobility needs(2).

Evaluation of Telehealth Systems

The studies to evaluate the implementation of a new technology can be performed before or during the adoption or implementation (3). An ethnographic study of seven projects for evaluation of telemedicine systems in England of the researchers observed a preference for controlled trials, however pointing the flexibility need in approach between two types of knowledge - experimental knowledge about qualitative and quantitative knowledge on usability results. The second has proved to be more useful, especially to evaluate the system in practice, guiding its development. What brings a greater recognition of the practical value of research methods that produce knowledge about processes rather than on health outcomes (4).

For the present study was chosen a methodology allowing the qualitative and quantitative analysis, through semi-structured questionnaire with closed answers and open, free, to enable the use of content analysis. Were prepared 02 (two) questionnaires, one directed to the teleconsultants use and the other for videoconference. The questionnaires were applied in two stages, in November 2006 and March 2007. In total 105 questionnaires were answered on teleconsultancy and 373 questionnaires on videoconferences.

The closed questions were organized to meet the following dimensions: impact care, work process, interaction and system utilization. They were subsequently consolidated and quantified.

The open questions were initially treated by block of questions. The reading allowed the recurring themes identification that were organized and transformed into categories and subcategories of analysis. The category list was included in the free software QDA - Weft. The categories were organized related on topics addressed: infrastructure (equipment, system, network,), Technical support, the process organization (time, subjects, teaching material), UBS organization (tasks division, internal physical structure).

It was concluded that: 1) the BHTelehealth program implementation has helped and qualified the care process in Belo Horizonte - 71% of professionals reported renewal of knowledge, 74% said that they help much in carrying out assistance and more than 85% refer to telehealth as a very

useful tool for resolving cases, conduct diagnostic and therapeutic qualified, 2) the low complexity of the technology use, replicable in different sizes, low cost, has been evaluated positively by professionals and 3) they are still perceived difficulties on their routine in the care process for the full utilization of interactivity resources and telehealth available.

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An Innovative Information System to Help Detect and Rescue Deteriorating Patients in the General Ward Environment – "PATIENTRACK"

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"Patient-safety, defined as freedom for a patient from unnecessary harm or potential harm associated with healthcare, is an issue of increasing concern all over the world. It is estimated that in EU Member States between 8% and 12% of patients admitted to hospitals suffer from adverse effects whilst receiving healthcare" (Communication from the Commission to the European Parliament and the Council on Patient Safety, 2008). In the UK alone, adverse events are calculated to cost the NHS £2 billion per annum of hospital operating costs (An Organisation With a Memory, Department of Health Expert Group and CMO, 2000).

This presentation will share the results of a project that is believed to be a world-first. The presentation will describe the inventive and practical ICT solution deployed, the project outcomes and lessons learnt and how ICT can be used effectively to tackle an issue of major concern in the EU and globally. This project was the result of a successful collaboration between an NHS Trust, a private sector specialist health ICT company and an NHS Innovation Hub.

Nurses use PDAs to record standard patient physiological observations such as heart rate and blood pressure. The observations are sent wirelessly, in real time, to a server where they are used to calculate an Early Warning Score (EWS) that is automatically sent back to the PDA. Using unique alert logic, the EWS prompts a repeat set of nursing observations at an appropriate interval and in the event of a high score an automatic alert is sent to a doctor through the hospital's paging system. The solution does not "let go of the problem" and the alerting continues until the patient's observations return to normal or another appropriate patient intervention is made.

Results from the project have been associated with a significant reduction in the length of stay for acutely ill medical patients, reduced in-hospital cardiac arrests and a significant reduction in critical care bed days. The

project has demonstrated that the deployment of simple smart technologies such as Personal Digital Assistants (PDAs) and wireless networks that leverage existing ICT investments can reduce the number, and impact, of adverse events in hospitals. Adverse events cause deaths, disabilities and prolonged hospital stays. Reducing their number will produce improved clinical outcomes and operational efficiencies, enabling more patients to be treated and delivering financial benefits.

Keywords: patient-safety, wireless, technology, hospital

About the Authors

Donald is a founder and director with specialist health ICT company MKM Consulting. Donald has over 25 years of international experience in health ICT, having held senior positions in the United Kingdom, Australia and New Zealand. Over this time he has been involved in some of the most significant and exciting reforms in the health sector. Donald specialises in ICT strategic direction, and innovative ICT solutions development and implementation.

Cost Structure in a Telecardiology Service in Brazil

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Abstract: **Although the Telehealth Center at the University Hospital of Federal University of Minas Gerais was not created with economic objectives, to follow up its attendance cost and to compare it to the cost of referring the patient to secondary level is strategically important. With the objective of supporting an expansion of the system and to evaluate a more extensive use of the technology in the public health system, it was developed a cost analysis structure.**

Introduction

A telecardiology service has been in operation at the Telehealth Center of the University Hospital of Federal University of Minas Gerais in Brazil since June 2006. Connecting 248 villages in the States of Minas Gerais, Espírito Santo (east region of Brazil) and Ceará (northeast region) and covering a population of 2.7 million inhabitants, until December 2008, the number of telecardiology activities reached 142,973 electrocardiograms, 3,805 urgency attendances and 1,452 teleconsultations.

The service has been implemented with the primary objective to support clinical professionals working in the Family Health Program in remote and isolate villages. Although the main outcome of this initiative, supported by the State of Minas Gerais Department for Health and the Brazilian Ministry of Health, is a better quality attendance to the population living in these regions, economic factors must be analyzed in order to guarantee the economical sustainability of the service.

A survey conducted by the Telehealth Center to characterize doctors' profile in the villages covered by the service showed that 50% of them have less than 3 year experience and 20% have less than 1 year experience. The lack of experience, allied to the fact that in most of these remote villages there is just one doctor, makes it difficult to discuss the patients' situation in

case of mistrust or to have a second opinion. As a consequence, a large number of patients have to be sent to a secondary care level, usually in another town with better health infrastructure. In view of the low income of the population in these villages (90% has less than US$ 420 as monthly income), the transportation expenses of these patients are usually paid by the municipal government.

In January 2008, the Ministry of Health supported a study to evaluate the economical sustainability of the telehealth system in these villages [1]. A sample of 20 villages was taken to collect information regarding the impact of the telehealth on municipal finance. In order to develop this study, it was developed a cost structure to allow an economic analysis. The objective of this work is to present a cost structure to allow a cost comparison between the referral attendance (patients sent to secondary level) and distance attendance (patients attended by telecardiology) in the villages covered by the Telehealth Center telecardiology service.

Referral Attendance Costs

For the cost analysis comparison, the cost related to referral attendance to be considered is the patient displacement cost covered by municipal health authorities. Part of this cost is salaries of administration staff and drivers and costs related to vehicles used for transportation of patients (fuel, tires, maintenance, insurance, taxes, depreciation, capital cost and rental). Since the population in those villages has low income, they usually receive a pocket money for daily expenses. Telephone and Internet costs are related to exam and consultation appointments with specialists made by the municipality. In Brazil all patients have the right to be attended in the public health system without cost. However due to the high demand for these services, the municipal health authority establishes, together with other villages, a health consortium where expenses with salaries, exams, etc. are shared. Another alternative found by some of the villages is a contract with private clinics or hospitals.

Distance Attendance Costs

The costs related to distance attendance are due to the implementation of the system, equipments in the villages and the Telehealth Center telecardiology activities (electrocardiograms, teleconsultations and urgencies). The implementation cost can be divided in salaries of personal involved (both in the Telehealth Center and in the villages) during the implementation period, travel expenses and training of village staffs on the system. Villages' equipment related costs are depreciation, maintenance and capital cost.

For a cost comparison, it is interesting to define a unitary activity cost at the Telehealth Center. This activity cost was defined as the monthly total expenses at the Center divided by the number of activities done (electrocardiograms, teleconsultations and urgencies). The expenses at the Telehealth Center are:

(i) Costs related to the equipment in the Center: depreciation, maintenance and capital cost;

(ii) Operational costs: coordination, salaries (technical and administrative), medical duties, consumables, travel expenses, Internet and telephone.

Discussion

Fig. 1 shows the structure of cost above described and the relationship between them in order to compare the two situations: referral attendance and distance attendance.

An additional parameter has to be introduced at this point. Since not all electrocardiograms or teleconsultation necessarily avoid the displacement of the patient to the secondary level, it was defined an "Efficiency of Teleactivity" factor as the coefficient between the number of avoided patient referrals and the total number of patients. This number for the Telehealth Center is presently around 70%. That means that 30% of the patients who looked for attendance in the villages' health centers are referred to a specialist in another village, usually as an urgency case, after they have their clinical situation analyzed and discussed with the doctors in duty at the Telehealth Center.

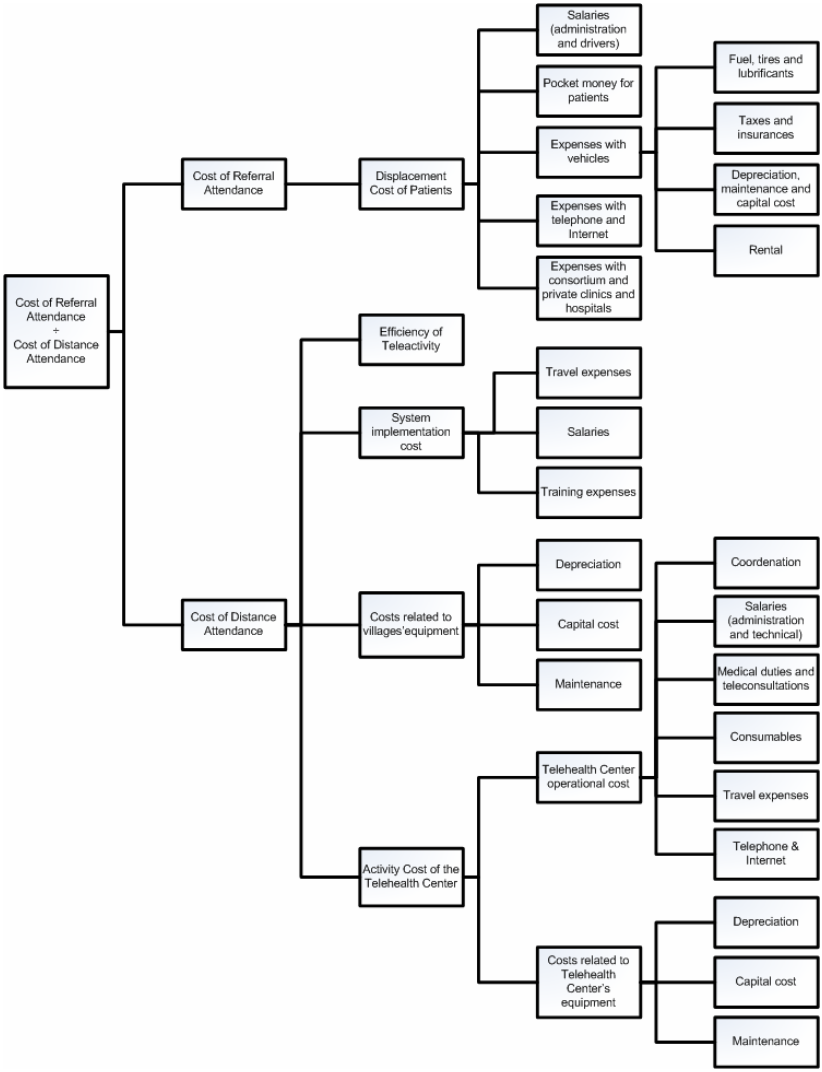

Fig. 1 – Cost deployment structure used to compare the cost between referral attendance and distance attendance at the Telehealth Center.

Conclusion

The implementation of the Telehealth Center at University Hospital of Federal University of Minas Gerais was made with the objective to support clinical professionals working in the Family Health Program in remote and isolate villages without any economic objective. However, an economic analysis is strategically important to follow up the cost of its activities and to compare it to the previous situation in remote villages, where the lack of experience of local doctors and absence of specialists result in a large number of referred patients to the secondary level,. The expansion of the system or a more extensive diffusion of the technology in the public health system will necessarily take in consideration economic aspects. The cost analysis structure presented here will be used to support these decisions.

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Human Factors as Key Components for the Acceptance of Telemedicine and e-Health Applications

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***Abstract*: User acceptance is one of the factors which determine the success of a telemedicine or e-health application. It is more than the user nodding or shaking his head answering the question whether he or she is happy with the application. Applications which do not pay sufficient attention to user acceptance are in danger of failing even though the application itself might be perfect. To cover user acceptance properly it is not only necessary to look at usability issues as 'ease of use' or 'comprehensibility' but to concentrate on relevant human factors, too. Human factors are user characteristics which have an influence on the way the user interacts with an application. Identifying relevant human factors will cover the human side of the interaction between the user and the application. In the paper nine such human factors are described. Each single human factor can influence the success of an application and can be responsible for its rejection. The human factors have to be included already in the design phase and have to be monitored during the whole life cycle of the application in order to improve user acceptance.**

Introduction

A change can be determined in healthcare: the patients are more and more becoming clients with wishes and requirements. Their position in healthcare has changed. They no longer accept any suggestion for treatment with total obedience but position their concerns about their health in a mature way with their own opinion and their own point of view. Therefore user acceptance of telemedicine and e-health applications is now more important than ever [1].

With telemedicine and e-health healthcare has experienced another important change. Over the past few years Telemedicine has become synonymous for unprecedented opportunities for improvement in medical care and cure.

Combining these two developments it is obvious that even the smartest telemedicine or e-health application will have to consider user acceptance as a crucial item. Often the success of an application lies in its innovative character: the presentation of a new or different way for diagnosis or treatment. However, as time goes by people will get used to the application and will put question marks to it if the application does not match their own requirements properly. In this respect the question arises which aspects must be tackled in order to satisfy the users' needs and gain their acceptance.

Nine human factors

For telemedicine and e-health nine factors have been identified playing an important role in the acceptance of applications by the end user. The factors have been derived by literature search [2] and by talking to people working in the area of telemedicine and e-health. The end user in this case is not always the patient, but may also be any other person involved in the application as for example physicians or nurses. They also have wishes and requirements and are subject to change, too. The nine factors mentioned here belong to the 'human factors' which means that they are connected to certain inherent user characteristics. Most of them cover emotional aspects, others are more based on interpersonal communication or information processing abilities. The nine aspects are as follows; for a more detailed description of the nine factors see [2]:

1. Aim and usefulness

The user must see an added value in the use of a new application. Otherwise he or she will not be willing to invest energy in order to get accustomed to the new application.

2. Respect

As well as we want to be taken serious during a conversation also the dialogue between the user and an application must be defined by respecting the user. This means that for example actions are explained to the user and that the user is appropriately informed over what is going to happen.

3. Control

Although we are used to technique and technique has become a part of our lives technique can still give you the impression that you have no influence on what is going on. In a situation where people's emotions are as important as in healthcare it must be clear that the application is only a tool which is always in control of a human being.

4. Retaining the care provider's status

Applying a telemedicine application might imply that a specialist or a nurse has to change the way of working in a certain way. As with everything else reluctance to change will be the initial reaction. The care provider might think that his or her status might decrease. Careful implementation of the application into the care provider's working process will contribute to a reduction of that reluctance.

5. User profile

'Know thy user' is one of the most important terms in the design of telemedicine and e-health applications. Without knowing the background of the client (as for example expectations, experience, skills and restrictions), it is impossible to serve him or her adequately.

6. Emotional condition of the patient

Generally patients visit a hospital or a doctor worrying about their health. This emotional setting changes the way they gather and process information and how they respond to information given to them. Using Telemedicine applications this should definitely be taken into account.

7. Levelling of communication

Telemedicine and e-health connect people with different backgrounds using the same application. The application should help to overcome differences in education, experience or perspective.

8. Traceability

With telemedicine and e-health, information will be recorded and will remain re-readable or re-viewable at any time. People might hesitate to enter information that might make them liable. It must be prevented that this will lead to a situation where vital information is not recorded because no one is willing to take the responsibility for it.

9. Information selection

With telemedicine it is quite easy to overlook the impact an application might have on the privacy of a patient: What information do video pictures contain which cross the line between information necessary to help the client and information violating privacy? What to do if video pictures of a client unintentionally reveal another problem than the problem which was the reason why a telemedicine application has been installed at a client's home? A script describing distinctly on how to act in such situations is absolutely necessary.

Conclusion

The nine human factors mentioned in this paper will support a smooth integration of telemedicine and e-health applications into healthcare and will lead to improvement in user acceptance.

The challenge now lies in the translation of these nine factors into the development process of telemedicine and e-health applications. The author of this article is currently busy to develop guidelines for the implementation of these nine human factors into real life applications.

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Language an Obstacle to Obtaining Informed Consent for Telemedicine? A Pilot study

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Abstract: **Informed consent is an integral part of the practice of medicine and by extension telemedicine. It requires the patient to fully understand what is to take place. South Africa has 11 official languages and in the State hospital sector it is common practice for informed consent to be obtained through an interpreter. A template with all relevant computer terminology required to fully inform a patient about the nature of a telemedicine consultation, was developed in English, for translation into isiZulu, the local ethnic language. Preliminary feedback has shown that direct translations of most computer terminology into isiZulu is virtually impossible. The results of this study will direct further research into the development of generic informed consent tools that take into account deficiencies in a language.**

Introduction

There are an estimated 2000 spoken African languages, of these approximately 40 are used on the World Wide Web.[1] Linguistic and cultural diversity are realities that impede Internet use and add to the digital divide.[2] These issues extend into the realm of telemedicine. The World Health Assembly resolution of 2005 (WHA 58.28) acknowledges the need to respect the principle of equality and differences in culture, education, language, physical and mental ability and geographic location.[3] While the vulnerability of people in developing countries has been the focus of recent debate around ethical issues relating of the standard of care and research,[4] the debate on vulnerability has not extended to the practice and use of telemedicine in developing countries.

Currently there is no eHealth policy in South Africa, although one is planned,[5] and there are no relevant clinical or technical guidelines governing the practice of telemedicine. Draft ethical guidelines have been developed by the Health Professionals Council of South Africa (HPCSA), which include the need for informed consent for the practice of telemedicine.

The concept of informed consent in Western medicine is firmly grounded in recognizing that patients are autonomous agents. Consent is also the primary means of ensuring that a patient's right to control their own treatment is protected. For informed consent the patient must be advised on

the nature of the proposed action, the potential risks, and benefits of the proposed action as well as any alternatives. Consent is only deemed legal if the consenting party is fully au fait with what they are consenting to. In South Africa the legal requirements regarding a legally valid consent have been set out by Castell v De Greeff. That is, the consenting party must have; had knowledge and been aware of the nature and extent of harm or risk; appreciated and understood the nature and extent of the harm or risk; have consented to the harm or assumed risk; and the consent 'must be comprehensive, that is extending to the entire transaction, inclusive of its consequences' [6] These requirements have been incorporated into the draft documents proposed by the HSPCA.

Language and Cultural Issues

South Africa has 11 different official languages, and a large population who can be defined as having limited English proficiency (LEP). In State Hospitals, interpreters are commonly used for clinical interviews and gaining consent. Studies have shown that where language barriers exist there is a greater chance of patient dissatisfaction and non-compliance to care.[7] Where there is discordance in the understanding of terminology used by the Doctor or Nurse Interpreter and the patient, studies have shown that *ad hoc* interpreting procedures in a clinical setting have up to 40% translation errors.

The language problem is exacerbated by cultural differences which can make communication and understanding very difficult.[8] In this setting, while telemedicine provides a means of enhancing the level of care to economically and geographically compromised patients, it also raises a new problem in the safe guarding of patients' rights regarding informed consent.

Nursing staff are traditionally used to advocate, mediate and negotiate on behalf of their patients; a process termed "cultural brokerage." It is essential to ensure that culturally competent nurses help their patients receive culturally competent care.[9] Patcher et al describe a system of culturally sensitive health care that respects ethnic and cultural values along with linguistic considerations to enhance the quality of the interaction between the patient and the health care system.[10] The information given to the patient will be dependent on the nature of the telemedicine consultation, eg synchronous or asynchronous, and the means of data transmission and storage.

The impact of language and culture on telemedicine and the use of complex computer terminology in the informed consent process has not been addressed in our pluralistic society. This study will hope to identify and address the key concepts in ensuring greater patient and health care

provider understanding of the terminology used when gaining informed consent for a telemedicine consultation.

Design and Participants

As an alternative to translation, one of the objectives of this study is to develop new consent materials in isiZulu, the indigenous language of our region. Field experts have reported that creating a document in the language of the intended audience is preferable to translating existing documents, as the document will more accurately reflect the values and beliefs of the client. In addition, creating new materials can prevent misunderstandings of content when words in English do not exist in other languages.

A list of all relevant computer terminology required to fully inform a patient about the nature of a telemedicine consultation including the risks and benefits involved was developed in English for translation into isiZulu by at least 5 experts in each of the following categories: IT specialists, medical students, nurse interpreters and doctors, all of whose first language is isiZulu, and Medical Doctors who are fluent in isiZulu, but are English speaking.

These translations were then compared to determine if there were any words used that have no isiZulu equivalent, words that may have been given different translations and words of similar meaning that were adapted for translation.

Preliminary Results

Preliminary feedback has shown that direct translation of most of the computer terminology is virtually impossible, with only a few common words such as phone lines and network, having a direct translation and others such as internet requiring a paragraph for explanation. In some instances the English word was used as the translation with the explanation that because there is no translation it has been incorporated into the isiZulu vocabulary.

The next stage of the study will be to develop and then translate a generic informed consent document. This will be based on the principles of using terms that are commonly accepted across dialects, gaining stakeholder consensus on translations and using symbols and pictures where relevant words do not exist. It will then be circulated to obtain feedback on materials, from community leaders LEP patients and by field testing with a focus group of LEP patients and nurse interpreters [8, 11].

Conclusions

Although not all the data have been returned, it can be concluded that f telemedicine consultations, it is not possible at present, to ensure that the full legal requirement of a valid informed consent, as set out by the HPCSA, are met. There is a need to provide with limited English proficiency are provided with information of appropriate quality and quantity of, to ensure that they will be genuinely informed in order to make an autonomous choice as to their preferred treatment in our current setting will require appropriate consent tools, as well as commitment from Doctors, health care administrators, community leaders and most importantly the Nursing Staff who largely "double" up as the "cultural brokers" in our health care setting.

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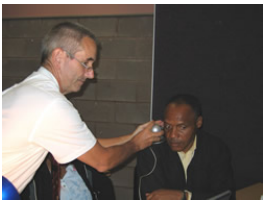

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Regional eHealth Project: Experience and Problems

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Abstract: **In this paper authors speaks about regional telemedicine system stadiums of development, directions of practice current work and perspectives aims. Special attention is given to human, technological and economic factors mobile telemedicine complexes.**

It is generally accepted that telemedicine (TM) technologies stimulate the development of regional public health systems. In Nizhniy Novgorod the introduction of TM technologies began in 1997 in the framework of the international project "Spacebridge to Russia" implemented in co-operation with Telemedicine Foundation (Moscow). At first the Regional center of TM (RCTM) was organized on the basis of Nizhniy Novgorod Regional Clinical Hospital. The professional trainings organized for the RCTM staff in Moscow was followed by teleconsultations and video lectures held in the leading clinics.

The next step was the formation of the regional TM net, which included the rural hospitals of the region. In 2000-2002 several pilot projects were implemented, which included the research into the initial technological basis of rural hospitals, the trainings for doctors and nurses on TM technologies, organization of pilot store-and-forward teleconsultations among hospitals, introduction of teleECG-system. Researches in sociology and economy were carried out. RCTM took part in Harmony Project on establishing the TM service center in a correctional institution.

As a result, the main problems in the sphere of TM were revealed, such as: the weak telecommunication development in rural hospitals, the absence of the legal basis, unstable recourse supply for TM projects and the deficit of qualified specialists in TM. TM represents the new sphere of technology: in 2002, for example, only 18.4 % of Nizhniy Novgorod population and 54.8% of doctors had minimal information about TM (in 2008 - 39.5 % and 83.3 %).

This leads to the complex of specific problems of TM introduction. In co-operation with the training units in Moscow and Nizhniy Novgorod the training system for specialists in TM was organized.

We selected three groups of specialists for different training programs in TM (1) students, doctors and nurses, who are passive consumers of TM-services, (2) consultants and lectors, who sometimes uses TM-technology, (3) constant personal of TM-centers. From this point of view where are three special contingents in TM-system: public health managers, patients and all population.

Since 2000, several successful projects include: (1) telemedicine training courses for physicians and nurses, conducted jointly with the Space Biomedical Center for Training and Research using distant learning technologies; (2) Nizhniy Novgorod State Medical Academy initiated "Fundamentals of Telemedicine" Course for 5th and 6th year medical students; (3) regional medical periodicals publication of educational materials on telemedicine for interested specialists and patients, (4) special web-site for some categories of patients (on endocrinology, gastroenterology, est.)

Six monographers on TM were published.

The results of the initial analysis of these data were first used in 2003 and in 2007, when The Ministry of Public Health was developing the Regional programs of health care informatization and TM. During 5 years it was found 5 multiprofile and special TM centers and 11 medical aid posts in rural districts.

There were two concepts of organizing TM centers:

- In large regional hospitals, which are working as the inter-district centers;
- And in the most remote areas, where there are a staff deficit of doctors and availability of medical aid to the population.

There are some basic directions in the work of regional TM-system:

- Tele-consultations of rural patients in regional level,
- Tele-consultations of patients in federal clinics,
- Distant diagnostic, such as electrocardiograms, roentgenograms et al.,
- Tele-education from RCTM for rural physicians,
- Distant training courses, scientific and practice teleconferences from federal clinics.

Our center took part in introduction of mobile TM-complexes and portable equipment for medical monitoring.

From 2006 the authors take part in development and testing of Mobile Telemedicine Complex (MTMC), which was created in connection with the Federal special scientific and technical program named “Research and development priority directions in science and technology” in 2002-2006 years with topic “Development of mobile telemedicine complexes to control living functions of people located in out-of-the-way and remote places, in centers of man-caused and natural disasters and terrorist acts”.

The complex was assembled on “Sobol” minibus and contained broadband satellite communication facilities, IEEE 802.11g standard wireless data communication facilities, portable computer equipment including modified portable kit, video conferencing facilities, medical equipment (electrocardiograph, electronic otoscope, tonometer, etc.). In addition there was a possibility to use the medical equipment available on-site.

The portable kit was based on the portable computer and contained a display, microphone and headphones located on investigator’s headset, a computer mouse located on investigator’s finger, a keyboard located on jacket’s sleeve along with processor and accumulators placed on investigator’s waist. Taking into account the tasks to be performed, the portable kit was in addition equipped by portable video camera also placed on investigator’s headset. The communication with the main complex located in the car was fulfilled via Wi-Fi protocol.

The field tests were made in the territory of Nizhegorodskiy district in Arzamasskij, Bogorodskij and Diveevskij areas as well as in Nizhniy Novgorod city.

The deployment of complex was done in the field conditions, in the medical obstetrical station, in some central regional and city hospitals as well as in Nizhniy Novgorod city.

Now MTMC is used in Nizhniy Novgorod Center of Accident Medicine.

Next stage of our work together with Institute of Biomedical Problems is development of portable equipment for outside of hospital medical control.

Complex includes means for registration, telecommunication and analyze medical data as electrocardiogram, oxymetry, reography et al.

The normative documents for TM at the regional level and protocols on distant exchanges of medical information were formulated. Now we have the experimental data on medical and economic efficiency of TM. According to it, the general cost of teleconsultation accounts for one third of 450-kilometers travel cost for usual consultation to a Moscow clinic. But now the work of RCTM includes not only teleconsultations, but tele-education, prophylactic, some administrative applications so. We see, the general road is from TM to e-Health.

So, one of social directions is distant record of patients from rural districts for consultations in regional polyclinics. From 2008 such Internet-project was started in head of regional Public Health Ministry. More 10.000 patients use new technology for choice of convenient time for trip to the regional centre.

Now special program developed for translation medical data from our hospital to federal clinic centers. This service is necessary for most heavy patients, and near 1000 peoples in Nizhegorodskiy region needs in this service.

On balance, the development of regional TM net is accompanied by several problems, but systems approach to the management process in combination with “step-by-step” principle and diversification become a base for its successful resolution. Even nowadays TM plays an important role in medicine of Nizhny Novgorod region, and in future e-health technologies may lead to the transformation of the whole structure of public health system.

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