ABSTRACTS

Telemedicine in South Africa
J.B. Fortuin, M. Molefi

Since the introduction of computer and the availability of broadband communication there has always been a possibility for the introduction of Telemedicine. Telemedicine is an evolving technology in South Africa. It has been described as “bridging the gap between the have and the have not’s. This emerging technology has been implemented in various areas of health within South Africa. Some of the activities include teledermatology, teleradiology, health channel and telemedicine product development. The challenges and success of telemedicine activities in South Africa has also been described. The way forward for telemedicine includes advocating for policy, collaboration and ensuring the involvement of all role players especially those on the ground.

Key words: telemedicine, primary health care, teledermatology, teleradiology, health channel, HIV/AIDS.

Advances in Albanian Medical Informatics and Telemedicine
Dr. Edlira Xhemo, Dr. Erion Dasho

The purpose of this article was to describe current status and future approach to telemedicine and eHealth in Albania. No medical informatics or telemedicine or e-health activity have been implemented since 1993. Albanian experience with Telemedicine is rather small but good will and desire to work among the enthusiastic professionals in the field shall lead to new projects and development.

Key words: medical informatics, telemedicine, projects.

eHealth in Australia
S. Kolachalam

Information and Communication Technologies (ICT) provide the necessary infrastructure and software tools to make connectivity between all healthcare providers possible; thereby moving the concept of “Health” to “eHealth”. eHealth is neither an event nor an overnight phenomenon but is a continuum of activities. This paper is a snapshot of key eHealth programs from 1984 to 2005 indicating the progress of eHealth in Australia.

Key words: Medicare, HCN, OAICS, MediConnect, HealthConnect.

Introducing the Electronic Health Record in Austria
Wolfgang Dorda, Georg Duftschmid, Lukas Gerhold, Walter Gall, Jürgen Gambal

The Austrian parliament has adopted legislation to introduce the electronic health record under the title ELGA. The present article first discusses several activities of other countries in this context. It then deals with the current situation of healthcare telematics in Austria and the next planned steps to introduce the life-long electronic health record.

Key words: Medical Records Systems, Computerized; Public Health Informatics; Computer Communication Networks; Standards.
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Dear Reader,

Almost one year ago the challenging idea has arisen to put together experiences of advanced users and new beings in telemedicine from various countries, mostly associated to International Society for Telemedicine and eHealth. Finally, this volume presents international efforts of developing telemedicine and eHealth in 22 countries. The delivery of remote healthcare, telemedicine as well the eHealth and newly created Telehealth, that covers almost all aspects of remote Health, is developing almost everywhere. It crosses borders, long distances, cultures, languages, formats, and makes medicine and health care so close to the patients and health professionals as never before. Each national telematically oriented community chooses its own way to enter and forward telemedicine projects, advancing international knowledge about its applicability, opportunities, possibilities and obstacles and barriers, as well. Sharing the knowledge and gaining the view on the problems (met already by others) may support and enhance initiatives, allowing entering the telemedicine “highway”.

I do believe the monograph presented here will fulfill this hope. I am grateful for meeting all contributors and ISfTeH Board of Directors who supported me to begin the adventure with “Advances …”.

Yours sincerely,

Wojciech Glinkowski MD, PhD
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Dear Reader,

I am glad to be able to talk to you in this foreword of the "Advances in International Telemedicine and eHealth", the first of a series of books, dedicated to the "Advances..." in several fields of Telemedicine and eHealth. This series will give you a good overview of what is happening in several countries in the various fields. Beginning with a general overview the series will continue with several special disciplines.

The thing I most like about this book (and the series) is the true international attitude in which it is written, which I – as president of the ISfTeH, an international society of eHealth supporters – completely share and support. Many Telemedicine and eHealth magazines and books only cover the local issues and subjects. Not many look across the borders of their own country. Even fewer publications cover more than only 1–3 countries. In this book alone (not to mention the other books still to come), we have 22 countries represented! That is really an "international" book, in my opinion.

The editor, together with the authors, will take you on a trip around the globe, always with the eHealth situation in the different countries in mind. You will hear from African experiences and from European projects, with an emphasis on Eastern European countries. America, South-America, Russia and the Far East are also represented. This will ensure diversified views on the topic and can broaden the Reader’s view on which "advances" are really made in the world.

I wish you "bon voyage" on your trip around the world on the next pages and would like to greet you again in the next issue of "Advances...".

Yours sincerely,

Prof Dr. Michael Nerlich
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Telemedicine in South Africa

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Abstract

Since the introduction of computer and the availability of broadband communication there has always been a possibility for the introduction of Telemedicine. Telemedicine is an evolving technology in South Africa. It has been described as “bridging the gap between the have and the have not’s. This emerging technology has been implemented in various areas of health within South Africa. Some of the activities include teledermatology, teleradiology, health channel and telemedicine product development. The challenges and success of telemedicine activities in South Africa has also been described. The way forward for telemedicine includes advocating for policy, collaboration and ensuring the involvement of all role players especially those on the ground.

Key words: telemedicine, primary health care, teledermatology, teleradiology, health channel, HIV/AIDS.

Introduction

The introduction of technology and communication in health is changing the way in which health care is being delivered. Initially there was much skepticism about the introduction and implementation of Telemedicine (TM) in a developing country since there was not sufficient evidence about the successes of telemedicine.¹ Telemedicine in South Africa is extremely beneficial considering the current status of public health care.

For developing countries, delivering even basic health care and education to remote, sparsely populated regions has long seemed an almost insurmountable challenge. Today, thanks to the advent of broadband communications links and advances in compression and image processing technology, telemedicine and tele-education applications are becoming realistic solutions. The telemedicine solutions address some the challenges that affect the quality of life and health care in South Africa. Some of the challenges faced in South Africa poverty, unemployment, high prevalence of HIV, inaccessible health care and lack of specialized health professionals etc.

The total population as reported in 2001 was 45 million people. South Africa has eleven official languages and Zulu was reported as the most common home language used. However English is the preferred language of communication used in the media and business.

The South African Telecommunications market is currently the largest in Africa based on customers and revenue totaling $6.8 billion in 2000.² Although telecommunications is not available in all parts of South Africa especially the rural and remote areas there are alternative solutions.
Telemedicine Projects

Teledermatology
In South Africa, numerous teledermatology projects have been implemented utilizing low cost infrastructure and equipment. The infrastructure a plain old telephone system (POTS) is using bandwidth of 56K or integrated service digital network (ISDN) using a bandwidth of 128k or more. A dial up modem or ISDN (128K) modem was also utilized respectively. The equipment used was Personal Computer and digital camera at the referral site. The digital camera was an off the shelf camera with minimum of 3.2 mega pixel with an optical zoom feature. An internet service provider was used to set up an email system.

In the even that the health professional is unable to assist patient or is having difficulty with the management of the patient they would then utilize the teledermatology service. This would involve: (i) explaining the process to the patient; (ii) asking the patient to sign a consent form; (iii) taking images of the dermatological condition; (iv) drafting an email explain the concern and requesting advice; (v) attaching the image to the email and (vi) finally sending the email. Thereafter in approximately 24–48 hours the consultant doctor responds by sending a reply.

Teleradiology
The Pretoria Academic Hospital (PAH) is a tertiary institution that serves Mpumulanga (and other regions) and it is the final referral centre for neurosurgical problems. It has been documented extensively that certain neurosurgical patients must be managed by specialists and that such management, if it starts very soon after the precipitating event (stroke, motor vehicle accident, etc.), can save lives and prevent permanent disability and other serious sequelae.

Prior to the availability of teleradiology, patients presenting with possible neurosurgical conditions were transported to PAH, where they would be managed. Some of the patients were inappropriately referred thus resulting in unnecessary and exorbitant costs. In addition time was not effectively managed not to mention that the patient should have received vital health information at the point of initial treatment.

A teleradiology link between the PAH and Witbank Hospital is now used to send all types of radiological and other information for all neurosurgical patients who in the past would have been transported. This data transmission is also now used extensively by the Neurosurgery Department of PAH to receive computed tomography images and other relevant data before the patient is transferred to PAH. In this way a triage by the neurosurgical team at PAH is performed at a distance and it prevents unnecessary transport, time and money wasting.

Mindset Health Channel
The Health Channel (the Channel) was launched in South Africa in 2003 and is a partnership between the National Department of Health (DoH), Mindset and Sentech. The objectives of the organizations incorporated implementing a satellite broadcast channel to disseminate HIV/AIDS to patients and healthcare workers across health care facilities in the country.

The Mindset Health Channel has been implemented in approximately 56 sites throughout South Africa, including urban, periurban and rural environments. The technology utilized includes satellite, computer, television screen and decoder. The specific method employed enables a patient to view 100 hours of HIV/TB related content from the media content providers. It consists of content packaged in form of health news, presenter introduction, health reports, drama, documentaries, public service announcements and educational programs. Health professionals are able to view and access information stored in the computer in the form of video content, multimedia support and key education messages.

The role of the Medical Research Council is to evaluate and monitor this project as to advise the organizations involved in terms of improving their product to ensure sustainability and efficacy.

Developing a Primary Health Care Telemedicine Workstation
A pilot telemedicine project based in Mpumulanga revealed various challenges whilst implementing and utilizing technology to deliver health care across a distance. The challenges included a lack of user friendly equipment and that could be upgraded/supported locally. Based on these
key challenges a project evolved in which a Telemedicine Workstation would be built specifically for the public health sector targeting the Primary Health Care Sector.

**Successes**

The success of Telemedicine in South Africa varies and in most cases cannot be quantified. This is largely due to the fact the telemedicine is an emerging technology in this developing country.

Teleradiology is of extreme importance since it: (i) secures images for radiologist to read so that no images will be accidentally lost in the form of physical transportation; (ii) teleradiology reduces the reading cycle time from when the image is formed to when the report is completed; (iii) radiology subdivides into many subspecialties, even a general radiologist requires an expert’s opinion, (iv) improves the efficiency and turn-around-time of the radiologist. There will also be an increase in financial turnover.\(^4\)

Store and Forward Applications of telemedicine is considered one of the most cost effective modes of e-Healthcare. It requires minimal infrastructure and in most parts of the world can be setup relatively easily. It has been reported that store-and-forward e-mail consultative support for mobile non physician’s healthcare workers is a feasible model for delivering care in the developing world.\(^5\) In Brazil, a country with limited technical and financial resources, a low cost system for teleassistance may be useful way of providing health-care in remote regions that have insufficient medical support.\(^6\)

Telemedicine can drastically improve the quality of life and health care in resource poor settings. In addition it has the potential to change the way in which health care is being delivered in a positive manner. As a result of telemedicine there could be a significant improvement in financial expenditure.

**Challenges**

The challenges related to telemedicine in South Africa are insurmountable and could intimidate even the most loyal enthusiast. However many individuals and organizations have persevered and have implemented and evaluated telemedicine projects. The key theme/s associated with challenges that have arisen include: (i) lack of infrastructure; (ii) no buy in from health professionals; (iii) too many projects but not sustainable to incorporate into day-to-day activities of the department of health; (iv) ethics and legal issues and (v) duplication of telemedicine projects.

**Conclusion**

Overall South Africa has solidified a platform for the use of information, communication and technologies in health. Telemedicine has much success that has not been over shadowed by the challenges. In light of this there is plenty of room for improvement for this evolving field.

The way forward would include reviewing the evidence of successfully established projects in developed countries and collaboration with other developing countries. A Telemedicine Bill in South Africa that is in line with the WHO e-Health Bill should be advocated for this will drastically improve usage/buy-in, collaboration, funding and legal/ethical issues.

**References**

Advances in Albanian Medical Informatics and Telemedicine

Dr. Edlira Xhemo, Dr. Erion Dasho

Abstract

The purpose of this article was to describe current status and future approach to telemedicine and eHealth in Albania. No medical informatics or telemedicine or e-health activity have been implemented since 1993. Albanian experience with Telemedicine is rather small but good will and desire to work among the enthusiastic professionals in the field shall lead to new projects and development.

Key words: medical informatics, telemedicine, projects.

Albanian’s population is younger than that of other European countries. A third of its 3.1 million habitants is under the age of 15, and 40% is younger than 18.1

Albania is one of the poorest countries in Europe. The presence of an extensive informal economy causes serious difficulties in calculating gross domestic product (GDP) and gross national product (GNP).1

Computer and informatics application in Albania has begun in the beginning of the years ’70: 16 November 1971 by the operation start of the Albanian Institute of Applied Mathematics and Informatics, that in that time was called: national Centre of Applied Mathematics: INIMA, depending from the Tirana University Rectorat. On 1974 this Institute passed under the dependence of Albanian Sciences Academy.

Medical Informatics started during 1974–1975 through a research project of a stomatologist researcher with the Albanian National Center of Mathematics (INIMA) and on 1979 this was referred in the second scientific session of the Albanian stomatologists first generation who were graduated in Albania. But after then for a long period of time until 1993 there was not done anything, neither on medical informatics nor in telemedicine or e-health.

On 1993 the Informatics subject got introduced in the medical, stomatologists, dental, pharmacists and nursery curricula, but it was taught until 2000, from the Applied Mathematics, Statistics and Informatics Department of the Economic and Finance Faculty/Tirana University. From 2000 until 2003 this subject was taught from the Informatics Department of Natural Sciences Faculty/Tirana University. On 2003 Dr. Edlira Xhemo in collaboration with a researcher and teacher of informatics to medical students: Mr. Taulant Haka, performed a strategic research on how implementing as more efficiently and developing medical informatics and telemedicine in Albania and in the same time they got contacts with the Ministry of Health in Albania to begin implementing developing projects of.2 As result of this Informatics got corporated to the Biostatistics Unit of Public Health Department of Medicine Faculty/Tirana University and Dr. Edlira Xhemo was invited as lecturer with major hours for the undergraduate students.

During 2000–2001, the Ministry of Health collaborated with experts from the Department of Health and Human Services (DHHS) of the US Government to draft "A proposal for the development and implementation of a Health Information System in Albania". The forthcoming USAIDS funded project (Partners for Health Reform Plus – PHRplus), began to be implemented by Apt and associates on 2003 and had health information systems a major component of their pilot project. The project was implemented in 4 urban and rural health centers in the
region of Berat. Its main output in the field of Health Information Systems was a computer based application that could open the path to the informatization of health information from the Primary Health Care structures. The information is captured from each encounter of the client/patient with the PHC structures, computerized and provided in form of feedback to managers and providers (family doctors and nurses).

On October 2004, the Ministry of Health decided to rollout this system in the whole country. The next USAIDS funded project (ProShendetit) is providing technical assistance to the MOH in the rollout process through training, technical expertise and troubleshooting. Up to now five out of twelve regions of the country are involved in the system and the first regional information is expected to flow around mid June 2006. Within mid 2007, the system is expected to operate in the whole country.

Meanwhile, the Health Insurance Institute operates since 2000 a health information system that captures information from the pharmacists’ claims for drugs’ reimbursement. The system is based on 12 regional directories collecting claims from the pharmacies contracted by them in the region, inputing them and processing to produce information that is mainly used for the purpose of controlling the cost of the reimbursable drugs (making up to 50% of HII annual budget). With funding from USAID and foreign expertise, the HII completed a feasibility study. It consists of establishing a Wide Area Network that will ensure realtime connection between HII regional directories, pharmacies and (optionally) health centers and providers.

Albanian experience with Telemedicine as conceived and applied nowadays is small. Individual and semi-institutional contacts have been established with the Telemedicine Center of Kosova, but there is no agreement or firm willingness to start a similar project in Albania. Some individual experts and nongovernmental organizations have already shown their interest in being involved in Telemedicine projects.

Good will and desire in working on the field still remains in the staffs. But there are a lot of other steps to go further for developing medical informatics, telemedicine and e-Health in Albania. Some of the most next coming projects: further developing the USAID funded project; building up and strengthening capacities of the national and local experts; implementing telemedicine: tele-epidemiology projects in collaboration with French National Center for Spatial studies; training medical staffs on good usance and well keeping of the equipment.

References

Abstract

Information and Communication Technologies (ICT) provide the necessary infrastructure and software tools to make connectivity between all healthcare providers possible; thereby moving the concept of "Health" to "eHealth". eHealth is neither an event nor an over-night phenomenon but is a continuum of activities. This paper is a snapshot of key eHealth programs from 1984 to 2005 indicating the progress of eHealth in Australia.

Key words: Medicare, HCN, OAICS, MediConnect, HealthConnect.

Introduction

Considering the mobility of people and the government’s obligation to provide citizens with their righteous and ever growing demand of healthcare services is a prominent challenge. To attain this, all healthcare providers have to collaborate effectively. Information and Communication Technologies (ICT) provide the necessary infrastructure and software tools to make this connectivity effective; thereby moving the concept of "Health" to "eHealth".

eHealth is neither an event nor an over-night phenomenon but is a continuum of activities which have to be meticulously managed to achieve success. Every project is conceived either to meet some specific needs or to capitalize on some opportunities. Hence, it can be inferred that no two projects may share same goals. Nevertheless, every subsequent project presents with some scope for improvement over the previous one.

This paper is a snapshot of key eHealth programs from 1984 to 2005 indicating the progress of eHealth in Australia. Section 2 shows the timeline of the programs; section 3 gives a brief description of each program implementation and finally, section 4 mentions privacy regulation across Australia.

The Timeline

Fig. 1 displays on a time scale the key eHealth programs from 1984 to 2005. Table 1 below; briefly shows the timeline of the programs.

Key eHealth Programs

Following is a short description of each eHealth program:

The North-West Telemedicine Project1

- Pilot testing of the government satellite communications network (Q-Network), 20 2way + 20 1way earth stations and the goal was to provide healthcare to people in five remote towns south of the Gulf of Carpentaria; 2/3rd of these people were Aborigines or Torres Strait Islanders.
Table 1. Timeline of key eHealth programs

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>The North-West Telemedicine Project at Queensland for remote residents of the Gulf of Carpentaria</td>
<td>[1]</td>
</tr>
<tr>
<td>1984</td>
<td>Introduction of Medicare, Australia’s Universal Health Care System</td>
<td>[2]</td>
</tr>
<tr>
<td></td>
<td>[introduced under federal Health Legislation Amendment Act 1983]</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>Trial of Medicare teleclaims, access of telephone claiming extended to rural and remote communities</td>
<td>[3]</td>
</tr>
<tr>
<td>Mar.</td>
<td>Queensland first to use new Online Medicare Claiming using Health Insurance Corporation (HIC)</td>
<td>[4]</td>
</tr>
<tr>
<td></td>
<td>Online software and Public Key Infrastructure (PKI)</td>
<td></td>
</tr>
<tr>
<td>Apr.</td>
<td>Announcement of Access to Broadband Technology Initiative as part of a fairer Medicare package</td>
<td>[5]</td>
</tr>
<tr>
<td>1989</td>
<td>Health Communications Network (HCN), uses Medical Director Software [a joint venture between IBM, Medibank Private and Australasian Medical Publishing Company]</td>
<td>[7]</td>
</tr>
<tr>
<td>1995</td>
<td>Telemedicine Applications for Remote Distributed Interactive Solutions (TARDIS), a telehealth project</td>
<td>[8]</td>
</tr>
<tr>
<td>1997</td>
<td>Pilot study of the Open Architecture Clinical Information System (OACIS), a proprietary product [South Australia’s Department of Human Services tried out at 4 major Adelaide public hospitals]</td>
<td>[9]</td>
</tr>
<tr>
<td>Jun.</td>
<td>First Implementation of Good Electronic Health Record (GEHR) in Australia, the project had started in January '01; OACIS to GEHR</td>
<td>[10]</td>
</tr>
<tr>
<td>Sep.</td>
<td>Commencement of Phase 2 of ICP (expected to finish June '04)</td>
<td>[11]</td>
</tr>
<tr>
<td>Dec.</td>
<td>Completion of Southern Health Care Network (SHCN) Smartcard trials</td>
<td>[12]</td>
</tr>
<tr>
<td>Nov.</td>
<td>Public pilot site of Health Insite launched, for providing quality and up-to-date information about human health</td>
<td>[13]</td>
</tr>
<tr>
<td>Apr.</td>
<td>Health Insite formally launched</td>
<td>[14]</td>
</tr>
<tr>
<td>Nov.</td>
<td>1st release of Health Online: A Health Information Action Plan for Australia, for better use of IT in health sector</td>
<td>[15]</td>
</tr>
</tbody>
</table>
The hub of the network was at the Mount Isa Base Hospital and all sites were supplied with a conference telephone, fax, and freeze-frame transceivers.

The project evaluation showed that technology did improve the healthcare of remote residents.
e-Health in Australia

Medicare^2-6
- Medicare is Australia’s universal health insurance scheme, and is administered by the Health Insurance Commission (HIC, known as Medicare Australia from 1st October 2005).
- HIC processes insurance claims and makes payments under various government programs related to the provision of health service.
- In 1997, the trial of electronic kiosks began at various rural pharmacies.
- Claims can be made electronically and payments can be made via electronic transfer directly to bank accounts.

Health Communications Network (HCN)^7
- HCN project was initiated by government agencies through the conference of Commonwealth and State Ministers for Health.
- A joint venture between IBM, Medibank Private and the AMA-owned Australasian Medical Publishing Company; the resulting company, Mednetwork Systems, now delivering to primary health care providers – a practice management package including a variety of communications capabilities, including links among practices, and between practices, their support services and health insurers.
- Uses Medical Director, a simple to use prescription writing, medication and patient management computer program.
- Mednetwork Systems has been de-listed from the Australian Stock Exchange following its takeover by Primary Health Care.

Telemedicine Applications for Remote Distributed Interactive Solutions (TARDIS)^8
- Royal Brisbane Hospital (Queensland) got computers allowing them to dial in from home and observe patient’s progress in real-time. This computerized system decreased the sense of professional isolation experienced by many doctors in rural and distant areas.
- About 80 consultations were satisfactorily completed during the 18-month trial period.
- It was found that no one company could fulfill all these requirements, so three prominent IT companies in Australia became project partners: Telstra, Queensland Technology and Ipex Technologies.

Open Architecture Clinical Information System (OACIS)^9,10
- An intensive pilot study of OACIS (a proprietary product) was run in conjunction with the renal units of the four major Adelaide public hospitals, and was extended later on in the Adelaide city to cover eight public hospitals and few private radiology and dialysis units.
- The system is consumer-centered with the objective of establishing a full Electronic Medical Record (EMR) and is currently influencing many sections of HealthConnect.
- The EMR model uses Health Level 7 (HL7) and Logical Observation Identifier – Names and Codes (LOINC) Code sets.
- In 2001, a project was carried out to transform clinical data from a non-GEHR hospital clinical system to GEHR (Good Electronic Health Record, originally Good European Health Record) format data suitable for use in GEHR compliant clinical applications used in General Practice.
- OACIS has been renamed as “careconnect.ca” in 2005.

Integrated Care Program (ICP)^11
- ICP assists General Practitioners (GPs) in their clinical management of diseases through the development of electronic decision support software based on Evidence-Based Best Practice Guidelines.
- The overall aim of the program was to demonstrate that evidence-based best practice implemented within the General Practice setting can: optimize patient outcomes; improve the efficiency of resource allocation; and create impact on health policy development and decision making.

Southern Health Care Network (SHCN) Smartcards^12
- Smartcard was envisaged as a solution for collecting and sharing information in a distributed
data system where providers were using a variety of information systems with no common standards or definition.

- The intention was to use Smartcard technology for "key" and "carrier" functions while safeguarding consumer privacy in relation to their health data.

**Health Insite**\(^{13,14}\)

- An Internet-based gateway for health information being provided by a wide spectrum of approved information partners.
- The objective was to provide Australians with easy access to reliable information about health and wellbeing toward more informed healthcare decisions.

**Health Online**\(^{12,15-16}\)

- A National strategic plan for health information management developed by the Department of Health and Ageing (DoHA) under the guidance of National Health Information Management Advisory Council (NHIMAC).
- Mandate was to bring uniformity to ICT in the health sector, Australia-wide.
- Key components are Health Insite, MediConnect, and HealthConnect.

**Transactional Health Exchange Linking Multiple Applications (THELMA)**\(^{17-20}\)

- Australia’s first online transaction-based Business to Business (B2B) solution for the healthcare industry- creates interoperability between the broad range of new and legacy software systems.
- The design objective for THELMA functionality was to enable exchange of simple and complex business transactions securely over the Internet in real-time as the catalyst for: hospitals, health insurers, medical practitioners and suppliers to cut administrative and technology costs, re-engineer tired healthcare processes, and improve patient care and member services.

**MediConnect**\(^{21-25}\)

- Formerly known as the Better Medication Management System (BMMS) was developed by the Australian Government to improve prescribing and medication management.
- It is a secure National electronic system and is the medication component of HealthConnect.
- The Australian Catalogue of Medicines (ACOM, currently known as "GS1") has adopted EAN standards for medical prescription.

**HealthConnect**\(^{26-39}\)

- A Health Information Network for all Australians aims to create EHRs with patient "event summaries" collected in standard electronic format at the point of care (hospital or GP).
- Retrieval and exchange of EHRs across a secure network with other healthcare service providers with its access only by patient’s consent.
- The EHR model is based on CEN EN13606-1 (Comité Européen de Normalisation or European Committee for Standardization; European Norm).
- The HealthConnect Clinical Information Program (HC-CIP) from South Australia; the ProviderConnect, National Providers Directory from Western Australia; the EHR*net, Health e-link project from New Sou-

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**Fig. 2. HealthConnect trials across Australia.**
th Wales; and the Community Health Online Record (CHORd) project from Victoria – are different eHealth programs initiated by respective states which, at a later stage became part of the HealthConnect agenda. Fig. 2 shows the HealthConnect trials across Australia.

Electronic Claims Information Processing Service Environment (ECLIPSE)\(^{40}\)
- An online patient verification system conducted by CompuSolve and Medilink.
- Transmission and retrieval within 4 seconds, delivering complete Medicare details and fund eligibility of the patient.

### Privacy Regulations

EHR contains individual’s personal and health related information and this data being sensitive, confidentiality has to be maintained to guarantee individual’s privacy. Healthcare providers have an ethical obligation against disclosure of individual’s personal and health related information wherein, the consent of individual obtained may either be implicit or explicit.

The area of confidentiality and access to medical records raises complex issues and is further complicated by the widespread use of advanced information technology in health service facilities and the increased use of multi-team and multi-facility health care. Any discussion concerning disclosure of confidential information and privacy in the health industry immediately raises the possibility of a conflict of interest. On the one hand the general public has a right to be protected from communicable diseases and other health threats and there is an obligation on the parts of governments to provide such protection. On the other hand individuals have a right to privacy.\(^{41}\) Table 2 (accordingly to Ref. 42) lists privacy regulations followed by different jurisdictions in Australia. It does not record the fact that all jurisdictions also use regulatory schemes, often legislative, to govern the use or disclosure of information gained by public employees in the course of their duties.\(^{42}\)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Public Sector</th>
<th>Private Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Australia (WA)</td>
<td>Health Act 1911 section&lt;br&gt;Criminal Code Sections</td>
<td>Privacy Act 1988&lt;br&gt;Confidentiality of Health Information Committee</td>
</tr>
<tr>
<td>Northern Territory (NT)</td>
<td>Information Act 2002</td>
<td>Privacy Act 1988</td>
</tr>
<tr>
<td>Queensland (QLD)</td>
<td>Information Standards&lt;br&gt;42 (general) &amp; 42A (health)</td>
<td>Privacy Act 1988&lt;br&gt;Privacy Act 1988</td>
</tr>
<tr>
<td>Tasmania (TAS)</td>
<td>Information Privacy Principles 1997</td>
<td>Privacy Act 1988</td>
</tr>
<tr>
<td>South Australia (SA)</td>
<td>Information Privacy Principles</td>
<td>Privacy Act 1988</td>
</tr>
<tr>
<td>Commonwealth (Cth)</td>
<td>Privacy Act 1998</td>
<td>Privacy Act 1988</td>
</tr>
</tbody>
</table>
**Conclusion**

The implementation of various eHealth programs from 1984 to 2005 indicates over 20 years of achievement. The successful implementation of both the OACIS Programme in the public sector and the THELMA in the private sector has a lot of positive things to offer. The Australian Commonwealth government’s ambitious HealthConnect program is huge and runs across all jurisdictions. For which, among others, "privacy" is a key issue yet to be resolved.

**Acknowledgement**

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Introducing the Electronic Health Record in Austria

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Abstract

The Austrian parliament has adopted legislation to introduce the electronic health record under the title ELGA. The present article first discusses several activities of other countries in this context. It then deals with the current situation of healthcare telematics in Austria and the next planned steps to introduce the life-long electronic health record.

Key words: Medical Records Systems, Computerized; Public Health Informatics; Computer Communication Networks; Standards.

Introduction

Increasing specialization has given rise to substantial progress in modern medicine. At the same time, the requirements for multidisciplinary collaboration in patient care have become extensive. More and more data are collected for individual patients as novel measurement techniques are developed. These data have to be exchanged between the various physicians and facilities involved to allow efficient cooperation. Clinical information management has therefore become a key technology in modern healthcare.

The issue of consolidating all the information available on individual patients in a single electronic health record (EHR) has been extensively discussed within the medical informatics community over the past decade. Records of this type would enable physicians and nursing staff to access the complete medical history of a patient in a well-structured format. Introducing the EHR for all citizens of a country therefore has the potential of revolutionizing healthcare.

ELGA* is the name of an initiative that has recently been launched after legislation had been adopted by the Austrian parliament to reform the healthcare system in this country. The present article will first discuss several activities of other countries in the EHR domain. Subsequently it will outline the current situation of healthcare telematics in Austria and the next planned steps to introduce the EHR.

National EHR initiatives

In 2004, the European Commission presented an action plan for a European e-Health Area.¹ It requires all member states to take measures to (a) support the interoperability of e-Health data records, e.g. by identifying an outlining EHR standards and through a common approach to patient identifiers until 2006; (b) offer EU citizens easier access to healthcare information and services, e.g. by supporting healthcare networks that provide services such as e-referral or e-prescription, or the use of electronic health insurance cards until 2008; (c) disseminate best practices, including the establishment of an e-Health monitoring institution that evaluates the progress made and develops recommendations for future e-Health measures until 2005.

*German acronym meaning "life-long electronic health record".

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In the UK, the NHS’s National Programme for IT (NPfIT)\(^2\) includes an initiative to implement the so-called NHS Care Records Service (NHS CRS), which shall provide a nation-wide EHR for all British citizens by 2010. A summary of each person’s medical history, the Spine, will be held in a central database and build the basis of the EHR. The summary record will also contain links to more in-depth clinical information, which will be stored in local systems. EHR systems may only be acquired from a small number of selected providers, which have been particularly licensed for this purpose. Patients will have the possibility to access their own health records by means of a web-based service.

In Denmark, the MedCom initiative\(^3\) was initiated in 1995 with the goal of setting up a message-based national healthcare data network. The implementation of MedCom is widely advanced today, which is underlined by the fact that, in April 2005 more than 60% of healthcare communications in Denmark took place through the healthcare data network. A major issue addressed by MedCom since 2002 is the development of regional central EHR databases (the SUP project), which will be fed by standardized extracts from individual local EHR systems. The unified EHR extracts may then be accessed by means of a regular internet browser.

The United States’ government has outlined a plan to provide most US citizens with EHRs until 2014 and created the Office of the National Coordinator for Health Information Technology (ONCHIT)\(^4\) for this purpose. The ONCHIT has specified a “Strategic Framework”, which describes a 12-step process for the implementation of this plan. Amongst others, it (a) demands certification of EHR systems’ functionality; (b) plans to achieve nation-wide EHR interoperability by fostering “Regional Health Information Organizations” that enable local EHR data exchange and interconnecting them within a “National Health Information Network”; (c) plans to provide patients with access to their own EHRs. Approximately $4 billion will be spent for health information technology programs and initiatives in this context.

In Canada, an independent not-for-profit corporation was initiated (Canada Health Infoway Inc.) after the government had announced in September 2000 to accelerate the development and adoption of modern systems of information technology in healthcare. One of the immediate priorities of this corporation is to develop and implement effective interoperable EHR solutions.\(^5\) It now has a total capital infusion of $1.2 billion (CDN) from the federal government. Infoway has embraced a seven-year plan to have interoperable EHRs in place across 50% of Canada’s population by 2009.

In Australia, the government will provide $128 million over four years towards the implementation of the national health information network HealthConnect.\(^6\) The aim of this project is to collect, store and exchange EHRs via a secure network and within strict privacy safeguards. Currently, a trial is being conducted which seeks to evaluate whether the EHR architecture specified by the openEHR foundation\(^7\) is suitable to meet the project’s requirements.

**Introducing the EHR in Austria (ELGA initiative)**

**Previous efforts related to healthcare telematics**

In 1995, the Austrian Ministry of Health appointed the STRING\(^**\) commission to advise the minister on all issues related to healthcare telematics.

The MAGDA-LENA framework: In 1998, the STRING commission developed MAGDA-LENA\(^8\) as the governing framework for electronic exchange of patient-related data in Austria. MAGDA-LENA outlines the technical and organizational aspects governing the development of an Austrian healthcare information network that will allow EHR contents to be exchanged. A detailed description of MAGDA-LENA – including a comparison with the HIPAA regulations in the US\(^9\) – was given in a previous communication.\(^10\)

A number of standardization projects have been conducted under the auspices of the STRING commission to facilitate implementation of the MAGDA-LENA framework by collecting experience in real-life environments, including a project on e-referral.\(^11\)

The key recommendations of MAGDA-LENA, relevant for introducing the EHR, are:

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**German acronym meaning “standards and guidelines for the use of informatics in healthcare”**.
Introducing the Electronic Health Record in Austria

a) to promote the use of standardized message formats for exchange of healthcare data. MAGDA-LENA aims to achieve a high level of compatibility between healthcare messages by specifying a common methodology for the development of new message standards;

b) to enable unique identification of patients, communicating parties and transmitted data via registered directories;

c) to implement specific privacy and security measures for the communicating parties both within their own working environment and in their electronic communications with others.

The MAGDA-LENA framework has recently been incorporated into an Austrian law on healthcare telematics (see section “The ELGA initiative and legislation to promote healthcare telematics”).

Electronic index of Austrian healthcare providers: In 2001, the Austrian Medical Chamber established an electronic index of Austrian healthcare providers. This index is currently used to promote electronic exchange of clinical information by providing the necessary identification data for both automatized and individual queries.

Social-security chip card: In 1999, the Central Association of Austrian Social Insurance Authorities was commissioned by parliament to develop a social-security card system. The system consists of chip cards providing a non-forgeable key for patient identification and card-reading devices connected to computers. In early 2002, parliament expanded the functionality of this chip card to facilitate its use as a citizen card, including the option to store digital signatures and medical data on a voluntary basis. In December 2004, the first chip cards were distributed in a comprehensive field trial. The process of issuing these cards nationwide is to be completed by November 2005. Eight million Austrians are then expected to have the card, and around 12 000 physicians working for the Austrian social insurance authorities will have card-reading devices in their offices.

The ELGA initiative and legislation to promote healthcare telematics

In 2003, the STRING commission recommended that concrete plans be undertaken to introduce the EHR in Austria. This initiative was entitled ELGA.

ELGA was embraced by the ministry of health and incorporated into the measures aimed at reforming the Austrian healthcare system. The 2005 Healthcare Reform Act, adopted by parliament in December 2004, therefore includes a regulation on healthcare telematics.

This law on healthcare telematics defines minimum standards to safeguard the confidentiality, reproducibility and non-manipulation of communication activities. Its provisions also include measures for healthcare information management and the establishment of an e-Health index to facilitate access to healthcare providers.

Furthermore, the Austrian parliament has made arrangements to introduce the EHR (ELGA initiative), has adopted general provisions to optimize the use of information and communication technologies in healthcare telematics, and has prepared the ground for e-prescription and e-reimbursement.

Based on these resolutions of the Austrian parliament, the STRING commission has specified the next work items in the implementation of ELGA:

– Contents and structure (which data should be contained in ELGA, to what extent should the structure be standardized, ...)

– Organisational measures (which processes will be supported, concept of privileges, ...)

– Legal basis (storage/access of patient data on voluntary or mandatory basis, ...)

– Technical standardization (central or federated local databases, communication standards, ...)

– Social and ethical issues (sensitive health data, technological impact assessment, ...)

– Economic aspects (cost/benefit, installation and maintenance of infrastructure, ...)

– etc.

A strategic framework to solve these open points will be developed by a professional consulting firm. The implementation will be coordinated on national and regional levels by a political steering board. The ministry of health has further started an e-Health initiative with the goal of integrating the industry.

To summarize, a number of legislative measures aimed at promoting healthcare telematics have been taken in Austria over the past few months, which notably include the introduction of the EHR.
Discussion and recommendations

In the authors’ view, two issues related to the EHR need to be addressed as a matter of priority in Austria. These concern (i) the standardization and (ii) the confidentiality of EHR contents. A brief discussion follows.

Standardization of EHR contents

The objectives of the ELGA initiative are now being defined in greater detail and have been categorized in order to permit more accurate cost-benefit analysis. At the time of writing this paper, a final decision on how to prioritize the various objectives of the ELGA initiative has not been reached, and the roadmap for implementation has not been finalized. Definitive schedules for rapid implementation have, however, been defined for some projects such as e-prescription.

The next step will be to derive the concrete communication processes and data contents from the various objectives and user requirements involved and to standardize them. To avoid an isolated EHR solution in Austria, it will be necessary to rely heavily on international standards. With this consideration in mind, all relevant international efforts at EHR standardization (CEN, HL7, openEHR)" are closely monitored at the Core Unit for Medical Statistics and Informatics of the Medical University of Vienna. It is recommended and planned to incorporate the results of these efforts into the ELGA initiative wherever possible.

Confidentiality of EHR contents

The legal implications of data protection were a key concern of the STRING commission from the very outset. Therefore, a task force to address these issues was established immediately when the recommendation to launch the ELGA initiative was published in 2003.

Meanwhile, this task force has thoroughly analyzed the legal requirements for introducing the EHR. Special emphasis has been placed on the differences between voluntary and mandatory participation.

It concluded that a mandatory life-long EHR for all Austrians presumes the demonstration of a public benefit and an accurate definition of the data protection requirements involved so that the constitutional right to data privacy would not be violated.

Summary

From the authors’ perspective, the situation of healthcare telematics in Austria and current activities for the introduction of the EHR can be summarized as follows:

Beginning in the mid-1990s, substantial efforts have been made to coordinate healthcare telematics. One result of these efforts has been the MAGDA-LENA framework for electronic data exchange. Furthermore, a number of standardization projects have been implemented.

Important steps have been made to promote the use of healthcare telematics as part of the ongoing healthcare reform. For example, parliament has adopted legislation:

– on healthcare telematics,
– to introduce the EHR (ELGA initiative).

This legislation has prepared the ground for extensive planning, which is currently under way to implement the concept of a life-long electronic health record in Austria.

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Introducing the Electronic Health Record in Austria

Advances and Development of Telemedicine in Bosnia and Herzegovina

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Abstract

Serious development of telemedicine in Bosnia and Herzegovina began in last decade of 20th century. If we disregard foreign military troops during the war (1992–1995) first application of telemedicine commences with telepathology in Bosnia and Herzegovina (BiH) which began by the end of 1996 at the Institute for the Pathologic anatomy of the Medical faculty of Sarajevo in the collaboration with the Institute for pathology of the Medical faculty of Zagreb and in the scope of the project SHARED. Apart from the two mentioned institutions involved in this project, there was also the Institute for Radiology and Oncology and the Clinic for ophthalmology of the Clinical Centre University of Sarajevo. Telesurgery and telemonitoring were introduced in Banja Luka Medical faculty in 2000 and 2001 and first steps in introducing teleneurosurgery in Bosnia and Herzegovina started at the beginning of 2005. In that year a Vamstec station was installed in order to provide communication between Neurosurgical clinic in Sarajevo and Cantonal hospital in Travnik. On daily basis two hospitals exchange DICOM compatible Neuro-imaging data followed by textual descriptions. In this paper authors described global development of telemedicine and some attempts in Bosnia and Herzegovina including telemedicine in catastrophes and military telemedicine conducted by the US army. Tremendous improvement was made in the area of teleeducation especially at Medical faculty, University of Sarajevo. We also stressed out some very little known effects of telemedicine such as: cost-effectiveness, telemedicine in rural areas and investing in telemedicine to improve health care services. Telemedicine in Bosnia and Herzegovina is getting to have more and more users, but at this moment global application is not possible without wider involvement of all stakeholders in the health system, especially decision and policy makers and sustainable financial support.

Key words: telemedicine, distance learning, development.

Introduction

By definition of the Association of Telehealth Service Providers telemedicine is the provision of health care and education over a distance, using telecommunications technology. Telemedicine is so-called "displaced medicine" or medicine at the distances. According to the definition of the European commission for telemedicine, it represents "the quick addition to the contributed knowledge of the medicine experts with the use of the telecommunication informatics – technology
regardless to the actual distance of a patient or of the relevant data”. In the 1980s, thanks to the development of the communicational systems, especially of the Internet, scientific information systems have been changed; transfer helped with established measures and telemedicine intensively began to be applied in the majority of the significant medical disciplines. That enabled patients to enjoy almost every quality of the health care protection in the rural as well as in the urban regions, mostly in the countries of Scandinavia, Germany, France, USA, Canada, Australia and Japan. In 1985 NASA used ATS-3 (Advanced Technology Satellite) system for the offering of emergency help and the salvation of the wounded by the Red Cross and the Pan-American Healthcare Organization on the occasion of the earthquake in Mexico City.

Telemedicine combines computer, video and telecommunications to provide healthcare to patients at distant sites. With the improved camera and transmission technologies of the 1990s, telemedicine can be used in a variety of situations. There are two basic technological systems: live interactive video and still image (“store and forward”). Potential users include patients who live in rural or difficult to reach geographic areas and those who are confined (i.e. prison inmates). Telemedicine can allow ambulatory patients to continue living at home rather than move into costly nursing facilities. Home telemedicine also allows greater responsiveness and higher frequency of visits by home care nurses, potentially reducing future hospital visits and costs. Two home telemedicine models are the personal telemedicine unit and the enhanced personal telemedicine module with pc-based video. Telemedicine technologies developed by the military for use on the battlefield that could be adapted for civilian use include medical simulations, individual monitoring devices and biosensors, portable retinal display monitors, life support for trauma/transport, and diagnostic ultrasound imagery. Ultimately, the benefits of telemedicine will be: consistency of care, easy access to specialized consultants, higher responsiveness to patients’ needs, and lower overall healthcare costs.

The history of telemedicine is characterized by many systems that have failed, or have only lasted a short period of time. A few telemedicine studies analyze its cost effectiveness. Some of them rely on faulty methodology, according to a study published in the British Medical Journal in June 2006. Based on a review of 557 published peer-reviewed papers, the authors concluded that no good evidence exists that telemedicine is a cost-effective means of delivering healthcare.

In this paper authors described global development of telemedicine and some attempts in Bosnia and Herzegovina (BiH). We also stressed out some very little known effects of the telemedicine such as: cost-effectiveness, telemedicine in rural areas and investing in telemedicine to improve healthcare services.1,2,3,4,5

Telemedicine is the use of some form of telecommunications for medical diagnosis, patient care and medical education or information sharing. It may include remote sensing and manipulation and may be in real time or store-forward. In its most fundamental form, telemedicine may provide medical services to sites that are far removed from the doctor or nurse. The communication may include the use of standard telephone service through high speed, wide bandwidth transmission of digitized signals and may employ computers, fibre optics, satellites, and other sophisticated peripheral equipment and software.

Telemedicine may assist in decision making. Remote decision making and database systems have been in existence for more than twenty years. More recently, remote sensing and collaborative arrangements have been designed for the real-time management of patients at a distance. Remote sensing consists of the transmission of such data as electro-cardiographic and echo-cardiographic signals, x-rays, internal and external patient images or patient records, from a remote site to a specialist at a removed site. Digital motion pictures have been integral to the long distance, real-time treatment of patients. Alternatively, store-forward technology has been useful, especially when the bandwidth is inadequate for high-resolution real-time transmission. Telemedicine can also include transmission of data for grand rounds for medical education purposes or teleconferences for continuing education. Collaborative arrangements consist of using technology to actually allow one practitioner to observe (and most recently, to virtually ‘touch’ and discuss symptoms with another practitioner whose patients are far away). Therefore, when we discuss telemedicine we need to touch important issues of referral and payment arrangements, credentialing, liability and licensure arrangements which potentially cross country borders or state lines.
Telemedicine in catastrophes

During the earthquake in Armenia in 1988 a project of the telemedicine assistance called Space Bridge was launched (the common system Intelsat and Comsat for consultations of several regional hospitals in Armenia with medical centers in Bethesda, Huston, and Texas at the field of neurology, orthopaedic, psychiatry, infective diseases and the general surgery). The same system was used for the telemedical consultations on the occasion of a gas explosion in the Russian city of Ufa (where for twelve weeks 209 patients were cared). In 1994 ACTS system (NASA Advance Technology Satellites) was being introduced for the simulations of the catastrophes by means of application of the telemedicine systems (tested in 1996, in the simulated catastrophe in the Exxon refinery of oil), by means of the application of the modified version ACTs (ultra-small aperture terminal – USAT, with portable telemedicine package TIP, developed by Johnson space center, for the retrieval of the nose, ear, skin, the application of ECG tests, examinations of the contents of oxygen in the blood). USAT, ACTS and TIP are used for quick diagnostics in Space Shuttle mission for telemedicine examination, catching and transmission of information about a patient as well as audio and video consultations with distant centers. Application of telemedicine in BiH during the war (1992–1995) is shown in Table 1.6

### Table 1. Application of telemedicine in BiH during the war (1992–1995)

<table>
<thead>
<tr>
<th>Operation PrimeTime aims</th>
<th>Preliminary discoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td>To support the patient’s responsibility</td>
<td>85% patients responsible</td>
</tr>
<tr>
<td>To minimize the evacuation</td>
<td>From 63 documented tele-consultation reviews, one resulted with the evacuation, from 153 evacuated (without tele-consultation), 11% have potentially been able to have avoided tele-consultation</td>
</tr>
<tr>
<td>To ensure the quick and definitive reply</td>
<td>There was no consultation during the first several hours in 200 documented injured</td>
</tr>
<tr>
<td>To provide high qualitative aid to soldiers</td>
<td>More than 80 clinical video conferences</td>
</tr>
<tr>
<td>by the special medical support</td>
<td>More than 650 tele-radiology consultations and more than 40,000 e-mail messages</td>
</tr>
<tr>
<td>To insure medical performance</td>
<td>The purpose network for the medical control was performed. It was done over 100 medical video conferences and over 5000 e-mail messages. The visibility from outside was significantly improved</td>
</tr>
</tbody>
</table>

Teleradiology during the war time and post-war period in Bosnia and Herzegovina

War and post war time was a great opportunity for countries that had military troops in Bosnia and Herzegovina to try its telecommunication capabilities in order to apply telemedicine, protect soldiers and decrease costs of unnecessary transports.

The United States military has been an effective proponent of digital imaging and teleradiology for the past 15 years. A digital imaging network that eliminates the use of x-ray film makes military medicine requirements simpler: X-ray film requirements include storage of new, unexposed films, storage and use of chemicals and water for processing, and disposal of chemicals. In some deployed situations, the chemical discharge needs to be collected and shipped out of the area. Therefore, the ability to implement electronic imaging and eliminate or greatly reduce the dependence on film, chemicals and water are intrinsically important to military medicine. In December 1995, the United States government began the deployment of 20,000 United States troops to Bosnia-Herzegovina. As part of NATO’s peacekeeping implementation forces (IFOR) operation a full complement of military medical support facilities was established in Bosnia. An army base in Hungary was the location from which the deployment was staged. The project to deploy telemedicine and teleradiology capabilities to the medical treatment facilities (MTF) in Bosnia and Hungary became known as PrimeTime III. Deployable teleradiology (DEPRAD) system was installed by the Ima-
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ging Science and Information Systems (ISIS) Centre, Washington, DC, at a number of facilities to implement filmless radiology and teleradiology services in support of PrimeTime III.\textsuperscript{7}

The Primetime III system demonstrates the technical ability to provide current telecommunications capabilities to medical units stationed in the remote, austere, difficult-to-serve environment of Bosnia. Telemedicine capabilities cannot be used without adequate training, operations, and sustainable support. Video consultations have eliminated the need for some evacuations. The system has successfully augmented the clinical capability of physicians assigned to these medical units. Fullest clinical utilization of telemedicine technologies requires adjustment of conventional clinical practice patterns.\textsuperscript{8}

**Application of telemedicine in BiH**

Application of telemedicine began after the war (1992–1995) in the following areas: ophthalmology, pathology, general surgery and neurosurgery. This paragraph describes effort in all the above mentioned medical disciplines in Bosnia and Herzegovina.

**Telepathology**

The application of telepathology in BiH began by the end of 1996 at the Institute for the Pathologic Anatomy of the Medical faculty of Sarajevo in collaboration with the Institute for Pathology of the Medical faculty of Zagreb and in the scope of the project SHARED, proposed by the San Raffaele hospital form Milan, Italy.

The project is supported and controlled by the Italian SFOR, while it is financially supported by the EU, NATO and ESU (European Space Agency). Equipment at our disposal is a Pentium 133 MHz Compaq computer, a CCD Panasonic camera and a Reichert Jung Polywar microscope. In the Italian Field Hospital, there is EUTELSAT, II F4 384 kbs satellite.

From 1996 to 2001 they had 222 consultations. The analysis of the results showed that in total 2040 minutes were spent on consultations for 222 cases (9 minutes per case). The greatest number of images was 44 per case, while the smallest was 4. The largest consultation length was 30 minutes per case. Although the number of consultations was small, it shows a high level of similar results. It has already been proved that realization and use of telemedicine system brings benefits in all segments of health care. The consultation of our national pathologists and use of telemedicine for diagnostic pathology has the highest priority within the concept of telepathology, while transmission of live microscopic images is of major importance at the moment.\textsuperscript{9}

**Teleophthalmology**

In this project besides two mentioned institutions have been involved the Institute for radiology and oncology and the Clinic for ophthalmology of the Clinical Centre University of Sarajevo. Italian NATO troops located on Balkans applied tele-medicine in the following medical disciplines: ophthalmology, pathology, radiology, neuroradiology, neurosurgery, paediatrics, dermatology, surgery, endocrinology, gynaecology, cardiology and haematology. Total number of activities in the period from 16 September 1996 to 15 September 2002 was shown in the Table 2.

**Talenaurosurgery**

During 2005, in Neurosurgery Clinic there was a Vamstec working unit installed for communication with the similar installation in Cantonal Hospital in Travnik, as a pilot project of telemedicine contact of two health institutions, with the aim of serving patients with neurosurgical conditions better and faster. One of the references that placed this project on the first place among highly profiled medical workers was relatively high availability, simplicity of use, stability and reliability and reports of practical use of Vamstec software in neighboring Croatia.
The system is represented by three personal computers (working units) which work on a sender-receiver-sender level. Daily, neuroradiology specialists sends DICOM compatible neuroimaging data along with textual description and history data from CH Travnik to Neurosurgery Clinic in Sarajevo. A neurosurgeon saves the data to a working unit, does the reading and gives finding, opinion and suggestion. If the evaluation shows causes of neurosurgery interest, patient is promptly sent to a Neurosurgery Clinic and then enters regular neurosurgical evaluation and treatment. The procedure of neuroradiology evaluation in distant hospital institution of secondary health level to highly specialized tertiary health level institution is considerably shortened. The patient gets working diagnosis (often definitive) on the fastest manner, while his bed on the Clinic is prepared, as well as further evaluation and treatment. Besides the importance of this fast and good-quality communication between therapist and diagnosis making health professional with "cold" cases, it’s of extreme importance the efficacy with emergency neurosurgical conditions (acute intracranial bleeding, severe neurotrauma, decompensate spatiom-occupying lesions, etc.).

**Software characteristics of the Vamstec**

Vamstec (Visual Analysis Measurement System Technologies), produced by Pharos and Issa Software, shows worthwhile for a test period (last 9 months). Sending, receiving, viewing data, manipulation with pictures (for better reading), input of findings and other clinical data for patient is simple and evidenced without serious problems. Complete set of clinical findings data (pictures and other data) are sent over the Internet. The data is sent encrypted and then decrypted and saved by a receiving station. After the analysis, the opinion is inserted and data sent back by simple and reliable way. Server (data base) logs the exact time of information revival as well as the sending of returning information, which is very important for purposes of eventual forensic expertise. On the other side, there is an option of SMS alert of the consultant about inquiry received, which makes the time from inquiry to giving opinion maximum short, for eventual absence of a consultant by a working unit.

All examinations received on Neurosurgery Clinic from CH Travnik or ones, imported from data bearer, made by the Institute for Radiology of Clinical Center of University of Sarajevo, or elsewhere, can be viewed in complete in an operational room, where another working unit is installed.

**Perspectives of tele-neurosurgery**

Considering this way of communication between highly profiled medical institutions and workers absolutely useful, completely reasonable and above all easy operational, for the benefits of patient, who is in the center of our interest. It’s advisable to make such a connection between all big medical centers in BiH by principles of the Internet and Vamstec technology. That would provide faster and cheaper consultative-specialist support and raise the health service to a higher and better quality level.10

**Telesurgery**

Telemedicine project on the Faculty of medicine in Banja Luka is a telemonitoring service focused on the aspect of education started in the year 2000. As highly upgradeable and open for further extensions, this project provides basic conditions for multidisciplinary education (videoconferencing, distance learning, telemonitoring, teleconsulting), providing wireless connection in real time between the amphitheatre of Medical faculty and two operating rooms at the University Clinical centre in Banja Luka on two different and distant locations. Using this system, students can follow surgical procedures in real time with plenty of details, listen to lessons given "on-line" from the remote sites to create a database and CD ROM/VIDEO library.

The secondary benefit of the research centers at the clinic is an access to the university computer center via router at the Medical Faculty providing Internet access on the LAN, but also possibilities for videoconferencing with scientists from abroad.

This project is an important step to the use of advanced technologies in the educational process, which offers many benefits to students and physicians and is also the first Telemedical service used in regular lecture in the universities of ex-Yugoslavia. The project was conducted in two phases.
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**Tele-surgery – Phase 1**

Implementation of phase 1 has provided building mobility of telemedical services, which should allow their use of necessary infrastructure for transmission of picture and sound at other surgery departments, because of great interest of leaders on the side of Clinical departments in the city centre and on those crucial disciplines (urology, orthopaedic department, Paprikovac hill to the amphitheatre of the Faculty of Medicine).

Two-way communication offers the moderator of a session together with students within the amphitheatre the possibility of watching surgical procedure, listening to comments of the surgeon, but also putting questions either to the surgeon or another expert who might be within the operating theatre. Second great benefit of the project is the provided access to the University LAN. This service provides students with access to medical databases at the Clinic, which are subject of regular classes. The phase has been realized using wireless communication via handling devices and by the mobility of the equipment via WLAN equipment, manufactured by BreezeCom (Israel), which provides wireless transmission of data using bandwidth of 1–3 Mbs depending on weather conditions and other influences.

**Telesurgery – Phase 2**

The second phase of the Telemedicine project includes upgrade of the existing project equipment which primary provides mobility of telemedical services, which should allow their use at other surgery departments due to great interest of other colleagues.

**Telesurgery – Technical specifications**

Technical specifications for the project were:

- 1 × MediaConnect 6000 VCON, mobile device that incorporates a modern PC and videoconferencing equipment (self-navigating camera, microphone and speakers), movable and simple for use in any classroom, at any position within the Faculty or Clinic. The same device will use the faculty’s access to the already existing WLAN;
- 1 × LCD projector, for displaying picture of great size and resolution, essential for transmission of details that appear in surgical procedures, in particular at ORL department;
- 2 × Access Point BreezeCom – devices for enlargement of WLAN, 300 m range in inner space, which should provide access from any OR or office for clinical subjects;
- 1 × Wireless network card for laptop, which provides communication between mobile and above mentioned Access Points;
- VIGO Professional VCON, minimized professional device for videoconferencing; connected to the laptop, it provides simple handling even for a poorly educated user, two cameras inputs plus a microphone.

**Telesurgery – Technical specifications**

A particular opportunity that Telemedicine offers for the Faculty of Medicine in Banja Luka is distance learning through video-conferences between the Faculty and other respective institutions from the region and the world. That is the next target that our institution will be focused on, through a few ongoing projects within BiH surrounding.11

**Teleeducation**

The greatest progress was made in the area of teleeducation and distance learning in Bosnia and Herzegovina. Distance learning does not preclude traditional learning processes; frequently it is used in conjunction with in-person classroom or professional training procedures and practices. Distance learning is used for self-education, tests, services and for examinations in medicine, i.e. in terms of self-education and individual examination services .The possibility of working in the exercise mode with image files and questions is an attractive way of self-education.12,13,14,15

Very first serious initiative was generated by WUS Austria (World University Service of Austria) in BiH. During 2002 and 2003 WUS Austria, through its programs, Distance learning 2002 and Distance learning 2003, supported the development of the educational processes at BiH universities. Since 2002 the realization of a project named "Possibilities of introducing of distance learning in medical curriculum" (approved by the Federal and the Cantonal Ministry of Science and Education) is in progress at the Medical faculty of the University of Sarajevo, the Cathedra for Medical Informatics. The purpose of the project is to facilitate the improvement of educational pro-
cess at biomedical faculties, applying contemporary educational methods, methodologies and information technologies in accordance with strategy and goals proclaimed by Bologna declaration. The pilot project was realized during three past school years (2003–2005), theoretical and practical education of the subject Medical Informatics is adapted to the new concepts of education using world trends of education from the distance. One group of students which was included in the project finalized by electronic exam registration and electronic exam on 20th June 2005, publicly, in the Physiology Amphitheatre of the Medical Faculty in Sarajevo (Figure 1).

The Bologna process, which started in last years in European countries, enables us to promote and introduce modern educational methods of education at biomedical faculties in Bosnia and Herzegovina. The Cathedra of Medical informatics and the Cathedra of Family medicine at the Medical Faculty of the University of Sarajevo started to use web based education as a common way of teaching of medical students. Satisfaction with this method of education within the students is good, but not yet suitable for most of medical disciplines at biomedical faculties in Bosnia and Herzegovina. Web sites of the Cathedra for Medical Informatics and Family Medicine and UTIC (University Tele-information Centre) are shown in Fig. 2.

Bosnian Society for Medical Informatics (BH-SMI) is very proactive in promoting telemedicine and teleeducation as part of it. The last event organized by BHSMI was a Special Topic Conference named e-Health and e-Education held in December 2005 (Fig. 3).

Distance learning in medicine has impact on telemedicine and practicing medicine as well. Basic skills of the use of computers and networks must be a part of all future medical curricula. The impact of technical equipment between patient and doctor, and the situation where the diagnosis based on live voice or picture is different from a normal doctor-patient contact must be understood. In some areas telemedicine requires unique techni-
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Cost-effectiveness of telemedicine

Cost-effectiveness of telemedicine: Clinical evaluation of an innovative healthcare initiative run by Medway Council and Medway NHS and Teaching Primary Care Trust in the U.K. has praised the success of telemedicine in providing a more coordinated approach to care provision. By enabling more accurate monitoring of long-term conditions and treatment levels, the initiative has reduced hospital admissions by 67%. The pilot study involved 31 participants and used equipment from Tunstall, a provider of Telehealth solutions. The study has successfully improved the quality of life for patients with long term conditions and has freed up valuable health resources, resulting in 133 hospital days and 117 nursing hours saved to date, in addition to the cost and time savings for GPs, practice and community nurses.

Doctors at large hospitals routinely use telemedicine to treat thousands of patients in rural locations across the United States, diagnosing skin conditions, monitoring irregular heartbeats, and conducting therapy sessions. But diagnosing and treating patients in the middle of a potentially fatal or disabling emergency is a new frontier. Doctors on both ends of the monitor are concerned about who is liable if a mistake is made while treating a patient. In many states, including Massachusetts, USA health insurers and the federal Medicare program usually refuse to pay "remote" doctors for their services.

Telemedicine in rural areas

Rural areas Clinics stand to benefit most from e-health but have the poorest infrastructure, capacity and capability for successful introduction. Infrastructure is inadequate, less accessible and more expensive in rural environments than in cities. Power and communication lines are unreliable and limited. Compared with their urban colleagues, rural doctors have larger patient workloads, cover a wider geographic area and have poorer access to specialist advice and support. In particular, rural doctors will need to learn new skills in using computer and e-health applications, and have ready access to technical support.

Conclusions

The application of telemedicine and telecommunications (Telematics) in the extraordinary conditions has been put into practice by the middle of the 1980s. The application of telemedicine in catastrophes is rather expensive and is the privilege of the rich countries. The access to telemedicine was limited to places where the Earth or satellite connections were available and where the possibility to install the high frequency equipment existed. The satellite systems play an important role in the application of telemedicine and the insurance of the mobility and the independency of the Earth connections. Flexibility of technologies (the miniaturization of the computers, biosensors and other) is especially important for the use of telemedicine. Internet, World Wide Web and e-mail are a significant support for the telecommunications and the teleconferences in vivo in the extraordinary conditions. The telemedical equipment should be easy, movable, and simple for repair and operating (with the possibility that training is being performed on simulators). Telemedicine in Bosnia and Herzegovina is getting to have more and more users, but at this moment global application is not possible without a wider involvement of all stakeholders in the health system and sustainable financial support.

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BHTelehealth: a public telehealth model in Brazil

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Abstract

The purpose of this report is to present the implementation experience of a telehealth model for primary care in the municipal public health system, in Belo Horizonte, Minas Gerais, Brazil. The BHTelehealth system has been implemented since 2004, with activities of tele-education and teleconsultation to support family health teams in medicine, nursing and dentistry. 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 implementation of this system went through the following phases: 1) definition of the technological structure; 2) system usage planning; 3) system implementation strategy; 4) track indicators to data collecting. The system is now implemented in 58 Primary Care Unit (PCU), doing educative teleconferences, discussions of clinical cases and specialized second opinion through teleconsultation. From April/2004 to June/2006, 197 events were held, summing up to 3794 PCU professionals participating on the sections. Seventy one percent of the patients whose clinical cases were discussed stayed at the PCU and the most demanded specialties were dermatology (15.7%) and endocrinology (10.7%). At the moment, BHTelehealth network is being expanded to 139 PCU. As the results were interesting, this model has been implemented in other 82 cities of Minas Gerais focusing on telecardiology (Minas Telecardio Project), a partnership with the State Health Department and it is seen as a model to the Brazilian national telehealth project of the Ministry of Health of Brazil.

Key words: Telehealth, Telemedicine, Primary Care, Videoconference, Public Health.

Introduction

The use of telehealth/telemedicine resources in primary care is in expansion, with a varied application levels that includes activities ranging from tele-education to teleconsultation, second opinion and telecare. However, the basis for its use in primary care is still being established.1,2

The BHTelehealth Project took into account the potentials and limitations faced by worldwide telehealth projects and the problems identified in Brazilian health care system. Therefore, the implementation of a telehealth model focused on family health teams and primary care intend to tackle two central problems concerning the Brazilian Unique Health System (SUS): the lack of specialized doctors and other professionals to work at primary care level, and the impossibility of the secondary care level to supply its demand. However, other barriers need to be overcome, for instance the academic formation and permanent education of the family health teams professionals, the low level of resolution in attendances in the primary care and the
reference and contra-reference system. Despite the efforts of the Health Ministry, the number of residences programs in Family and Communities Medicine in Brazilians medical schools are still insufficient. As a consequence, there is a high turn over in the family health teams, because they are not prepared to be isolated and they also decide to study or specialize in the big cities after a short period of time.

To deal with this scenario in the health primary care, the UFMG, in association with the SMSA developed this telehealth system with educational and assistance purposes. Considering that BHTelehealth was built to be applied in the public health system it needed to be low-cost, simplified and capable of being implemented in different organization realities.

Belo Horizonte is considered a reference city in implementing innovative public polices in the health system. The city was able to organize in the primary care the Family Health Program in a broad covering area, comprehending 502 health family teams – to a population of 2,238,526 inhabitants. Besides that, it has introduced a great project to incorporate information technology in the health area, which makes it possible to implement electronic health records in several units.

The viability of the telehealth system was possible because of the finance support of the @lis Project, from the European Community, and the Brazilian Ministry of Health. The project is resulted from the incorporation of European experiences (Volontariato Group, from Italy; North Karelia Hospital District, from Finland; Danish Center for Health Telematics, from Denmark; Provincia Autonoma de Trento, from Italy; and Regione Emilia Romagna, from Italy and Centre Hospitalier Universitaire, from Rouen, France) and also from the joint of the information and communication technology experts from SMSA and UFMG.

The aim of this report is to present the experience of BHTelehealth system focused on primary care, including permanent education in service, teleconsultation and second opinion support system. The specific objectives are: 1) describe the construction process of the telehealth model connecting primary care units and a public university; 2) identify working components and flows of the telehealth system; 3) present its preliminary results.

Materials and Methods

From the methodological point of view, it was chosen a sequence of phases which reflects the BHTelehealth project construction and implementation, following the detailed steps below.

Technological structure definition

The first step was to create a system connecting UFMG and PCU. A multipoint videoconference software, acquired in the market, was adopted. It allows sharing electronic health records and other files, such as electrocardiograms, radiological images and digital photos. This software is used for educational videoconferences and for sharing files of pedagogical contents as well. Another software was developed allowing assistance support and teleconferences management. With this infrastructure the professionals are able to schedule teleconsultations as well as the specialists to register their reports. This software enables the implementation of the project in the units that do not use the electronic health records.

The model allows the discussion of clinical cases in two ways: 1) store-and-forward operation in which professionals consult specialist in elective cases; and 2) real time teleconsultation which is used in complex cases. In the latter, professionals schedule the discussion with specialists in advance and are able to share images, voice and information. Teleconsultations and teleconferences can be watched simultaneously in real time by professionals in all PCU connected to the system, using voice and image resources and/or chat.

The developed software manages the teleconferences, registers the activities and controls the attendance.

During the software development, ethic and safety aspects were considered to preserve information privacy and confidenciality. It was formatted an informed consent term respecting the patient’s health information autonomy.

After the definition of the software, performance analysis was made, considering different network patterns. As a result, a 64 kbps connection has been used in each PCU.
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Considering the hardware, it was chosen a simplified and low cost model, consisting of microcomputer with multimedia and webcam in each PCU. The videoconferencing systems are located in the university and in the Department of Health, mostly used for the international videoconferences. The transmission quality is guaranteed by high speed network, such as the National Research Network (RNP, Brazil), CLARA Network (South America) and Géant Network (Europe).

The telehealth rooms in UFMG and in SMSA have workstations similar to those in the health unit, besides digital camera, videoconferencing devices, scanners and servers.

After the technical definitions, the software was tested by the health professionals, who had the opportunity to make suggestions. After that, several tests were made in order to establish the system to be used.

System usage planning

The process was structured covering discussion of clinical cases and teleconferences about selected themes.

Considering the discussion of clinical cases, the professional ask to schedule a teleconsulta-tion using the teleconsultation management software, defining the specialist to be heard and adding a small description of the situation. In addition, they select the lab tests and images that will be discussed at the moment of the teleconsultation.

For educational videoconferences, different methods were used to define the themes. In the nursing field, it was decided to raise the themes through a videoconference, with no initial restriction. In the medical area the request for themes was unrestricted at the beginning. After the second year, the themes were chosen from an epidemiological priority list. In dentistry, the videoconference subjects were identified in a structured session. To this list, it was also included themes that the project coordination considered relevant.

The international videoconference transmissions made from the University Hospital or from the UFMG Medical School to the PCU are part of international cooperation programs.

System implementation strategy

The project started with 14 PCU and was extended to the others. After training the professionals in basic informatics, sensibility sections were held among the managers and the health professionals. After that, training on the system was carried out in loco under the supervision of informatics technicians.

After the training, the professionals in the primary care units were able to access the teleconsultants. They were also registered in the system according to the area – nursing, medicine and dentistry.

The last step consisted of the establishment of one management group for each area. The telehealth groups from the university and from the City Department of Health were responsible for the daily management of the system.

Definition of the system utilization variables

During the development of the system, the coordinators were concerned about the incorporation of variables (number of activities, attendance, specialties, degree of resolution) that permit evaluating the utilization of the BHTelehealth system. This subject was discussed among the management groups, resulting in the definition of variables that make it possible to have a broad perception of the utilization of the system. These variables are showed in the system report, and periodically analyzed by the managers.

Results

The system implemented in 58 PCU make, on average, six conferences each month in the medicine, nursing and dentistry areas, with remarkable participation of professionals.

Figure 1 represents the activities in telehealth developed since the beginning of the project. Observe that at the moment there is a stabilization of the number of telehealth activities, which decreases in the month of the vacations in Brazil – from December to February.
Considering the number of participants (Figure 2), it is possible to observe an increase in the number of attendance. It is important to note that the project started in April 2004, with 14 PHU; today there is 58 units interconnected. Nevertheless, the number of participants in the telehealth activities has significantly grown.

Table 1 shows the details of the telemedicine, telenursing and teledentistry activities. The telemedicine activities embrace the discussion of clinical cases, with second opinion (127 activities), teleconferences (14) and international and national videoconferences (18), summing up to 1202 doctors attending to the events.

In the telenursing field, there were 27 events between teleconferences and teleconsultations, summing up to 1318 professionals participating. In the dentistry area, which is a more recent project (started in November 2005), there were 11 teleconferences, with 1274 participations. In the period there were 197 telehealth activities, with the participation of 3794 professionals.

The case discussions occur between doctors from the PCU, professor from the UFMG Medical School and doctors from the University Hospital. Seventy one percent of the patients remained in the PCU (Figure 3).

There are 24 specialties involved in the telehealth project. Dermatology and endocrinology are the most demanded ones (Table 2).

<table>
<thead>
<tr>
<th>AREA</th>
<th>Type of activity</th>
<th>Number of activities</th>
<th>Number of participants</th>
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<td></td>
<td>Teleconsultation</td>
<td>127</td>
<td>274</td>
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<td></td>
<td>National and International Videoconference</td>
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<tr>
<td></td>
<td>TOTAL</td>
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<tr>
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<td>1303</td>
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<tr>
<td></td>
<td>Teleconsulting</td>
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<td>0</td>
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<tr>
<td></td>
<td>TOTAL</td>
<td>22</td>
<td>1303</td>
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<tr>
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<td>11</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>TOTAL</td>
<td>160</td>
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</tr>
</tbody>
</table>
Discussion

Since the 90s, Brazil has been testing some experiences in telemedicine, coming from private and public initiatives, both unable to stimulate a national wide telehealth project.

In Brazil, the initiatives concerning telehealth which have its results extensively measured are still incipient. A potential application of telehealth in primary care comes from a United Kingdom research, which analyzes the telehealth use as an instrument to correct iniquities in structuring primary cares. This study particularly tackles the recruitment and retention of generalist doctors in their workplace and the accessibility to the health services in rural areas, and finds out that it is a promising experience. Another survey, conducted by California University shows a high level of use of telehealth resources in rural areas.

Surveys taken among primary health care professionals in remote areas of Scotland shows that those professionals recognize the general benefits of telehealth, but they do not use it very often due to different identified barriers. Nevertheless, in Quebec region – which there is a wide telehealth project implemented – a survey, objecting the collecting of public perception and opinion about the project, concluded that the majority believe that telehealth facilitates the access to the health services, increases the quality of the care and reduces costs. These all indicate a high satisfaction level of the users, in a scenario in which 50% of the patients use telehealth services when it is offered. A literature review from this theme corroborates these findings. Also, the Arizona telemedicine program, analyzing its activities, showed high level of patients’ satisfaction in real time and store and forward teleconsultations.

On the other hand, some experiences presented significant problems. The US Army found limitations linked to the undefined variables of the telehealth services in health systems and to the precarious base in the cost-benefit relation. Other authors showed that the potential of telemedicine in primary care is still to be reached.

The experience with the implementation of the BHTelehealth system has demonstrated so far that a new technological process demands time to become a routine in primary care. The results of this experience have been interesting and complex, and demand more time to be completely studied.

The implementation process has demonstrated high adhesion levels, mainly concerning the participation on the teleconferences. The virtual training of the telehealth professionals, which is fundamental to the Brazilian Unique Health System (SUS, has some similarities with the presence training sessions. However, the tele-education overcome the presence capacitating sessions
because it involves more subjects and allows a higher integration between health services and the university. For instance, an educative videoconference offered by the BHTelehealth system is usually attended by health professionals from 58 PHU simultaneously. These professionals can also participate and interact in national and international videoconferences promoted by the academia, which are transmitted to the PCU, as an innovative method of permanent education.

The University can also benefit from the integration with the primary care provider, and so it can identify gaps and improve its teaching/learning activities. Besides that, since the education process happens at the health unit, it implies in efforts optimization and resources rationalization, once the professionals do not have to move from his/her workplace.7

Considering the assistance aspects, the possibility of the PCU professionals discussing the clinical cases with specialists increases the effectiveness and add quality to the primary care of the City Health System.12 It was observed that 71% of the patients whose clinical cases were discussed in the project remained in the PCU. The objective and subjective evaluations of the benefits that come with this data is a complex process, which is under development in the project. Concerning the second opinion, its usage contributes to structure the assistance models linked with the different complexity levels.

The accumulated experience with the BHTelehealth system has shown that the incorporation of an innovative action that changes the conventional paradigm in the assistance model is a slow assimilation process. The discussions of the problems in the routine definitions need to be developed, because it will allow important leaps to the structure of new telehealth projects in the public sector. The challenges faced with the daily use of the telehealth in the Brazilian assistance model are still something new to the management of the public health system.

The analyzes of this experience allows us to conclude that the telehealth model adopted in the BHTelehealth Project is slowly being incorporated into the organization of the assistance in the PCU, benefitting patients and better qualifying the primary care professionals.

The telehealth model tested in Belo Horizonte is currently under expansion to other 82 small cities in the state of Minas Gerais with the specificity in cardiology. It constitutes now as a telehealth service model in Brazilian UHS.

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Telepsychology: First Steps in Application in Rural Areas

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Abstract
The aim of this paper is to present the first steps in application of distant psychology consultations in rural areas as part of project OHN 1514/2005 funded by National Science Fund, Bulgaria. The emphasis is on developing a network for tele-psychology counseling for people living in the countryside who do not have an easy access to highly qualified psychologists.

Key words: Distant psychology counseling, tele-psychology.

Introduction
Despite its importance, psychology is often considered as the Cinderella of healthcare. World Health Organization estimates that nowadays almost 1 500 million people suffer from psychological problems and need help. Nevertheless, psychological consulting, with a very few exceptions, is not covered by insurance funds. Tele-psychology offers a relatively cheap solution that may satisfy both patients and experts, and will not put enormous burden on health care budget.

What is tele-psychology? The simplest definition has been provided by Australian Psychological Society: "The marriage between technology and psychological services is known as Telepsychology" http://www.psychology.org.au. This new psychological area relies on convergence of available electronic equipment and telecommunication facilities for exchange of audio, video, and/or text for therapeutic communications. E-psychology, tele- or virtual psychology or e-, online or web-counselling – all of these terms reflect the nature of remote psychological services.

The idea of utilization of information and communication technologies for online counseling and therapy is not a new one. Discussions about the application of Internet for the needs of psychology began almost 35 years ago with the start of Internet’s prototype, the project ARPANET (ARPANET started operation in late 1969 and ended in 1989).

In general tele-psychology consists of short interventions. It is applied when face-to-face contact with licensed psychologist is impossible due to long distance, lack of transport, desire for anonymity, etc. In addition, tele-psychology is an excellent alternative for those who cannot afford private consulting as well as for shy people who want quick answers. The service is an option for a rapid psychological counseling. An additional plus is that tele-psychology expands the group of potential clients of psychological help. Most often e-psychology is realized as exchanges of e-mails, chat or chat groups, videoconferences.

The purpose of this paper is to present in brief the first steps in the development of tele-psychology as part of the ongoing project OHN 1514/2005. It will discuss only one aspect of tele-psychology – virtual psychological consultations and how we are planning to realize them.
The Project

The project was developed in conjunction with the Valetta Action Plan (http://www.itu.int/ITU-D/univ_access/program3.html) that sought to promote universal access to basic telecommunications, broadcasting and Internet as tools of development in rural and remote areas. The project focuses its efforts on introducing e-health (tele-psychology) in rural and semi-mountainous region in Bulgaria.

The project’s strategic goal is to develop and offer a virtual high quality psychological service (at the beginning focusing on child psychology and depression) to people from rural areas that had no contact with a licensed psychologist. Text, colour images, video and audio clips will be transmitted. The project employs state-of-the-art networking technology to enable experts to communicate directly with patients and perform remote consultations, supervision, etc. The project has to test and evaluate pros, cons and overall effectiveness of tele-psychology services and thus provide a platform for wide introduction of tele-psychology.

The project’s target area is a semi-mountainous region Septemvri, including 2 towns and 8 villages most of them with 1000–2500 residents, with a total area of 349 km², ~ 20 000 inhabitants, scarcity of public facilities and technical personnel, difficult topographical and climatic conditions, low level of economic activity based on agriculture and high percentage of unemployment (>33%). Another reason to choose Septemvri is that there are not enough licensed psychologists. Thus, in order to receive an expert opinion, clients have either (a) to wait (sometimes weeks or months) or (b) to travel minimum 60 or even 100 kilometres to another region. And if they prefer to stay anonymous during the consultations, the task becomes even more difficult.

The project uses an existing telecommunication infrastructure of another ongoing project (Project 7 - BUL/03/001 co-funded by Bulgaria and International Telecommunication Union). The latter consists of wireless and optical connections in the target region, connection in a network of these 10 towns and villages. Public tele-centres were built and equipped in these 10 places, also for those, who do not have Internet at home. The network is also connected to the local Emergency medical centre, regional medical center, offices of general practitioners and to the police stations plus to a specialized tele-server at the Bulgarian Academy of Science (BAS). Via the server at BAS, psychologists will offer tele-counseling.

There are four main reasons for focusing on the development of tele-psychology via the project:

1. The means to offer tele-psychological consultations are available. Experience of other countries revealed the importance of tele-psychology and its effectiveness. But foreign expertise is not applicable if there are no accurate conditions to introduce it and if this expertise is not adjusted to local characteristics and requirements.

2. In Bulgaria there is a demand for such services. Although computers and Internet are not available in every household, about 1% of Internet visitors are looking for psychological information and support. What are the users looking for? The answer is simple – many people know how they should live healthier (food, weight, exercise, etc.) but are not able to adjust their life to this knowledge. Internet users are very much looking for such information. In addition, they are looking for psychological advice and counseling in lots of areas covering life-style problems, loneliness, melancholy, jealousy, marital problems, alcohol and drug dependence, bulimia, etc. All of this may be just a part of everyday life, or may be serious mental illnesses, or anything in-between. Even less serious problems are often a cause of misery and lack of capacity for productive work and healthier life.

3. Abroad, many web sites offering exclusively or as part of their service virtual psychological consultations exist. Some are free, some require a small fee. The users contact these sites either from home or from work. In the project’s target region home computers and Internet access from home are rare. The development of local public tele-centres, is a solution offering a bigger proportion of population access to virtual psychology consultations.

4. In addition, tele-psychology consulting is not covered by national insurance funds. Tele-psychology offers relatively cheap solutions (compared to face-to-face consultations) that may satisfy patients and will not put enormous burden on their health care budget.
Realization

Enthusiastic licensed psychologists are involved in virtual psychological consultations, including representatives of the Institute of Psychology at the Bulgarian Academy of Sciences (IP-BAS). This is the most appropriate decision as IP-BAS is the largest national center for fundamental psychological research and transfer of scientific achievements in different branches of psychology and technology. Thus, the project employs state-of-the-art remote networking technology to enable experts from the IP-BAS to communicate directly with patients and to perform remote counselling and supervision. A specialized website is under construction, where those who need help may contact highly qualified specialists. Potential clients have either to contact the specialized website from home/office or to visit local telecenters where specific, hidden from view and sound proof places for psychological consultations are equipped. Thus, if and when necessary, users rely on technical advice and on the help of tele-centre staff. The technical staffs are not attending tele-sessions. Direct connection is organized between local tele-centres and a server at STIL-BAS. In order to make tele-psychological contact as easy as possible, 3 models of contacts are foreseen:

- Exchange of text messages, i.e. e-mails;
- Internet telephony and
- Video connection.

But which is the right way to start? In order to be inline with the requirements of potential users, an Internet survey was performed. Its aim is to study the attitude of users towards tele-psychology consulting.

Results from survey

The questionnaire was presented via one of the specialized psychology websites and filled in voluntarily and anonymously. In 2006 people from 7 countries (Belgium, Bulgaria, Germany, Italy, Sweden, UK and USA) took part in the survey.

Further on, only the results from Bulgarian residents will be presented and discussed as the main goal of the project is the development of tele-psychology for Bulgarian rural area. A total of 127 participants from almost all regions of the country took part in the survey (Fig. 1) that makes us feel confident in the results. The age of participants varied from 20 to 60 yrs.

The first point that we were trying to clarify was whether subjects are willing to use Internet as a media to receive psychological help and/or advice. The results are more than promising – almost 76% of subjects are positive about the use of tele-psychology for their own needs (Fig. 2a).

The most useful for the project were answers revealing subjects’ preferences as far as the type of media for telepsychology is concerned (Fig. 2b). As we expected (but have no evidences) more than half of the participants prefer exchange of ordinary e-mails as the main source of consultations. In the second place is the application of Skype program (28%) followed by ‘chat’ and video. The combination of several media channels is less preferable. These results gave us confidence that what we have planned in advance – to start with e-mail exchange as a main source for tele-psychology consulting, is correct and the project is on the right track.
In addition, the data also revealed that 30.3% of the participants had already tried to find psychology support, help or advice via Internet. Those who had tried varied in their estimations of the level of satisfaction from tele-psychology (Fig. 3).

The results do not correspond to the data cited in the literature. Foreign authors underline that, as a whole, tele-psychology is very effective and patients highly evaluate Internet contacts with psychologists. Surveys revealed that users’ satisfaction varies from 68% to 88%. That is why tele-psychology musters up strength. Its applications have the potential to advance the fields of psychology in a multitude of ways. A possible explanation for the differences between our data and the results in the literature is that tele-psychology in Bulgaria is at its very beginning. It is not widely spread; clients do not have the habit to use it and do not know what to expect, existing sites (when available) are often managed by students and not by licensed psychologists. Nevertheless, having the results in mind, we face a big challenge – to offer excellent tele-psychology services during the life-time of the project in order to convince potential clients that it is worth using this new and promising service.

One more interesting result was found – in general, men are more willing to look for psychology help via the web. 44% of men participating in the survey have tried to find appropriate distant anonymous psychology consultations, while only 26.4% of the women have done this. In addition, there is a clear age and sex dependent difference in the profile of the potential tele-psychology clients (Fig. 4). Till late 20’s both sexes need and look for psychological help at an almost equal level, while after that age the interest and needs of women gradually decline. The decline is very sharp in men and the need for psychology consultations in the decade 40–50 is almost at the same level as at the age of 20. Around 50’s men start looking for psychological support again, which may be explained with the crises of the middle age.
In conclusion

Bearing the results of the survey in mind, we’ll continue with the project in the next months, offering at the beginning only off-line e-mail sessions, relying entirely on text messages. Visual contact will be used only in case of necessity and after preliminary agreement between clients and psychologist. We’ll put the stress on text-messages as the main communication source of tele-psychological counselling because:

– E-mails are easy to use, familiar to many potential patients and very similar to writing letters;
– E-mails create a text talk as John Suler [5] brilliantly explains. For those who love to write, e-mail is heaven;
– E-mails may be anonymous. If users want, they may use pseudonym, not real names. The only requirement is to keep the same pseudonym during the entire duration of e-psychological contacts;
– E-mail contacts are usually off-line and do not occur in real time. They do not create simultaneous conversations. This is essential for users / patients as it gives them time to think, evaluate and compose their messages in the most appropriate way. The same counts for a licensed psychologist, who is not pressed to respond on-the-spot and if necessary may take the advantage of this and dedicate more time to considering every particular case. In addition, the asynchronous character of e-mail exchange gives the chance to adjust the speed of virtual counseling according to the needs of the users. Interactive time can be shortened or stretched, as needed.
– Last but not least, e-mail exchange enables us to record the interactions by saving the typed-text messages.

It is essential to underline that the project does not focus on treatment of severe mental conditions. It is not oriented towards serious illnesses, which may require hospitalization. Tele-psychology, as foreseen in the project, is targeted at those many people, from all age groups, who are suffering in silence, who do not seek a doctor or a psychiatrist but who can be aided in achieving a better and more productive life by psychological advice.

Through this project, exploiting new technology, we hope to illuminate the potential for virtual psychological counselling, and to share our evolving understanding of what is truly possible, despite the prevalent myths, which shape our thinking about e-psychology.

References

Abstract

The Danish health care sector has a strong tradition of electronic communication between the parties in the Healthcare sector. In the field of telemedicine, teleradiology and teledermatology are the most disseminated applications on the national health-net.

Key words: telemedicine, National Health IT strategy, teleradiology, teledermatology.

Telemedicine in National Health-IT strategy

The National IT Strategy 2003–2007 for the Danish Healthcare Sector states, that the current use of telemedicine in Denmark is quite limited and primarily used in hospitals. In order to widen the application of telemedical solutions, the Strategy recommends a National coordination project within the field of telemedicine.¹

Telemedicine in hospitals

In the autumn of 2003, the Danish Society for Clinical Telemedicine conducted a survey, in which all Danish hospitals were included, in order to get a clear overview of telemedicine and its usage in clinical settings.² Seventy-one departments responded. The survey showed that 41 departments used clinical telemedicine as part of their everyday routine, while 31 departments had clinical telemedicine projects running. 102 departments expressed wishes to start clinical telemedicine projects.

The following medical specialties had clinical telemedicine as part of their everyday activities: Pathology, Cardiology, Dermatology, Radiology, Ophthamology, Nephrology, Audiology, Gynaecology/Obstetrics and Paediatrics.

The conclusion was that a number of clinical specialties already use clinical telemedicine, and most other clinical specialties expressed their wish to include clinical telemedicine. Therefore, several local telemedicine projects have currently been initiated in the hospital sector. Teleradiology is far the most used telemedicine application in the Danish hospital.

Teleradiology: "Lookup of Xrays and descriptions via the Internet"

The aim of the "lookup of X-rays and descriptions via the Internet" project (2002–2005) has been to give healthcare professionals direct access to central patient information, which is stored in
another county or in the hospital’s own RIS (Radiography Information System) or PACS (Picture Archive Communication System), including conjunction with urgent admissions, treatment of free-choice patients or preparation of treatment of a new patient. The healthcare professional can obtain the information quickly via Web lookup, so that the patient’s treatment is effective and of the highest quality. Web lookup also makes it possible to establish different telemedicine services, such as asking an expert for a second opinion. As the shortage of experts in the area of radiology clinics increases, this type of telemedicine solutions will steadily gain ground, perhaps in cooperation between the hospital service and specialists in private practice or private radiology clinics. Finally the lookup solution will be useful for GPs when they have to inform patients about their illness and treatment, as X-rays can encourage dialogue with the patient.

Seven counties have linked PACS or RIS servers to the Internet-based Healthcare Data Network during the project period and in more or less defined pilot projects have made the information available to partners outside their own organisations. The information has been available using web lookup via the closed Healthcare Data Network. Provisional experience suggests that X-ray lookup solutions are particularly useful for cases between the hospital service and private clinics and for teaching purposes in general medical practice. Urgent need for exchange of X-ray information between hospitals is based on actual teleradiology transfer of X-rays, in several places via the Healthcare Data Network.

**Telemedicine in primary care**

Regarding primary care, 98% of the GPs use EDI-communication between primary and secondary care and other organizations. 3.5 mio EDI messages are exchanged every month over the Danish Health-care Data Network, mainly prescriptions, discharge letters, referrals and laboratory results. In addition; a national tele-dermatology network has been established by MedCom.

**Teledermatology**

Teledermatology is based on the sending of digital images of skin conditions as a supplement to the traditional cooperation and patterns of patient referral between medical practice and specialists in dermatology. The overall aims of the teledermatology project (2002–2005) have been to:

a) Replace/supplement general referrals to skin specialists with telemedicine consultations.

b) Assure patients of equal and quick access to specialist assessments of skin images through their own doctor.

c) Support continuing training of GPs through communication with skin specialists.

d) Establish nation-wide provision for telemedicine skin image consultation.

The following activities have been carried out in the project period:

**Healthcare recommendations**

Healthcare recommendations on practical conditions in connection with cooperation between general medical practice and dermatology specialists have been drawn up, including the content of patient referrals and discharge letters in teledermatology cooperation. The Recommendations are drawn up in cooperation with the Danish College of General Practitioners and the Danish Society of Dermatology and Venereology.

**Digital photography course**

In cooperation with a dermatology specialist, MedCom has issued an instruction cd "How to take a good skin photograph in two minutes", with practical advice on photographic technique and patient setups for photography during the consultation. This material has provided the basis for several photography courses for GPs.

**Pilot projects**

Eight counties and Copenhagen Hospital Corporation have had teledermatology activity on a varying scale over the project period. In several places the project has been based on local Section
2 and Section 3 agreements between the local National Health Service unit and practitioners on fees to be paid for general practice and specialist dermatology practice.

The MedBin standard

In the vast majority of cases digital images of skin conditions have to be sent by ordinary e-mail, with anonymous image material attachments, while the patient referrals are sent as EDI. This procedure entails a number of manual procedures at both the sender and the recipient. The intention is for image exchange in the future to be done using MedBin standards, where the sender’s record system automatically links the image material to the patient referral, and the recipient’s record system automatically stores images and referral together in the patient’s record. All significant suppliers of record systems for specialist dermatology practice and by far the majority of suppliers of record systems to general practice now support the MedBin standard for use in teledermatology.

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Abstract

The state of health of a population is a direct determinant of a country’s development. Many developing countries have inadequate healthcare and medical services and are suffering from a shortage of doctors and other healthcare professionals. For countries with limited medical expertise and resources, telecommunications has the potential to provide a solution to some problems, improving both the quality and access to healthcare regardless of geography. The present article reviews the eHealth/Telemedicine projects implemented in Georgia and focuses upon the possibilities of eHealth in the country.

Key words: eHealth, telemedicine, telecommunications, healthcare, medical service.

Introduction

The state of health of a population is a direct determinant of development. It affects productivity, the potential of children, infant and general mortality, and the allocation of resources within a family, community and nation. Access to better healthcare services redounds to poverty reduction and increased productivity. Investment in healthcare is a prerequisite to economic and social progress.1

Population growth and the emergence of new health problems are increasing the demand for healthcare services and for more expensive treatment. Increasing demand, slow economic growth and rising healthcare costs have not been in parallel with the funding of the healthcare sector in most developing countries. Healthcare infrastructure, buildings and equipment, medical staff, drugs, vehicles, is central to good healthcare requiring high investments. Healthcare services must also be integrated, cost-effective and available to the people who need them. The adoption of sound policies and strategic plans that will guarantee the provision of quality, sustained and integrated healthcare services to its population are challenges faced by most governments of the developing countries today. To meet this challenge, governments and private healthcare providers must make use of the existing resources and the benefits of modern technology.

Many developing countries have inadequate healthcare and medical services. Developing countries suffer from a shortage of doctors and other healthcare professionals. The inadequate infrastructures of telecommunications, roads and transport make it even more difficult to provide healthcare in remote and rural areas and to transport patients properly.2 Where clinics and hospitals exist, they are often ill-equipped and, especially, outside urban areas, beyond the reach of normal communications.

Developing countries face various problems in the provision of medical service and healthcare, including funds, expertise, resources, which relate to the lack of facilities and systems.

Several years ago, any talk related to the Internet, would have to be preceded by an explanation of what it is and how it works, but at present Information and Communication Technologies (ICT) became an essential part of life and practical activity. eHealth/Telemedicine is the dissemination of medical information using the digital medium. This field absolutely depends
The communication technologies have two tasks in eHealth/Telemedicine. Firstly, they may serve as a repository of knowledge from which healthcare professionals interested in telemedicine techniques may draw. In the field of eHealth, this aspect still has a long way to go. More importantly though, it may be conduit by which telemedicine is implemented. For most areas, the communication technologies represent the easiest existing infrastructure to use, with the World Wide Web (WWW) being best suited to multimedia applications.

For countries with limited medical expertise and resources, telecommunications has the potential to provide a solution to some of these problems. eHealth/Telemedicine services have the potential to improve both the quality of and access to healthcare regardless of geography. They enable medical and healthcare expertise to be accessed by under-served locations. Healthcare professionals can be more efficient. eHealth/Telemedicine offers solutions for emergency, medical assistance, long distance consultation, administration and logistics, supervision and quality assurance and education and training for healthcare professionals and providers. eHealth/Telemedicine can help in combating infectious diseases and meeting the particular requirements of dermatology, traumatology and many other medical specialties.

In the developed countries, there has been a rapidly growing interest in telemedicine and eHealth as means to ease the pressure of healthcare on national budgets. Some of the technologies and experiences of the developed countries could help developing countries in their desire to provide, especially, primary healthcare.

Telemedicine and eHealth have many socio-economic benefits; they can generate new sources of revenues for service providers and equipment suppliers and can optimize the use of available human and capital resources in developing countries. But these fields need to be implemented carefully and managed well. The impact of telemedicine on healthcare structures can be significant. In this respect, eHealth can be seen as a tool to reorganize or to build up new healthcare structures. It also raises concerns about liability, confidentiality, competition and other policy and regulatory issues.

eHealth/Telemedicine has a great potentiality; however, today there are unfortunately few examples of large services. The benefits of expanding its use are threefold: it can improve the quality of healthcare services; it allows a better exploitation of limited hospital resources and of expensive medical equipment; and it helps to address the problem of unequal access to healthcare. Throughout the world the number of people requiring special care is increasing as the proportion of elderly people rises, at the same time, in a high-tech age the expectations of the society for a better healthcare are also rising. eHealth/Telemedicine offers the opportunity for improving healthcare service and for making healthcare expertise available to underserved locations.

Description

The present monograph focuses on description of eHealth/Telemedicine activities in Georgia.

There were two International Telecommunication Union (ITU) supported telemedicine projects implemented in the country. The first one was started in September 1998 and involved the connection of the Institute of Radiology in Tbilisi to the Diagnostic Imaging Centre in Lausanne, Switzerland via the Internet in order to acquire medical second opinions. In the frames of this project Vidar VXR-12-Plus was used for CT and MRI images digitization.

The second telemedicine project – Telecardiology, has implemented the simple method of ECG transfer using ordinary telephone receiver. It was partly funded with excess revenues generated by the ITU Telecom exhibitions. The project enabled a trans-telephonic electrocardiogram for diagnostic and emergency services. The project was one of several others which were implemented in selected developing countries as part of the ITU’s strategy to use information technology for the aim to help healthcare professionals solve some of the most acute healthcare issues in developing as well as emerging economies, according to Recommendation Nine of the Valetta Action Plan adopted by the ITU in 1998. Partners in the project include the Tbilisi Cardiac Clinic GULI, Telecommunication Company of Georgia and the Telemedicine Foundation of Russia.

But in Georgia there were other telemedicine projects implemented too. In 1996 and 1997 National Association of Cancer Control established email communication and conducted televi-
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Diological and telemorphological conferences through financial support of Open Society Georgia Foundation. Particularly, X-ray grams, histograms and cancer incidence database were transferred from Batumi (Adjara region) to Tbilisi National Cancer Center by email. Heart and Vascular Clinic uses Agfa Deluxe Slide Scanner for teleradiology. The center also transfers phonocardiograms, ECG and Video .avi files to medical centers in Germany and US for second opinion gathering.

Emergency Cardiology Center and National Information Learning Center are implementing telecoronography (telecardiology/teleradiology) – transfer of X-ray images for second opinion to German and Turkish colleagues (by usage the both HP ScanJet and Apple 1 scanner as well as Olympus Camedia D-620L high resolution digital camera).

Center of Disaster and Emergency Medicine has developed software and tested TelCoNet – Teleconsultation network project for emergency medicine.\(^5\)

In 2004 in Georgia a non governmental organization Georgian Telemedicine Union (Association), which organizes remote consultations and educational sessions in different medical fields, was established. Remote consultations are implemented in static (through consultational servers and emails) as well as in dynamic (teleconferencing) modes. In 2005 Georgian Telemedicine Union (GTU) starts the implementation of NATO Networking Infrastructure Project "Virtual Health Care Knowledge Center in Georgia" in collaboration with Dr. Thomas Schrader (Charite Clinic, Berlin, Germany), which aims at the creation of telemedicine consultation server, organization of eLearning courses and also set-up of regional (West Georgia) telemedicine unit.

GTU is also implementing Black Sea Economic Cooperation (BSEC) project "A System to Fight HIV/AIDS, Tuberculosis and Malaria in BSEC Countries with a Help of Info-Communication Technologies" in collaboration with Russia and Ukraine.

On the background of practical activity of Georgian Telemedicine Union it was revealed that the probability of an incorrect handling of a relevant medical data is still dangerously high, mainly due to:

- **Environmental factors.** Many medical organizations are not fully able to face every disease, e.g., in a peripheral hospital only the most frequent pathologies for that geographical area are treated.
- **Instinctive factors.** The decision making of a physician is usually mainly based on the limited number of cases in her/his experience and/or on a static medical knowledge available from databases of the main published studies. This factor is very variable between different specialists and general practitioners.
- **Emotional factors.** Medical decisions are often influenced by the opinions and decisions that have been taken by the physicians who have already examined the same patient.

As a consequence the probability of a serious error occurrence could be high and the probability of its recognition and correction very low. This frequently causes a repetition of exams in the same time or in different medical units and it slows down the diagnostic process (resources waste) and the proper treatment. So, proper actions for improving the working procedures have to be taken.\(^6\)

Correct medical information management and transmission is a key point, hence the introduction of innovative ICT can be relevant. Furthermore ICT performance, and in particular the telemedicine bandwidth requirements are high and rather asymmetric (there are more often needs for retrieval than for entry or update of medical data). Multimedia clinical record transmission is a suitable topic for the telemedical networks. Each actor connected to a network needs to be driven towards the most proper resource available on it, e.g., an important objective of clinical data management is the availability of common and precise data about patients treated in medical centers connected to the network.\(^7,8\)

GTU’s projects will provide a new teaching/learning service based on collaborative and bi- and multi-directional communication processes. Interest in co-operation does not affect only teaching but all intellectual and cognitive activities, "collaborative learning" will refer to a method in which actors work together towards a common task. Physicians are traditionally responsible for their own and their fellow’s learning: in this way, individual success helps all others to achieve positive results. In fact an active exchange of ideas in between small groups does not only improve the interest in communicating but also promotes a development of more critical thinking.

The main telemedicine applications concern: remote second opinion consultations and teleconferencing (one to one and/or multipoint). On the other side the main applications that have
been implemented for eLearning are: video lessons (live and/or on-demand), a media library, and a laboratory collaborative learning environment. Since the request for more effective healthcare services has been increasing over the years, the health delivery system needs to focus on:

- Improving the performance of the healthcare services;
- Optimizing the running costs of the healthcare structures and the allocation of resources.

For this reason, health is now following a "delocalization" process: information, i.e. knowledge and skills, should be moved, rather than people or tools. The practical activity of the Georgian Telemedicine Union aims to provide an answer to such an evolution to eHealth.

Results

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

1. Partial solutions approach instead of integrated total approach to healthcare assistance needs.
2. Lack of economical drive and consequently no self-sustainability for large scale exploitation.
3. Insufficient H24 (24 hours/day 365 days/year) medical and social operators support.
4. Insufficient networking approach for medical operators and scientific/clinical structures.

In 2005 in the frames of NATO Networking Infrastructure Project "Virtual Health Care Knowledge Center in Georgia" a teleconsultation server was created by the Georgian Telemedicine Union in collaboration with Charite Clinic. There are implemented eGroupWare, Moodle and Teleconsulting tools at the server.

eGroupWare is a type of software that allows a group of individuals on a network to work on the same project at the same time. This programme allows users to share documents, calendar and addresses, plan projects or manage news. The main aspect for choosing it is the large community and the fact that "Virtual Health Care Knowledge Center in Georgia" is a "young" telemedicine project which is assuring a promising future. eGroupWare is arisen as a subsidiary to phpGroupware, but with some known bugs fixed and a redacted desktop.

Within the scope of eHealth/Telemedicine, teleconsulting is an important sub area, where several cases can be discussed with experts all over the world. The main idea for Teleconsulting tool was the possibility to create a case by an external Team. The essential data is stored on the server and it is viewable by all interested groups. The last one can comment and recommend the questions and requests. After finalization the case is stored on the server and can be viewed by the users. Simple Machines Forum (SMF) is used for organization of teleconsulting. The SMF is the only one that contains the possibility to attach files to a thread.

A learning management system (LMS) is a software application or Web-based technology used to plan, implement, and access a specific learning process. Typically, a learning management system provides an instructor with a method to create and deliver content, monitor student participation, and access student performance. A learning management system may also provide students with the ability to use interactive features such as threaded discussions, video conferencing and discussion forums. There are several LMSs. The Moodle was determined as the most suitable and appropriate tool. Moodle is a software package for the production of Internet-based courses and web-sites. It is provided freely as Open Source software (under the GNU Public License). The word Moodle was originally an acronym for Modular Object-Oriented Dynamic Learning Environment, which is useful mostly to programmers and education theorists. It’s also a verb describing the process of lazily meandering through something. As such it applies both to the way Moodle has been developed and to the way a student or teacher might approach studying or teaching an online course. Moodle will run on any computer that can run PHP and can support many types of database.6

It was revealed, that eHealth/Telemedicine is most important for ensuring the safe primary medical care in Georgia. The first contact of patients needing medical help is the contact with
the local primary care health center. Second opinions from specialists are often required in primary care health centers. (i.e: radiology, cardiology, dermatology, consultations with specialists regarding further treatment of the patient; is hospitalization needed or not? etc). An efficient and appropriate strategy of medical care can be worked out at the initial steps of a patient’s contact with health care. Such an approach can avoid unnecessary hospitalization, and will be a substantial contribution to the reduction of health costs.

EHealth/Telemedicine has the potential for offering the country these qualitative and quantitative improvements:

1. Distance consultations, diagnosis and advice for treatment.
2. Opening up new ways for education and training. Improvement in qualification of national specialists and health technicians, by opening up international medical databases.
3. Overall improvement of service by regional centralization of resources (specialists, hardware and software packages).
4. Effectiveness and efficiency in management of actions related to the reduction of waiting times for consultations, and introduction of medical information systems.

Telemedicine could reduce health costs in the country potentially in these ways:

For the patient:
1. Cutting down on the journeys to major health centers or for specialist consultations.
2. Reduction of length of stays, and therefore cost of hospitalization, since the patient can be treated and checked at a distance.

For providers of health services:
1. Reduction of operating costs through centralization and optimization of resources (expertise, laboratories, equipment and etc.).
2. Reduction in travel cost and time for specialists visiting other hospitals and centers for consulting.
3. Reduction in costs of training and updating, improvement of specialists’ qualifications through distance teaching and access to medical databases.

EHealth/Telemedicine introduces added value and a positive impact on social, economic and cultural levels. Therefore, this field is beginning to have an important impact on many aspects of health care in developing countries. When implemented well, eHealth/Telemedicine may allow these countries leapfrog over their developed neighbors in successful healthcare delivery.

Discussion

Reference data and medical support services provided by Georgian Telemedicine Union (Association) are complying in a cost-effective way to the continuously increasing healthcare professionals’ needs for a faster access via Internet to data and services supporting decision making in clinical practice and medical education. In particular, the services provided by the Virtual Healthcare Center (VHCC) are:

- Access to clinical and educational data, tutoring and eLearning functions: reference data (clinical data) and text databases for diagnostic and patient care decision support and for undergraduate or postgraduate courses and professional continuing education schemes support; educational tutoring and learning progress assessment; off-line and on-line consulting on specific issues;
- Support to the teleconsulting sessions with the above mentioned data and workgroup function as forum. Most patient data is stored in large files. For this reason, the transfer rate of the multimedia contents in the web-sites is a qualifying element to satisfy the needs of healthcare professionals, scientists and students in various medical areas.

It should be noted especially, that a medical record collects data items from direct patient examination and from medical instruments. These "events" representing significant episodes in the patient’s medical history, belong to two classes: analytical events and descriptive events.

The healthcare staff worldwide needs to certificate their participation in continuing medical education (CME) programs. These courses have traditionally been done in the past either face-to-face or via reading materials. Web-based technologies allow courses to be available on-line, this enables healthcare operators to train themselves at any time and from any location and
available information to be greatly increased. Traditional web systems are too simple to be really effective and the commercial eLearning platforms require a complex configuration and are too ‘technical’ for customers, furthermore, the focus of this system is often on on-line interactivity, while a structured arrangement of educational contents must be the first priority.9,10,11,12,13 For this reason a new system will have been developed having the following features:

- **Structured courses.** Stored in a relational database maintained by a suitable administration tool. Each course is multi-language and is integrated with evaluation forms. The course structure (lessons, concepts) is easily editable and the results are immediately available.

- **Innovation in content.** The system is based on an object called "concept", an innovative way to build a lesson. This concept encloses images, videos and texts that are needed to communicate educational concepts.

- **On-line interactivity.** Learners communicate with teachers by using audio/video/whiteboard interaction in multi-user sessions (virtual classrooms). The quality of audio/video depends on the network but the system allows the exploitation of asymmetrical ADSL.

- **Minimum configuration of users.** The system will run on most hardware and operating systems and it needs no configuration of the user workstation. In addition, the server runs open software products to reduce costs and to increase portability and performances.

The main objective of VHCC is the availability of a common base of medical data relevant to any Institution connected to the web. Telecommunication network and proper software provide patient data in remote sites enhancing the co-operation between healthcare professionals belonging to different Institutions. The system guarantees:

- **Patient assistance.** The underlying idea is that the information collected during the contacts with healthcare organizations has a great importance for further treatment of the patient’s diseases. Data has to be accessible by authorized medical personnel only. The patient must not be bound, as far as possible, to working and traveling constraints. So the patient could have contacts with other Institutes, possibly abroad, and her/his data must be easily accessible, provided the security permissions are verified. Medical and paramedical personnel store and retrieve relevant data coming from exams, anamnesis, therapy and any other event that is relevant to patient’s contacts with any Institute joining the system.

- **Decision support based on large statistical samples.** The availability of a wide collection of medical cases can be very useful in determining the best decision about a new patient.

- **Research activities.** The dissemination of large number of medical data integrated in a single network implies that a huge amount of data will be available. This information can be used as a common base for scientific statistical analysis for medicine.

- **Economic objectives.** The system gives relevant economical advantages. It allows patients to be treated in remote sites, sharing the relevant data for medical decisions support and diagnosis with physicians in Centers of Excellence. Medical protocols and guidelines for disease treatment can be shared. Medical personnel in remote sites can join Centers of Excellence programs and associations. It enhances the autonomy of the remote sites hospital system, increasing efficiency and allowing quality assessment.

The patient-record at VHCC is based on "events", i.e., episodes that occur during the patient’s contacts with the healthcare organization. The patient’s record is the collection of all his/her events; these medical data could be heterogeneous, ranging from numerical values to radiographical images. A relevant step forward is that information is gathered during routine patient treatment, not during activities explicitly dedicated to scientific research within Universities or research Institutes. Educational module slides will be already collected in a central database. The particular importance of this point is:

- Data flow is asymmetric;

- There is no requirement for the session leader workstation. The roles of the participants is logically assigned by the software and not dependent on the terminal features;

- Slides are collected in a hierarchical form in a relational database. In this way structured access to courses is granted and large amounts of content are administered and maintained centrally in a well ordered way;

- Access to contents is granted conditionally based on user privileges. The tutor grants access to the appropriate educational material. The system also allows dynamic on-line transmis-
sion of local images and even clipboard graphic paste of graphics in the virtual board. Of course the asymmetric nature of the network is not efficient in this case. The program allows user commands to be automatically sent to all the participants that see the same window and can give commands that will be broadcasted to the others.

For the users there have been savings from:
- An operating cost reduction through the optimization of resources;
- A reduction in costs of training for the physicians through eLearning and access to medical database;
- A decrease in travel costs and time for physicians visiting other hospitals for consulting.

Acknowledgements

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3. Leong F.J.W-M. Telepathology and the World Wide Web – Internet resources applicable for telepathology. XXIII International Congress of The International Academy of Pathology and 14th World Congress of Academic and Environmental Pathology
Abstract

India is a vast country of 1.4 billion population occupying an area of 3,287,268 sq. km. It consists of 29 states and 6 Union Territories governed by a federal system. There is no national health insurance policy for the country. It has been observed that there is a great deal of disparity in quality and access to healthcare between urban and rural regions. This healthcare division needs to be bridged since most of the Indian population lives in rural areas. The government of India has recently launched “National Rural Health Mission” aiming at equity in best health care to this target group. Telemedicine is an emerging Information and Communication enabled health technology which has the potential to facilitate access to healthcare in underprivileged population if adopted into existing healthcare delivery system. E-health service in India has been very small so far considering its size, mostly limited to medical transcription, health awareness through portals, telemedicine, hospital management system and customer service using the Internet. Both government and private agencies have been involved in implementing Tele-healthcare projects over the last five years. Few e-health industries are coming up providing complete telemedicine solution and services. Most of the research and development projects are supported by Information Technology department and application including infrastructure support by Indian Space Research Organisation of federal government which has led to successful outcome like development indigenous telemedicine software and practice modules, Large public and corporate hospitals are gradually adopting Hospital Information Management System (HIS) and few have introduced Picture Archival and Communication System (PACS). Business Process Outsourcing (BPO) services in health sector are expanding rapidly. Knowledge Process Outsourcing (KPO) is limited to Tele-radiology services only. E-health industry is coming up and policy and standard issues are getting addressed. Government efforts are directed towards setting up standards and defining ICT enabled healthcare infrastructure for the country. Recently, late in the year 2005, the Ministry of Health, Government of India has constituted a National Task Force on Telemedicine. Human resource development in e-health field is also realized. A school of Telemedicine and Biomedical Informatics is coming up which is being projected to become the National Resource Center on Telemedicine and Biomedical Informatics.

Key words: e-Health, Distant Medical Education, Telemedicine, Tele-health care.
Introduction

With its huge area and urban-rural division and large population of 1.4 billion, India is an ideal setting for telemedicine. In the current scenario, 75% of the qualified consulting doctors practice in urban, 23% in semi-urban (towns) and only 2% in rural areas where the vast majority of population (70%) live; while our health care resources and expertise are concentrated in urban areas. The Ministry of Health & Family Welfare and the Ministry of Communication and Information Technology (ICT) are jointly creating a national health information infrastructure, for easy capture and dissemination of health information. There are more than 165 telemedicine platforms supported by the Indian Space Research Organisation (ISRO) and 76 by Communication and IT Ministry. Recently, the Ministry of Health had formed "Telemedicine Task Force" to address many issues relating to e-health technology based healthcare which will facilitate in forming a framework for e-health application for the country.

Details of e health and Telemedicine Initiatives in India

Hospital Information System (HIS) in India

The majority of hospitals in the country are rooted in manual processes, which are difficult to access. The insurance sector demands more efficient information storage and retrieval. Automation alone can help hospitals to meet these challenges. Many sturdy, standard HIS solutions have been developed by the major IT companies e.g. Centre for Development of Advanced Computing (CDAC), Wipro GE Healthcare, Tata Consultancy Services (TCS) and Siemens Information Systems Ltd (SISL). CDAC, an autonomous government IT organization developed the first total HIS software in collaboration with Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow in 1997. Wipro GE Healthcare cover the entire spectrum of the healthcare industry’s needs including a HIS, Picture Archival Communication System (PACS) and telemedicine solutions.

Tel-health Care Services In India

Healthcare is a state subject which follows a three tier system – primary health centers catering a group of villages, secondary level health care located at a district level and medical college hospitals constituting the tertiary level of healthcare located in big cities. Besides, there are few advanced medical institutes of national importance having clinical, teaching and research facilities in various super-specialities. In addition to the government run health system, same hierarchical healthcare service exists in the private sector too. In spite of well planned public health care system in place, access to healthcare in rural areas is far from satisfactory. Several case studies in the country and abroad have proved the technical capabilities of telemedicine in satisfactory transfer of knowledge and information pertaining to patient care, professional and skill development of healthcare providers and administrators from tertiary level through secondary to primary level. This will not only educate the doctors but also improve the quality of patient care on these levels. Most of the telemedicine platforms both in public and private health sector in the country are being launched as start up projects supported by the Indian Space Research Organisation (ISRO) (Fig 1), Department of Information Technology (DIT), Ministry of Communication and IT and the Government of India in partnership with state governments (Table 1). All the nodes are linked to multi specialty hospitals whose network has been summarized in Table 2.

Distant Medical Education

Imparting quality medical education in all the medical colleges and maintaining a uniform standard across the country is not only dependant on adopting a uniform curriculum prescribed by a regulatory body but also requires the availability of excellent infrastructure such as qualified teachers, knowledge resources, learning materials and teaching technology. Though all these measures are ensured and followed in the developed countries, it is not so in the developing countries due to financial and logistic constraints. Advancement in Telecommunication and Information technology provides an opportunity to bridge the knowledge gap by networking
Table 1: State Wise Location of Telemedicine Platforms

<table>
<thead>
<tr>
<th>Sl No</th>
<th>State</th>
<th>Medical Colleges &amp; Specialty hospitals</th>
<th>District hospital, CHC &amp; PHC</th>
<th>Type of Communication</th>
<th>Funding &amp; Implementing Agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jammu &amp; Kashmir¹</td>
<td>Sher-e-Kashmir Institute of Medical Sciences, Srinagar, Government Medical College, Srinagar and Government Medical College, Jammu Proposed Telemedicine Network (Army &amp; Airforce)</td>
<td>Kargil, Kupwara, Poonch, Doda, Leh</td>
<td>VSAT</td>
<td>ISRO</td>
</tr>
<tr>
<td>2</td>
<td>Himachal Pradesh</td>
<td>Indira Gandhi Medical College, Shimla</td>
<td>Chamba, Tissa, Hamirpur, Dharamshala, Reckong-Peо, Kulhu, Sangla, Mandi, Shimla, Rampur Khaneri, Rohru, Pooh, Nichar, Bharmaur, Bilaspur, Keylong, Nahant, Solan, Una, Killar, Shalai, Kwar, Udaipur, Kaza</td>
<td>Leased line, VSAT &amp; ISDN (Center for Development of Advance Computing)</td>
<td>ISRO</td>
</tr>
<tr>
<td>3</td>
<td>Punjab²</td>
<td>Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh</td>
<td>Mata Kaushalya Hospital, Patiala, Government Hospitals, Hoshiarpur &amp; Amritsar</td>
<td>VSAT</td>
<td>ISRO</td>
</tr>
</tbody>
</table>

Fig. 1. Courtesy: ISRO
<table>
<thead>
<tr>
<th>No.</th>
<th>State</th>
<th>Proposed Telemedicine Network</th>
<th>Hospital/Institute/College</th>
<th>Location(s)</th>
<th>ISDN/VSAT/ISRO Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Uttaranchal</td>
<td>Proposed Telemedicine Network</td>
<td>Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow</td>
<td>Almora &amp; Srinagar Base Hospitals</td>
<td>Govt. of Uttaranachal</td>
</tr>
<tr>
<td>5</td>
<td>Rajasthan</td>
<td>Proposed Telemedicine Network</td>
<td>Proposed Telemedicine Network (Army &amp; Airforce)</td>
<td>ISRO</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Madhya Pradesh</td>
<td>Proposed Telemedicine Network</td>
<td>Proposed Telemedicine Network</td>
<td>ISRO</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>West Bengal</td>
<td>Proposed Telemedicine Network</td>
<td>School of Tropical Medicine &amp; Neel Ratan Sarcar Medical College, Kolkata</td>
<td>ISDN &amp; VSAT IIT Kharagpur, Webel ECS Ltd.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Tripura</td>
<td>Proposed Telemedicine Network</td>
<td>2 Super Specialty Hospital</td>
<td>ISDN DIT, IIT Kharagpur, Webel ECS Ltd.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Orissa</td>
<td>Proposed Telemedicine Network</td>
<td>SGPGIMS, Lucknow</td>
<td>National Informatics Center</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Maharashtra</td>
<td>Proposed Telemedicine Network</td>
<td>District administration medical specialists in Pune</td>
<td>Pune District Administration, Global Health portal &amp; Tata Council for Community Initiatives</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Andhra Pradesh</td>
<td>Proposed Telemedicine Network</td>
<td>Proposed Telemedicine Network</td>
<td>ISRO</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Karnataka</td>
<td>Proposed Telemedicine Network</td>
<td>Narayana Hrudayalaya, Jayadeva Institute of Cardiology, St. John's Medical College, Samatvam Institute of Diabetology, NIMHANS, Bangalore JSS Institute of Medical Sciences, Mysore</td>
<td>ISRO, DIT ISRO</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Tamilnadu</td>
<td>Proposed Telemedicine Network</td>
<td>Super Specialty Hospital in Adiar</td>
<td>ISDN DIT</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Kerala</td>
<td>Proposed Telemedicine Network</td>
<td>Amrita Institute of Medical Sciences (AIMS), Kochi, and Sri Chithra Tirunal Institute of Medical Science and Technology, Regional Cancer Centre (Kerala Onconet), Thiruvananthapuram, Five Medical Colleges</td>
<td>VSAT, ISDN ISRO, DIT C-DAC, Trivandrum Malabar Cancer Care Society</td>
<td></td>
</tr>
</tbody>
</table>

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academic medical centers of excellence with peripheral medical colleges to practice distance learning in the form of interactive virtual classroom, teleconference of operative procedures, accessing library, and web enabled teaching activities etc. The scenario in India is no different from any other developing country. Considering the recent availability of enormous bandwidth from existing space and terrestrial telecommunication infrastructure, Information technology profes-

Table 2 Super Specialty Hospital Telemedicine Network (Public & Corporate Sector)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Super specialty Hospital linked with</th>
<th>Telemedicine nodes</th>
<th>Type of Communication</th>
<th>Funding &amp; Implementing Agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>SGPGIMS^8,9,10,11,12,13,14,15 Lucknow</td>
<td>Orissa, Uttaranchal State network</td>
<td>VSAT, ISDN</td>
<td>ISRO, DIT, Govt. of Orissa Uttaranchal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AIIMS, New Delhi, PGIMER Chandigarh</td>
<td>VSAT, ISDN</td>
<td>DIT, CDAC Mohali</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AIMS, Kochi, SRMC, Chennai</td>
<td>VSAT, ISDN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eight states of North East</td>
<td>VSAT, ISDN</td>
<td>National Informatics Center</td>
</tr>
<tr>
<td>2.</td>
<td>All India Institute of Medical Sciences, New Delhi</td>
<td>J &amp; K network, Haryana (Rohtak Medical College, Ballabhgarh Community Centre), Cuttack, Guwahati, Chennai, Kochi</td>
<td>ISDN, VSAT</td>
<td>DIT, ISRO, C-DAC, Mohali</td>
</tr>
<tr>
<td>3.</td>
<td>PGIMER, Chandigarh</td>
<td>Punjab and Himachal network, SGPGIMS Lucknow, AIIMS New Delhi</td>
<td>ISDN, VSAT</td>
<td>ISRO, DIT and Govt. of Punjab and Himachal Pradesh</td>
</tr>
<tr>
<td>4.</td>
<td>Amritha Institute of Medical Sciences (AIMS), Kochi^16</td>
<td>SRMC, Chennai; Sankara Nethralaya, Chennai; Indira Gandhi District Hospital, Kavaratti, Lakshadeep Islands; Andaman &amp; Nicobar Network; Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow; J &amp; K Network; Swami Vivekananda Memorial Hospital, Sargur, Karnataka; AIIMS, New Delhi; Trivandrum medical College, Pattanamithitta; District Hospital, Kerala; Narayana Hrudayalaya, Bangalore; Ravindranath, Kolkata; ramchandra Bhanja, Cuttack; AIMS Emergency Medical Center, Pampa</td>
<td>ISRO, DIT</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Tata Memorial Hospital, Mumbai^17</td>
<td>Cancer Hospital at Barshi, Dr B Borooah Cancer Institute at Guwahati, Dr Walawalkar</td>
<td>ISRO, DIT</td>
<td></td>
</tr>
</tbody>
</table>
sionals, necessary hardware and software, and the emerging technology of grid computing, the country is now in a position to afford such kind of network. Over the last five years few tertiary academic medical centers are engaged in such activities with encouraging results (Table 2).

**e-health and e-Governance**

The e-Governance initiative of the Govt. of India examines the practical implications of IT related issues in the Government with the aim of improving services to the citizens. The application of e-governance in health care can monitor and improve the quality of health care services, make the system efficient, transparent and cost effective as it will bring healthcare providers, policy makers, professionals and the public on a common platform. The government of India has launched Village Resource Centers (VRCs) using communication and remote sensing satellite provided by Indian Space Research Organisation (ISRO) to give essential and intelligent services to 600,000 villages. The villagers will get information on agriculture, health, education, natural resources through VRCs. Initially, the VRC will be set up on the Andaman and Nicobar Islands, Wayanad and Palakkad areas of Kerala and in some parts of the northeast.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Organisation</th>
<th>Project title</th>
<th>Objective</th>
<th>Funding Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SGPGIMS, Lucknow (June 1999)</td>
<td>Telemedicine in extremes of environment</td>
<td>Telehealth care for the Kailash Mansarovar Pilgrims</td>
<td>Kumaon Mandal Vikas Nigam (Govt. of U.P.), SGPGIMS, Online Telemedicine Research Institute (OTRI)</td>
</tr>
<tr>
<td>2</td>
<td>SGPGIMS(January 2001)</td>
<td>Application of Telemedicine Technology to provide Tele-healthcare during Mela/Festival and Disaster</td>
<td>ele-healthcare in Festivals and Disaster situations</td>
<td>DIT, Ministry of Communication &amp; IT, Govt. of India</td>
</tr>
<tr>
<td>3</td>
<td>AIIMS, New Delhi, SGPGIMS, Lucknow, PGIMER, Chandigarh, C-DAC Mohali (Year 2001–2005)</td>
<td>Development of Telemedicine technology and it’s implementation towards optimisation of medical resources</td>
<td>Development of Software (Mercury &amp; Sanjeevani) Implementation at three premier institutes and one medical college linked to each</td>
<td>– Do –</td>
</tr>
<tr>
<td>4</td>
<td>SGPGIMS, Lucknow (Year 2002)</td>
<td>Development of Mobile Telemedicine Units</td>
<td>Mobile health care for remote areas, emergencies &amp; disaster management</td>
<td>OTRI, Ahmedabad</td>
</tr>
</tbody>
</table>

Table 3. Summary of Research Projects
### Current status of telemedicine & eHealth in India

<table>
<thead>
<tr>
<th>No.</th>
<th>Organization/Institute</th>
<th>Project Details</th>
<th>Benefits/Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>SGPGIMS, Lucknow (Year 2002)</td>
<td>Development of Portable Telemedicine Units in suitcase.</td>
<td>Emergencies &amp; disaster management</td>
</tr>
<tr>
<td>6.</td>
<td>Indian Institute of Technology (IIT), Kanpur</td>
<td>Development of Portable Mobile Rural Healthcare Module (Sehat Sathi)</td>
<td>Dissemination of information, diagnosis &amp; treatment on health &amp; disease</td>
</tr>
<tr>
<td>7.</td>
<td>IIT, Kanpur</td>
<td>A mobile platform (Infothela)</td>
<td>Designed to accommodate diagnostic equipments like blood pressure, blood sugar testing machine &amp; other primary health diagnostic and testing equipments</td>
</tr>
<tr>
<td>8.</td>
<td>IIT, Kharagpur</td>
<td>Augmentative Communication System for the speech impaired &amp; people affected with cerebral palsy (Sanyog)</td>
<td>Natural Language Sentence Generator, Icon Interpretation &amp; Disambiguation, Text to speech system, A predictive virtual key board, Facility to store &amp; retrieve frequently used messages, Varied access switches</td>
</tr>
<tr>
<td>9.</td>
<td>IIT, Kharagpur</td>
<td>An Embedded Indian Language Text to Speech System (Shruti)</td>
<td>Provides a speech based communication interface for speech impairments &amp; forms an integral part of a talking web browser for visually challenged</td>
</tr>
<tr>
<td>10.</td>
<td>AIIMS, New Delhi</td>
<td>A replicable model for IT based health system at grass root level (Ca:sh)</td>
<td>Digital updation of data at PHCs &amp; CHCs, Enables automated generation of work plan, management of childhood diseases and other applications on handheld devices</td>
</tr>
<tr>
<td>11.</td>
<td>IIT, Delhi</td>
<td>Zero Configuration wireless mesh network (802.11b)</td>
<td>Disaster mitigation &amp; management</td>
</tr>
<tr>
<td>12.</td>
<td>Byrraju Foundation</td>
<td>32 Ashwinwi centers in 84 villages of Andhra Pradesh</td>
<td>Specialist consultation health education and promotion and continuous medical education</td>
</tr>
</tbody>
</table>

### Research and Development

Though telemedicine application projects have been undertaken in many states in the country, research and development has not grown in that proportion. Research projects completed/under development till date are summarized in Table 3.

![Fig. 2. Courtesy: Dept. of Information Technology, Govt. of India.](image)

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**Table 3.** Summary of telemedicine projects completed/under development till date in India.
Policy Issues and Standardization

To standardize services of different Telemedicine centers, a document "Recommended Guidelines & Standards for Practice of Telemedicine in India", has been prepared by DIT which is aimed at enhancing interoperability among the various Telemedicine systems being set-up in the country (Fig 2). These standards will assist the DIT, state governments and healthcare providers in planning and implementation of operational telemedicine networks. To establish a telemedicine center, a standard should be set for the telemedicine system, software, connectivity, data exchange, security and privacy issue etc. Guidelines should be made to conduct the telemedicine interaction.

Capacity Building

Apollo telemedicine network foundation in collaboration with Anna University, Chennai has started a 15 day certificate course in Telehealth Technology which is a blend of technical, medical and managerial skills. SGPGIMS, Lucknow in collaboration with the State and Central Governments and the Ministry of Information Technology has taken up the initiative to set up a School of Telemedicine and e-health on its campus. This 2500 sq. metre building will house different laboratories in the field of e-health such as Telemedicine, Hospital Information System, Biomedical informatics, Medical multimedia and image management, Medical Knowledge Management, Artificial Intelligence, Virtual Reality and Robotics. The objectives of the school are: the creation of various resource facilities and a structured training programme, research and development, providing consultancy to government and private healthcare organizations as well as collaboration with technological and medical universities in the country and abroad. It is expected to function in the year 2006. Currently SGPGIMS is providing training in networking, technical, managerial aspects and application of telemedicine to man power involved in Orissa and Uttaranchal telemedicine projects.

Table 4. Scientific Meetings & Workshops in the Field of Telemedicine Held in India

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Name</th>
<th>Year</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Technology driving healthcare forward in the developing countries</td>
<td>23rd – 25th August, 2002</td>
<td>Medical Computer Society of India, Sri Ramchandra Medical College &amp; Research Institute, Chennai</td>
</tr>
<tr>
<td>3.</td>
<td>First Annual Conference of Telemedicine Society of India</td>
<td>22nd – 24th November 2002</td>
<td>SGPGIMS, Lucknow</td>
</tr>
<tr>
<td>4.</td>
<td>ISRO Telemedicine Users Meet</td>
<td>April, 2003</td>
<td>Bangalore</td>
</tr>
<tr>
<td>5.</td>
<td>Annual Conference of Indian Medical Informatics Association</td>
<td>October, 2003</td>
<td>PGIMER, Chandigarh</td>
</tr>
<tr>
<td>6.</td>
<td>ISRO Telemedicine Users Meet</td>
<td>November, 2003</td>
<td>Ahmedabad</td>
</tr>
<tr>
<td>7.</td>
<td>2nd Asia Pacific Telecommunity</td>
<td>25th – 26th February 2004</td>
<td>SGPGIMS, Lucknow at New Delhi</td>
</tr>
<tr>
<td>8.</td>
<td>ISRO Telemedicine Users Meet</td>
<td>February, 2004</td>
<td>Imphal</td>
</tr>
<tr>
<td>10.</td>
<td>CME on &quot;Tele-ophthalmology&quot;</td>
<td>6th August</td>
<td>Mysore Ophthalmologist Association, Mysore</td>
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<td>11.</td>
<td>CME on Telemedicine &amp; Telepathology, &quot;Today &amp; Tomorrow&quot;</td>
<td>7th – 8th August</td>
<td>HM Patel center for Medical care &amp; Education, Karamsad, Anand, Gujarat</td>
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<td>12.</td>
<td>International conference on Medical Informatics &amp; telemedicine</td>
<td>10th – 11th December 2004</td>
<td>Medical Computer Society of India, NIMHANS Bangalore</td>
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Current status of telemedicine & eHealth in India

National Task Force on Telemedicine

In the later part of the year 2005 Ministry of Health, Govt. of India has constituted a National Task Force on Telemedicine. The group has met once in the month of October and formed various working groups to work out various issues related to telemedicine in the national context.

Tele-health Industry operating in India

Technically India is now self sufficient in meeting the need of hardware, software, connectivity and services. Industries providing hardware and software supports are Apollo Telemedicine Network Foundation,32 Hyderabad; Online Telemedicine Research Institute, 33 Ahmedabad; Televital India,34 Bangalore, Vepro India, 35 Chennai and Centre for Development of Advanced Computing.36 Telemedicine technology is getting familiar with healthcare providers in India. Some states have started adopting it but most of the applications are in project modes. It will take quite some time for the diffusion of this technology into a health delivery system. Technically the country has all the resources to face the need of the users. Broadband connectivity is widely available and the cost is coming down fast.

Conclusion

This technology is used for tele-health care and distant medical education by linking some of the medical colleges and district hospitals in remote areas. Most of the telemedicine projects are driven by the doctors and the success is entirely dependant on human rather than technical factors. Awareness among patients and health administrators is essential to accept this emerging technology as a facilitator for the quality healthcare delivery in remote areas. There is a need to address policy issues like standardization, legal, ethical and social factors besides developing revenue models and creating infrastructure for meeting the need of training manpower and carrying out research and development. Though start-up projects are successful, models should be developed to sustain and integrate them into the health delivery system. Telemedicine has an immense scope and great potential for a country like India which has a disparity of resources and maldistribution of manpower between the rural and urban areas. E-health application module through e-governance stream needs to be worked out uniformly for the whole country; hence, coordination with National Task Force is essential.

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Telemedicine in Ireland: Policy and Applications

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Abstract
The monograph is prepared at a time of significant structural reform in the Irish health system. It addresses the status and advances in telemedicine in Ireland from the dual approach of (a) reviewing the main relevant health policy and strategic level developments over the past five to seven years and (b) identifying the level and variety of telemedicine applications on the ground.

The findings show a high volume of health policy and strategy documentation, but an inconsistent inadequate policy treatment of telemedicine in the various health agency service planning and in strategic reports, such as, on primary care and mental health. In attempting to rectify this position the government commissioned a strategy report on telemedicine and telecare which was completed in 2005. Action on it is awaited. On the application side, a rich variety of telehealth activities, mainly at early or piloting stage of development were uncovered. Some twenty outline descriptions of the activities, some very innovative, are provided under the categories of clinical, pre-clinical and research, tele-educational and special telemedicine services initiatives.

The discussion highlights positive early evaluations and the resonance with similar international experiences, the use and features of models of the telemedicine service development process and the important of a guiding framework of service development. Some concluding observations include, the positive patient response to the telemedicine service experience, the need to integrate telemedicine into all strategic planning for health services, the possible acceleration of service development through a Telemedicine Innovation Fund and a core message on the urgent agenda – transform and perform!

Key words: Telemedicine, Telehealth, Health Policy, Applications, Ireland.

Introduction
This monograph is prepared at a time of significant structural reform of the Irish health system. It is widely acknowledged that the performance of the Irish healthcare system over the last decade or more has not matched the rising expectations of Irish citizens, particularly patients. Overcrowded Accident & Emergency (A&E) Depts., patients on trolleys, long waiting times and lists, lack of modern facilities and treatment overseas, are some of the symptoms of a sector whose urgent agenda reads – perform!

This challenge is notably happening against a backdrop of national economic success and unprecedented international technological change, particularly within information and communication technologies (ICT) that enable health telematics and telemedicine. While mainstream information technologies look to provide ehealth solutions, the question is: where is telemedicine as an emerging service option on urgent agenda?
The terms telehealthcare, telehealth, telemedicine, and telecare are defined elsewhere in greater detail\textsuperscript{1,2,3} but for this profile they are treated as interchangeable generic terms to describe the use of telecommunications to deliver healthcare services at a distance. It is not new; as it was practiced over telegraph, radio and in more recently times over telephony. The focus here is on advanced digital telecommunications networks and of applications that go beyond the use of traditional telephony. Services can be categorized in the broad terms of the activities in the health sector, such as, clinical, laboratory, educational, research, technical and administrative services.

The primary objective of this monograph is to provide a brief overview of the advances in telemedicine in Ireland by examining activities (i) at the national policy and strategic level and (ii) at the operational service level and providing illustrative examples of Irish telemedicine applications. The secondary objective is to contribute to the broader exchange of information on advances in telemedicine.

The context of Republic of Ireland is that of a small nation in western Europe, a member of the European Union, with a population of some four million, of which one million live in Dublin the capital city and 40% live rural\textsuperscript{4}.

The current Section – Introduction, serves to set the objectives and the background to the paper. The Section -Method and Materials, outlines the process involved. The Section -Results, states the findings and the Section -Discussion, reviews the findings.

\textbf{Materials and Methods}

The report relies on: (i) literature research for the discovery of relevant published material and (ii) on direct telephone and email with health organisations and various clinical, administrative and technical contacts, to identify studies, surveys, projects, services and health policy and strategy activities. The findings were not expected to be treatable in a uniform and rigorous scientific manner given the diverse nature of the enquiry. The twin focus on policy and applications is perceived as yielding important evidence of the top-down and bottom-up components in the cycle of progression. The findings provide a basis for commentary and serve to promote awareness of the status and advances in telemedicine in Ireland.

The aim was to report in an adequate manner, yet real constraints existed, so no claim to being fully comprehensive is made. Again, it was a conscious decision to exclude the several EU healthcare research projects with Irish involvement, conducted under the different European Community Framework Programmes of research and technical development that are well documented elsewhere. They are nevertheless additional activities of significance to the Irish health system which can stimulate new thinking and lever catalytic action.

\textbf{Results}

The results are presented below in Section Telemedicine Policy and in Section Telemedicine Applications.

\textbf{Telemedicine Policy}

The process of reviewing the health system over the past 5–10 years has led to the generation of a significant volume of documentation of a policy or strategic nature. Nevertheless, the evidence is that both the recognition and policy treatment of telehealthcare, telemedicine and/or telecare is inconsistent and patchy at best.

Telemedicine is entirely absent from some key reports, such as, primary care strategy. It features in limited segments of other vertical sectors, such as, mental health policy. Disappointingly, within the key horizontal activity of ICT strategy and action plans its treatment is surprisingly inconsistent, if not absent. Encouragingly, the results show that in the last 2–3 years the focus on telemedicine is sharpening with the completion of (a) a first dedicated report specifically on "telemedicine and telecare strategy" for government and (b) evaluative research of emerging telemedicine services and the policy context.

By way of the actual references found to be relevant to the health policy and telemedicine, the sources are listed under the following sub-headings:
1) The Irish Government’s socio-economic National Development Plan 2000–2006 was published in 1999. It briefly recognises the potential role of telemedicine – to deliver services at the most appropriate locations, to access various centres of excellence with their professional expertise and to share diagnostic imaging and laboratory data.  

2) The current Irish health services policy document of 2001 entitled, “Quality and Fairness: A Health System for You. Health Strategy” approved by Government and published by the Department of Health & Children. It contains five references to telemedicine which, inter alia, recognise “telecare and telemedicine has the potential to bring specialised diagnostic and clinical expertise closer to people, especially those in remote locations, making the health service more accessible and responsive”. ICT policy was stated as falling largely into the remit of the pending Nation Health Information Strategy, which would frame the best use of such technologies. Crucially, a new statutory agency the Health Information & Quality Authority (HIQA) would have a central role in implementing the Information Strategy.


5) In 2004 the Dept of Health & Children also published the delayed “Health Information: A National Strategy”. Chapter 14 is entitled “Information and Communications Technology”. It briefly recognises the potential of telemedicine. Its Action Plan (Chapter 17) was to deal inter alia with “telehealth solutions”. This it fails to do.

6) To assist the above transition to HSE the Health Boards Executive (HeBe) developed and published in 2004 a strategic ICT report on “Embedding the ‘e’ in Health: A Strategic Framework for the Irish Health System”. It however makes no explicit mention of telemedicine, although various regional Health Boards had been incorporating telemedicine in their and prior services plans and supportive ICT strategies. Indeed the Southern Board articulated a strong integrated ICT strategic vision, for which it won a Public Service Excellence Award in 2004 in Ireland. In addition it had in 2001 been the first healthcare agency in Europe to receive the eGovernment Award for “Best Practice and Recognized Excellence in eService Delivery” in Brussels.

7) The Dept of Health & Children and HeBe commissioned a Steering Committee and Project Group to undertake a "Telemedicine & Telecare Strategy" Report which was completed in October 2005. The main purpose of the study was to put telemedicine and telecare firmly "on-the-map" for those charged with the modernization of the health services. It recommended a composite strategy of eight strands be adopted to advance telemedicine and telecare, namely; (1) a formal administrative framework (2) central telemedicine support infrastructure (3) virtual national medical services (4) undergraduate & post-graduate education (5) proactive support for enthusiasts (6) seeking its application to amenable priority services (7) awareness and promotion and (8) develop a legal framework. This has as yet to be acted upon and incorporated into strategy and action plans for services and ICT.

8) Researchers at the Department of General Practice, National University of Ireland, Galway, published two directly relevant studies; (a) an evaluation of five early stage telehealthcare services in the western and northwestern regions (2004) and (b) an assessment of the evolving policy context for telemedicine services (2006) based on resonance of the Irish data with international experiences using a model for service normalisation. The studies are believed to be the first evaluative studies conducted in Ireland. Both outcomes were very supported of building the momentum behind telemedicine and identified the key policy issue of nurturing "enthusiasts", namely, the essential leadership by clinical and technical innovators.

9) A number of individual Ministerial and Government statements all supportive of telemedicine were uncovered from public events, such as, announcements on the All-Ireland Cancer Consortium, the Children for Children Fund and the British-Irish Council Summit, that focused on telemedicine in May 2005.
10) The 2001 Primary Care Strategic Report "Primary Care: A New Direction". An ICT strategy assignment to underpin primary care was commissioned in mid 2004. The ICT Strategy and Action Plan for this primary community and continuity care initiative, published a Phase 1 report "Outcome from Workshops" in early 2005 with ICT Implementation priorities. It contains no mention of telemedicine.

11) The 2006 Mental Health Policy report "A vision for Change". The only direct mention of telemedicine is in relation to a single sub-area of neuropsychiatry services. It recommended that facilities for video-conferencing and telemedicine should be considered, to extend the multi-disciplinary expertise, located in the two major neuropsychiatry centres in Dublin and Cork to enable them to become a consultation and training resource.

Telemedicine applications

The results of research into the status of telemedicine applications found four main sources of information on telemedicine activities in the Irish health system. Additional applications were uncovered in this review.

1) A national audit of telemedicine projects was conducted by the Health Board Executive (HeBe) a co-ordinating body for the Health Boards in the 2003–2004 period. Replies from the regional entities and seven major hospitals listed some 57 entries. The results of the audit have been taken into account in the strategy report to DoHC.

2) A national survey to assess the use of telemedicine was undertaken of 187 hospitals – as part of the ongoing development of oncology services. Activities were reported in 40 hospitals of 157 (84%) hospitals replied. The main applications in the 40 hospitals were (i) tele-radiology 53% (ii) tele-conferencing (video-conferencing) 30%, (iii) tele-pathology (13%) and paediatrics (13%).

3) A presentation given to the American Society for Telehealth Providers in 2002 listed an inventory of activities.

4) An evaluative study of two western regions of the country, but did not purport to cover the national scene. However, five of the eleven services listed were found to be dormant at the time of its analysis.

However, taking the above into consideration as well as additional applications, it was not possible to readily synthesis the findings into a single coherent list. For example, the different entities naturally list the same shared telemedicine service in which they each participate. Thus tele-radiology, co-ordinated by Beaumont Hospital links with 19 hospitals and would then appears in a number of hospital returns. It could be classified as 20 services or as one. Again, the same systems and networks could be used for multiple applications. Some applications were at different stages of development or dormant or abandoned. Again, the major initiative of the Children for Children and Adult Care Foundation which installed telemedicine systems in every paediatric ward and maternity hospital through 2005, added considerable momentum if uncertainty to a coherent set of statistics.

In the absence of an established system of nomenclature for telemedicine, an appreciation of the current level and breadth of activities is offered by way of representative examples of the different telemedicine applications uncovered. They are outlined under the headings of (1) Clinical (2) Pre-Clinical & Research (3) Tele-Educational and (4) Special services.

Clinical Services

1) Tele-Radiology

This is the largest established telemedicine service in Ireland. As an emergency neurosurgical tele-radiology system it was initially installed in the mid 1990’s in two referring hospitals to transmit images to the neurosurgical department in Cork. Beaumont Hospital in Dublin is now the National Centre for Neuroscience. Its Neurology Department provides the national teleradiology service to 19 hospitals. The service enables distance clinicians to transfer CT scans and obtain second opinion from consultant staff at the Centre.

2) Tele-Cardiology

The Crest Directorate, St James Hospital, a major tertiary hospital in Dublin, links with the Consultant Cardiologist, Sligo General Hospital, for tele-consultations on digital angiograms of heart patients. Audio-conferencing with data-conferencing is involved. The batch of pa-
Patient data is transmitted prior to each consultation. Synchronized playing of the patient’s digital angiograms on workstations at both locations was identified as the key initial need in 2001 for successful conferencing. The innovative system was developed and was implemented during 2003.

In the first year some 438 diagnostic angiograms were performed at SGH and 185 images transferred for cardiothoracic conferencing, 70% within 24 hours of their angiogram. The service has received high degrees of satisfaction from patients and clinicians leading to better and quicker clinical decisions, reduced waiting times, shorten hospital stays and less travel.\textsuperscript{28}

The service continues and its wider national roll-out is progressing through 2006 to Tullamore hospital and other regional hospitals.

3) Tele-Oncology
Linking of the Medical Oncology team at Sligo General Hospital (SGH) in the northwest of Ireland commenced in 2002 to expedite patient cases on a Multi-Disciplinary Team meetings (MDT) basis with specialists in St. Luke’s and St. Vincent’s University Hospitals (SVUH). Multi-site conferencing with General Hospitals in Letterkenny and Mullingar followed as multi-point bridging permitted. The results of the first 35 patient cases under MDT format after an 18-month period confirmed the potential benefits of telemedicine were being realised.\textsuperscript{29,30}

4) Tele-Clinics: PrimaryCare-Surgical
Killybegs Community Hospital (40 beds) in the northwest of Ireland. From its Telehealth Unit regular video-consultations are carried out between (a) patients and the primary care team and (b) a general surgeon in Letterkenny hospital some 75 Km away. In reviewing the first 60 patients, benefited 90% from avoiding travel, reduced waiting times and faster decision-making. The G.P.’s and primary care liked it as they could speak direct to the specialist. There is potential to apply this model on a national basis to community hospitals for delivering telehealthcare services.\textsuperscript{31}

5) Tele-Pallative Care
Weekly video-based case-conferencing takes place between the palliative care consultant, at a HSE run hospice in Letterkenny, Co. Donegal and the nursing care support team members throughout the county.

6) National Healthlink Project
The objective of the Healthlink project is to implement a prototype healthcare communications network with specific reference to Primary Care Practitioners and acute Hospital and agency relationships, and data exchange. It is a web-based messaging service which allows the secure transfer of patient information over the internet. The message types available in the Healthlink Online system include:
- Laboratory and Radiology results, Appointment updates and others. They integrate with the practice management systems. It is now backed by 14 hospitals nationwide.\textsuperscript{32}

7) Nurse Conferencing in Clinical Setting
In the northwest region nurses and midwives are currently using webcam-based conferencing for a number of applications in a clinical setting including inter-clinic specialist meetings, document sharing and collaboration, administrative meetings and educational session delivery. It has proved particularly useful for groups within the clinical nurse specialist field and within the managerial team.\textsuperscript{33}

8) Assistive Technology: Service Tele-Rehabitation, Tele-physiotherapy, Tele-Technical Support
The Assistive Technology (AT) service in the north west piloted video-based services regionally and centrally with the Central Remedial Clinic (CRC), Dublin. Services vary from wheelchair seating adjustment and Gait Lab, to tele-physiotherapy and AT support, saving difficult travel for clients with impaired mobility and families. The CRC now offers tele-services to its national centres.

\textbf{Pre-Clinical & Research Services}
1) Tele-Oncology
The high incidence of cancer in Northern Ireland (N.I), the Republic of Ireland (IRL) and in the United States (US) has led to the formation of a tripartite international partnership between the three countries called the Ireland-Northern Ireland-NCI Cancer Consortium.
In 1999, this five year agreement was signed under an inter-government Memorandum of Understanding (MoU). The goals of the consortium are to enhance both cancer research and the quality of patient care on the island of Ireland. It is a collaborative "partnership-in-science" which focuses its work programmes on research, radiation oncology, clinical trials and educational exchanges as well as enabling ICT systems and infrastructure needs. It allows Ireland, north and south, to benefit from CIT and NCI developed leading-edge technologies and world-class expertise in addressing healthcare for cancer and also allows joint collaboration between scientists at all locations.34,35,36

Under the Consortium’s scientific programme, centres are now established in Belfast City Hospital, St Luke’s Hospital, and St James’s Hospital, Dublin. It is anticipated that a new five year MoU will be signed in late 2006 to extend the agreement and add further momentum to the work of the cancer consortium.

2) Tele-Paediatrics: Tele-Rheumatology/Tele-Physiotherapy Pilot Service
In November 2004 the tele-paediatrics video-conferencing applications commenced at national tertiary children’s hospital, Our Lady's Hospital for Sick Children, Dublin and demonstrated its usefulness when a rare case, a five-year old child suffering from dermatomyositis, was presented via the Telehealth Unit at Killybegs Community Hospital, Donegal, located in northwest Ireland. The scope of the presentations included tele-physiotherapy and tele-rheumatology. The case illustrated major benefits of the teledmedicine service: a speedy specialist review of a rare case and the avoidance of arduous long-distance travel by both patients and parents.

3) Tele-Neurophysiology Pilot Service
Clinical Neurophysiology (CN), an underdeveloped specialty in Ireland, illustrates another potential benefit of telemedicine, namely, improved accessibility of services. A study undertaken to determine the needs, expectations and satisfaction with CN services by both patients and referring clinicians, assessed the impediments to access that Tele-neurophysiology might overcome.37 The results of this study made a good case for a tele-service and approval was given in 2006 to commence a six-month pilot Tele-Neurophysiology service.

4) Tele-Emergency Referral Design
A design study of needs for patient Referral services between an outreach A & E Department and three tertiary Emergency Departments services was completed.

Tele-Educational Services
1) Royal Colleges in Ireland – Surgeons (RCSI)/Physicians (RCPI)
The RCSI in its post-graduate teaching programmes, has several established educational applications with video-conferencing involving its teaching hospitals in Dublin, regional locations in Ireland and overseas. Specialist disciplines, such as, radiologists and ENT have also been involved. The Nursing Faculty as well its administrative and overseas educational interests.

The RCPI has recently opened new video-conferencing facilities in Dublin.

2) Research and Educational Foundation (REF)
The Research and Educational Foundation (REF), Sligo General Hospital, has established and has in use since 1996, a video-conferencing facility for lectures, case-conferencing in Orthopaedics (linking with Cappagh Hospital, Dublin), and also in Surgical, Oncology and ENT disciplines (linking with RCSI) as well as for administrative applications.38 Workshops in tele-conferencing have been held for the hospital doctors under their Core Skills Programme.

3) Rehabilitation Counselling M. Sc. Degree Programme
What is believed to have been the first transatlantic Master’s Degree course, combining the use of video and data-conferencing in an innovative teaching model, was conducted over an 18-month period in 1998–1999 between Ireland and the US. The Rehabilitation Counselling degree was operated by the University of Illinois under the auspices of the Tipperary Rural and Business Development Programme, Ireland. Sixteen post-graduate students from throughout Ireland traveled biweekly over eighteen months to Tipperary to complete the degree requirements.39 Another M.Sc. degree course in Rehabilitation Counselling is scheduled to commence in 2007 using the same teaching model.
4) Ophthalmic Post-Graduate Teaching Programme
The Irish College of Ophthalmologists, the recognized training body for ophthalmologists in Ireland, has, in co-ordination with the Eye & Ear Hospital, Dublin, has operated its post-graduate teaching programme of clinical cases and special topics to regional hospitals for the last three academic cycles. The system is based on a pedagogical model that combines dual conferences namely: (i) audio and video-conferencing and (ii) ophthalmic images and text via synchronized displays with collaborative software that preserves the quality of ophthalmic images.40

5) Tele-Hospital-School
Ireland’s first interactive school was opened in Cork University Hospital in 2001. With video-conferencing linkage, a child who is confined to hospital for weeks or months can attend virtually in class and see and talk interactively with his/her teachers and classmates.

Special Services
1) Cooperation and Working Together (CAWT):
Tele-Neurology: Tele-Learning: Tele-Nephrology
Cooperation and Working Together (CAWT), a cross border body, formed in 1992 between the North Eastern and North Western Health Boards in the Republic of Ireland (known as the Health Service Executive as of 1 Jan 2005) and the Southern and Western Health and Social Services Boards in Northern Ireland, agreed to cooperate in an EU-supported programme with a view to improving the health and social well-being of their combined resident populations of over 1 million people.
The CAWT Business Plan 2002–2006 states "Problems of isolation, peripherality and rura-

lity are endemic in the CAWT region. Videoconferencing, teleconferencing and e-mail are

technologies now widely available, which can often provide a solution to such issues",41

A network of 10 video-conferencing sites in hospitals and centres on both side of the Border

has been established. The various health supported applications include:
a) Nine outreach Tele-Neurology Centres across N.I. are linked by video-conferencing to special-

list consultations on patients suffering from strokes, epilepsy and severe headaches in
the Royal Victoria Hospital, Belfast
b) Tele-education through the Dental Outreach Skills Centre in Strabane N.I. where region-
al dentists taking mandatory continuous professional development (CPD) requirements
from both jurisdictions participate thereby saving much time and travel.
c) Nephrology Network launched May 2006 to improve the quality of care at three N.I. sites and three sites in the Republic for 360 haemodialysis patients with data on a single unified information system.

2) Tele-Paediatrics: Children for Children and Adult Care Foundation
Tele-haemology: Tele-oncology: Tele-cardiology and Tele-educational
In early 2006 the founders of the Children for Children and Adult Care Foundation were honoured for donating telemedicine units to 42 hospitals in the north and south of Ireland. This included all hospitals with Paediatric and Maternity Units.42,43
Similar units had been successfully used for several years in St Jude’s Hospital, Memphis TN, USA and special transatlantic links exist between that hospital and Our Lady’s Hospital for Sick Children (OLHSC) Dublin. Tele-haemology, tele-oncology and tele-educational are prominent in the priority applications.
OLHSC with new video-conference room facility and a roll-about unit now participates in weekly multi-site lectures from St Jude’s, regular tele-cardiology case conferencing with Royal Victoria Hospital Belfast and monthly gastrointestinal pathology tele-consultations with Altnagalvin Hospital, Derry, N.I. Also the administration employs the video-conferencing facilities for the overseas recruitment of priority healthcare personnel.

3) Telemedicine Projects: Vodafone Foundation Ireland
The Vodafone Foundation is sponsoring two services (a) a tele-cardiology emergency service with West of Ireland Cardiology Foundation (Croí). The patient’s ECG data is transmitted from the ambulance via mobile telecommunications to the hospital emergency team in advance of the patient arrival and (b) an innovative text messaging service with the Irish Blood Transfusion Board sponsoring 500,000 messaging in a year to prompt registered donors to attend their local Donor Days.
Discussion

The results confirm that at the policy level, the awareness of the strategic potential of telemedicine was a largely defective and intermittent in the last 5–7 year period. The commissioning of the Telemedicine and Telecare Report effectively acknowledged this fact and sought to remedy it. Its purpose was 'to put telemedicine and telecare on the map'. While the diagnosis has been late, the remedy is still lacking. A mature policy prescription and implementation is now required.

In the absence of a formally enacted NIIQA, the active integration of the telemedicine dimension into DoHC policy-making and HSE strategies in particular, would be beneficial in compensating for the prior underdevelopment of formal telemedicine services. The scholarly evaluative policy research of NUI Galway certainly adds value and weight to the process by building from the evidence-base of innovative pilot services. Its cautionary note of limited sample size is appropriate. Actively promoting new innovative services is essential. One agrees on the identified need for competent "enthusiasts" to champion service development.

To realize sustainable professional national services there will generally be the need for a more rigorous path from piloting, patient consent and technical improvements to evidence-base protocol developments, re-skilling and evaluation. The exact phased model adopted will most likely vary and be dependent on the particular service context. A noteworthy consideration in this regard is the four phase model for successful telemedicine system design from which the NCI and CIT technology suite for the Cancer Consortium was derived. It is a good departure point for appreciating how the uncertainty of technical solutions for the clinical environments is progressively reduced. The Consortium’s core technologies are built on a rich base of telemedicine research outcomes in collaborative working environments. Again, meeting the needs of mainstream day-to-day clinical oncology services, –as against research services -would most likely include a value-for-money dimension.

At a generic service level the Canadian framework of guidelines for their national telehealth programme is a comprehensive guide for procedures and standards. Again, specific telehealth practice recommendations for diabetic retinopathy were developed by the Telehealth Ocular Group of the American Telemedicine Association to guide that service. Such groundwork can ensure that with telemedicine the quality of care will be equaled if not enhanced.

The challenge for the health services in an age of unprecedented technological changes for healthcare is to establish a culture that reinforces innovative leadership and strengthens service champions for better patient outcomes. To compensate for delays and to accelerate delivery of the recommendations of the telemedicine strategy report, one policy measure could be the establishment of a Telemedicine Innovation Fund for projects. Awards could be on the basis of competitive proposals to selectively seed new service concepts and take existing pilots to the next level in priority area needs and stated strategic plans. Perhaps the unique Telehealth Unit in a small dedicated facility in Killybegs Community Hospital could be replicated onto a larger scale where local leadership exists to realize its use and give value for money. The background evidence from applications is that suitable shared professional conferencing rooms and equipment facilities with adequate broadband connectivity for (i) diverse clinical services (ii) multi-purpose education and training applications and (iii) administrative meetings and interviews, do not exist in most hospitals.

It would also appear timely to apply the potential of telemedicine applications to the context of Primary Care Strategy. In turn this can translate into practical timely targets for primary care clinics adopting and equipping for home monitoring, ECG and video-consultations. Again, the Mental Health Policy is a similar case in point.

The results also confirm growing numbers of applications. The examples provided confirm a surprisingly wide variety of applications of telehealthcare services. In addition the growth rate has significantly increased in the last two years. Further, the very rapid growth in recent years of private health centres, clinics and hospitals will undoubtedly see further telemedicine applications in appropriate services where such investments are financially attractive to service both domestic and overseas markets.

While telemedicine services are not a panacea for all situations, achieving both a maturity in strategic thinking and actions and maintaining a high quality clinical care as applications progress are twin key considerations. From the perspective of advancing telemedicine services
towards mainstream sustainability, it is held that a mix of perspectives of top-down strategies and bottom-up applications inter-works to enrich the understanding of both perspectives.

In conclusion, the following observations on the advances in telemedicine in Ireland are offered:

1. Irish evaluative studies support that most patients find telemedicine services acceptable. This is very much in line with international experiences. They want more! That’s the good news. In a stated policy era of patient-centric services that should also be good news!

2. While Ireland may be late among nations in coming to the telemedicine table on a large scale, it now has in motion an increasing array of early stage applications.

3. The policy response to Strategy for Telemedicine and Telecare report needs to be firm and bold to place telemedicine on the map -indeed onto the international menu of world-class health services..

4. Telemedicine now needs to be comprehensively integrated into (a) the national health service plans (b) horizontal ICT strategy and action plans, particularly in crises and priority areas, such as, A&E, and better access to under-served communities, (c) vertical segments, such as, mental health and primary care and associated action targets ex. Home monitoring for 25% of appropriate patients in 24 months and (d) into all future policy formulations for specialist services.

5. Innovative telemedicine service development would benefit from dedicated funding, such as, a competitive Telemedicine Innovation Fund, targeted to the priority health services and goals, professional quality shared telehealth facilities and to supporting local clinical and technical leadership and service champions.

6. The real implications of widespread, advanced and rapidly changing ICT technologies on the health services on a strategic timeframe, is probably going to be more radical and disruptive than articulated above.

The refreshed urgent agenda reads-transform and perform!

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E-health and Telemedicine in Italy

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Abstract

This paper describes (even in a not complete manner) a general situation of ICT applications in medicine and health care in Italy.

A description of different application fields of e-health and telemedicine (telecardiology and telecare, teleradiology, telepathology, Health Networks and web based systems), together with a brief list (not exhaustive) of projects, services and products utilized in this technological sector are drawn up.

The main part of this paper regards some case studies relating teledmedicine and telecare aspects and systems based on web services (portals). Moreover an experience about smart card applications (in particular into the Social Health Information System of Lombardia Region) is analyzed.

Key words: e-Health, Telemedicine, Homecare, Web Portal, Health Cards

Introduction

E-Health and Telemedicine use ICT (Information and Communication Technologies) in health care and medicine in order to acquire, manage, process and transmit data and to deliver medical services, often over great distances.

In general e-Health regards electronic applications to the whole field of health sector, by means of intelligent and connected data systems in different activities (medical record design, clinical/epidemiological data base management, hospital/health information systems architecture, teleconsulting/telediagnosis process, etc.).

So e-Health includes medical information systems, public health surveillance, e-learning for health professionals, telehomecare and telemedicine. Telemedicine and e-Health services have captured the attention of the medical community and of the health authorities as a tool to improve the access to quality assistance and also to reduce the costs.

Telemedicine, as sub-field of e-Health, is the interactive transmission of clinical data, signals and biomedical images, in order to enable patients, living in remote locations, to receive the best possible care delivery and services.

Telemedicine can be distinguished from telehealth, in the sense that the last is the provision of health administrative services (booking medical visits, health ticket payment, receiving lab test results, etc.) to users who are at a distance and are not necessarily ill or wounded. The common element in these different aspects is the use of telecommunications to deliver health-care services to persons wherever they are located (telemedicine and telehealth can be considered as part of e-health).
In Italy many hospitals and regional health authorities had proposed and developed several projects of e-health and telemedicine fields. The diffusion of integrated health/hospitals information systems, of the electronic patient’s record, health smart cards and systems and services of telemedicine and telecare have been improved in different areas, even if not in the whole national territory. Many projects and applications on e-health and telemedicine in Italy are improving and they are supported in the frame of Regional, National and European Health Programs.

In Italy the development of e-health and telemedicine followed the development of ICT. In the last 70 years, from when in 1935 the CIRM (International Centre of Medical Radio) has been created (the CIRM first President has been the Nobel Prize Guglielmo Marconi that in 1901 discovered wireless telecommunications), and telecommunication systems have been used in health emergency. CIRM initially operated for medical assistance on ships and after the II World War extended the service to medical assistance on airplanes and on small islands. More recently, in 1970 and 1980, several projects and products of medical informatics and telemedicine have been developed in the frame of Finalized Programs of the National Council of Research (Parallel Computing and Expert Systems and Epidemiological Diseases Risk Factors). In 1991 the Ministry of Research financed (50 million of Euros) a big program (TELEMED) that for 10 years represented a focal point for several applications in radiological teleconsulting, telecardiology, network of excellence Hospitals (oncology, neurology, etc.), teltraining, etc. The main results of the TELEMED program have been some prototypal platforms in radiological, cardiological and oncological fields and implementation of Hospital Information Systems Networking.

Since a few years the Italian Health System is entirely decentralized and the health policy and management are now under the government of Regions. The Italian health care system presents two peculiarities: it’s mainly public and it’s strongly decentralized on the base of regional territories (22 different regional authorities for programming and management of medical and care services). The Regional Authorities have started different projects and applications in health informatics and telemedicine, involving their hospitals, ambulatories of health districts and GPs. The development of health informatics and telemedicine systems in Italy needs to have an efficient regional and national information systems and to build a network backbone with high band width, in order to get more speed and high quality of data and images during teleconsulting/telediagnosis applications (from regional level to national level now a new Italian Health Information System is in developing phase). It’s necessary to consider these aspects for improving e-health and creating concrete national and regional services on telemedicine.

In these last years, the @ITIM – Italian Association on Telemedicine and Medical Informatics has had a proposing role to improve the cooperation and the diffusion of medical informatics and telemedicine culture and application, in the whole Italian Health System.

Fields and medical specialities

Some Technical Aspects

Now, even in Italy there is a strong issue (at national and regional level) in order to grow up e-health and telemedicine applications and to renovate hospital information systems and their subsystems as RIS (Radiological Information System), LIS (Laboratory Information System), CIS (Clinical Information System), ADT (Admission Discharge Transfer), etc. and also administrative information subsystems of health activities (like patient visits booking, prescriptions, e-procurement, etc.).

Moreover intra/extranet in healthcare, integrated and networked regional information systems (between hospital, health districts, GPs and the patient at home) are now developed. In many regions and health districts a lot of attention is devoted to the development of PACS (Picture Archiving Communication System) for large areas in order to store and transmit biomedical images (Echo, TC, MRI, etc.) useful for supporting the medical diagnostic process.

That also requires standards in e-health and Telemedicine, very important and useful for the HIS in order to favour real interoperability between different databases, programs languages, developing tools etc. (so new applications can be add to the system without changing any software). The diffusion, also in Italy, of HL7 (Health Level 7) studied, developed with the aim to exchange electronic data between health structures and different health/hospitals information systems, is becoming a reality.
For images processing and transferring the DICOM (Digital Imaging and Communications in Medicine) the standard now is to conform to the seven-layer International Organization for Standards (ISO) – Open Systems Interconnection (OSI) reference model for communication services, a model widely used in the communication industry.

Diffusion of Internet also in healthcare systems makes it necessary to manage medical records using new tools for database in web environment. With the use of SGML (Standardized General Markup Language – standard ISO) and XML (eXtensible Markup Language) it is possible now to solve this problem, making a standardization of the information exchanged and not of the data format. XML can favour diffusion of medical records into telemedicine services, using Internet infrastructure.

Web based systems now provide a universal means of research and consultation of clinical data also of multimedia type and web portals and web services represent the future in health care circles, offering a wide range of medical news, clinical guidelines, medical directories, protocols of care and e-commerce applications. The diffusion of Internet based systems makes telemedicine at home possible. In order to facilitate that, in the health telematics market different products that combine fixed, mobile and wi-fi telecommunications and medical diagnostics and monitoring devices exist today. Some Telecommunications providers look to this sector in healthcare (i.e. British Telecom created a Health Mobil Forum and in Italy there is a strong interest of Telecom Italia and other italian ICT companies).

The main application areas of telemedicine systems are telecardiology, teleradiology, telepathology and telehomecare. (There are other specialties that use telemedicine services, as teledermatology, teleoftalmology, telesurgery, telepsychiatry etc., but these are of poor applications at the moment).

Telecardiology and Tele-Care

It is the oldest telemedicine application field, thanks to the transmission of ECG signals by means of normal telephone lines (using a simple modem and appropriate devices).

By means of telecardiological systems it is possible to carry out either telediagnosis/telesurveillance of a patient (in particular in emergency care or also in case of monitoring of medical parameters of patients with chronic diseases).

Tele-Home Care allows offering medical assistance to the patients directly to their home, using television sets, interactive instruments (for measuring and checking vital parameters) as well as video-conference systems, particularly suitable for communication and action in real time.

Tele-Home Care may improve the quality of life of those patients needing periodical health checkups, avoiding uncomfortable and repetitive hospital transfers of the patient.

The ageing of the population poses significant economic, social and health-care challenges. The elder age is characterized by high incidence of chronic multi-pathologies and disabilities, such as diabetes, hypertension, heart disease, chronic respiratory failure, asthma and neurological disease as Alzheimer or Parkinson. However, such diseases can be managed away from the hospital at home: home-care and community based health service are becoming an increasingly important part of the healthcare services, allowing the so called "Continuity of care".

Teleradiology

Radiology is one of the fields where telemedicine has been more developed. (Teleradiology is the most widely used telemedicine service at present). Radiographs converted in digital format or digitalized images are transmitted in order to have a medical report (useful when there is lack of local expertise and it is necessary to avoid moving experts who have to read the images).

Different types of images produced and transferred in radiology departments include: conventional X-rays and Computerized Tomography (CT) images, Magnetic Resonance Imaging (MRI), ultrasound images, images from nuclear medicine scans, and from thermography, fluoroscopy and angiography. Each of these modalities can produce an anatomical or functional image of the patient; for example, the diffusion of neuroradiology, thoracic radiology etc, so that the emergency medicine, are a suitable application field for teleradiology.

The first step in the radiology process is capturing the images for interpretation and a radiological workstation must acquire all images from the connected modalities automatically.
Once the image is available in digital form, it can be compressed for more efficient storage and/or transmission via telecommunication to a distant location. Using often sophisticated compression techniques, without significant loss of information, makes it possible to transmit radiological images over virtually any communication network.

Today workstations located in a department of Radiology must integrate the RIS (Radiological Information System) and PACS (Pictures Archiving and Communication System). So teleradiology is also growing due to the high requests for diagnostic tests based on medical imaging. In Italy the diffusion of diagnostic system based on medical imaging (thanks to the introduction of PACS in many hospitals) will now permit the development of teleradiology as an important aspect of the healthcare delivery with reduced costs.

Telepathology

Pathology is the medical study of disease related changes in cells and tissue. It covers a very broad range of disease and medical disciplines which makes it impossible for single pathologists to be experts in them all. Pathologists frequently need opinions from those who specialize in particular diseases (hence consultations are an important part of the practice in pathology).

Telepathology is the practice of pathology at a distance. The pathologist sees images of tissue on a monitor rather then viewing the tissue specimen directly at a microscope. Telepathology can be used for obtaining a second opinion or a primary diagnosis. Telepathology has been especially useful in the support of isolated and non-specialty pathologists. A telepathology system consists of a high resolution video camera mounted on a microscope to capture images of pathologic specimens, a telecommunication set up to transmit images to the remote site. A telepathology workstation consists of a computer with a graphic card, a color monitor and software to manage images.

Telepathology has two major branches: static and dynamic (recently, a hybrid system has been introduced which incorporates both static and dynamic imaging).

“Static Telepathology” is focused on single frame, "persistent" images that can be stored and shared on a server (static imaging has also been shown to be useful in telepathology, especially when time zone differences, costs and limited bandwidth make dynamic systems impractical). Static imaging has also been used for image documentation, high quality image production, as input to image analysis programs and as an educational tool.

"Dynamic Telepathology" is focused on real time interaction through a video feed from a microscope mounted camera and (optionally) providing robotic control of the camera, microscope and stage. The diagnostic capability of this approach proved, in large clinical studies, to rival direct examination of the glass slide through a microscope.

Telepathology is used not only for remote diagnosis but also for education especially in a country poor of library.

Telepathology is more often used in rich countries with few pathologists (i.e. Japan, Sweden, Norway) and, when they can buy the instruments, in poor countries where often pathologists are few or completely absent. In Italy telepathology, in general, has seen limited use and has not become a standard tool for pathology practice because the presence of relatively many pathologists and because the computer practice is not so diffused between the pathologists.

Some applications and projects

The list of e-Health and Telemedicine applications (projects, systems, services, etc.) in the Italian contest is very long. Some examples (not described later as case studies) are:

- TELECARE IN RESPIRATORY DISEASES (INRCA of Casatenovo – Lombardia Region): service delivered in order to monitor at home patients affected by respiratory insufficiency and mechanically ventilated (many of these patients are affected by Amyotrophic);
- TELEMATIC CARDIOLOGICAL AMBULATORY (L. Sacco Hospital, Milan): a network between ambulatories of GPs and Cardiologists;
- TELECONSULTING IN ONCOLOGY BY MEANS INTERNET (Oncogenetic Service, Casa di Cura Pio X, Milan);
- TELECONSULTING FOR SERIOUS NEUROLOGICAL DISEASES (Sicilia Region): network between Neurosurgery Department, Intensive Therapy Dept. and CT Operative Centres;
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- **TELEMEDICINE INRCA** (National Institute of Research and Treatment of the Elderly, Ancona): Telecardiology and telespirometry for home treatment via ECG transmission through the phone, spirometry test at the INRCA, active 24 hours a day, with telephone assistance in case of emergency;

- **M2DM** (Pavia): Multiaccess Services for diabetes management to provide sustainable care to diabetes patients at home and when out of the house. Quality of care will be improved by facilitating communication between patients and caregivers;

- **MEDICATE (EU)**: entails the development of an Internet based care model and associated compliance and aimed at the delivery and timely dispensing of précised medication. The compliance aid is connected to a dedicated control centre to which doctors, pharmacists and a service platform have access, via an Internet based communications network;

- **e-CARE -MEDICAL EXPERT SYSTEM FOR CONTINUITY OF CARE AND HEALTHY LIFESTYLE** (EU – ALDIA, Pavia): Home monitoring for patients with chronic pathologies, those in post-operation state, or those predisposed to the risk of serious pathologies that require constant contact with the doctor;

- **2D/3D TC** (University La Sapienza of Rome): reconstruction and radiological database;

- **RIS/PACS INTEGRATION ON A LARGE HEALTH AREA** (Tuscany Region): teleconsulting and telediagnostics in radiology;

- **WEB BASED REAL TIME SYSTEM FOR HOME MONITORING OF VITAL PARAMETERS IN PAIN THERAPY** (Rome): An operating model for telehome care activities able to support real time actions in pain therapy;

- **TELEMATIC MANAGEMENT OF CARDIOLOGICAL EMERGENCIES/URGENCIES** (Hospital Malpighi – S. Orsola, Bologna): Family physicians and ambulances can link up with the hospital to have clinical data and electrocardiographic signals sent immediately;

- **TELEASSISTANCE OF CHILDREN WITH PERITONEAL DIALYSIS** (Clinical institute, Milan): Home monitoring via internet of a child as he undergoes peritoneal dialysis;

- **TELEMEDICINE ON ISLANDS** (University Federico II, the Polyclinic and Hospital Villalba of Naples and Pozzuoli): Radiological, cardiological or general medicine teleconsultation which links up Ischia and Procida islands;

- **LEONARDO PROJECT** (Puglia Region): Telecardiological system for patients with heart disease;

- **WARD IN HAND** (S. Martino Hospital Genoa): Wireless and PDA system in the HIS;

- **INTEGRATED LABORATORY INFORMATION SYSTEM** (Desio, Vimercate, Monza Hospitals): Integrated software based on Caché DBMS and Ensemble for management of biochemical and microbiological data in laboratory;

- **TELEOCULISTA.NET** (Macchi Hospital, Varese): Web Site and database network on retinopathy and ophthalmology;

- **TELECARDIOLOGY AND TELEMONITORING OF WORKERS OF ENI** (Italian Company of Oil), etc.

**Cases studies**

**Tele-Home Care Vi.T.A. System**

Vi.T.A. (Video Tele-medical Assistance) is based on Aethra audio-video codec, and it is composed of two parts: a control center (at the physician’s location) and one or more clinical data monitoring units (at the patient’s location).

Data acquired by electro medical devices are sent through a Multi Asynchronous Receiver-Transmitter Adapter (M.A.R.T.A.) device and codec from the patient’s side to physician’s side, using Aethra codec data channel. On the physician’s side, all received data are shown on PC monitor using specific software applications for the selected electro-medical devices. At the same time, the physician may interact with the patient through a fully interactive audio-video conference.

The architecture of the tele-home-care system regards full audio-video interaction that is established between a patient and a physician (using ISDN/IP communication line).

The call center is located at the hospital I.N.R.C.A. – National Institute of Research and Cure of Ageing (Ancona) and it’s shown in the following picture together. Aethra Telestethphone (Vi.T.A.) system was indicated as "product of the year" for telemedicine in 2005 by Videoconferencing Insight). (Fig. 1)
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WebCare and T-Care Projects

MS Webcare is an environment that integrates in a common Internet based architecture technologies and tools related to very different areas (telemedicine, biomechanics and multimedia).

The main device used in this telemonitoring system is based on WAD (Wearable Acquisition Device).

WAD is an acquisition device composed of a special shirt housing, a number of sensors connected to a pocket-sized communication unit, which autonomously records and broadcasts data via a number of media (Fig. 2).

In its standard version WAD can monitor the following partners:

- 6-lead ECG or dedicated electrode pad for sport applications;
- respiration via accurate impedentiometric measure or thoracic and abdominal breathing expansion, through resistive bands;
- SpO2 and BPM through finger, ear or forehead pulse-oximeter;
- blood pressure through wrist or arm pressure monitor;
- body and environmental temperature;
- 3-axial acceleration/speed, through a flexible number of sensor modules wirelessly connected.

In addition, WAD can be connected to virtually any sensor and equipment, through its analogue inputs and its communication capabilities (GSM and GPRS, Bluetooth, 802.15). Moreover it provides long-term storage for later analysis on a PC or PDA via Secure Digital cards.

By means of the standards supported, several customized solutions can be engineered using WAD either as a stand-alone device or as a peripheral for PC or PDA. Furthermore, simple processing (e.g. thresholds) can be implemented locally on the device, thus providing real-time alarms.

MS Webcare integrates different software among healthcare facilities and between hospitals and their local districts. The system permits health professionals to share clinical data and to manage communications among hospitals, general practitioners, homecare service providers, nursing homes and social services.

It enables physicians and health staff to transfer claim submissions, eligibility and status inquiries, referrals, laboratory orders and results, prescriptions and formulary support to the Internet without affecting their existing information systems.

An evolution of this system is T-Care project, which will use a Set-Top-Box (STB), digital interactive connection to Television, biomedical and specific utility devices and wi-fi net technology (for telemonitoring and telehomecare). The system transmits medical data, via a digital TV channel, to a dedicated web portal where a health database will be accessed by the medical specialists (in cardiology, diabetology, neurology, etc.) and the social health operators.

The continuous telemonitoring of the clinical parameters, using biomedical sensors linked to a STB, can concern parameters such as body temperature, pulse (heart rate), SpO2, ECG,
glucose level, etc; but other information can be inserted and sent to a web based repository server.

Furthermore, the system can give these people (at home or in other environments where they live) messaging and information services arising from social health service centers (i.e. advice on drugs or on behaviors and alert for therapeutic aspects). From specific TV channels educational programs relating for example to rehabilitation exercises, (diet instructions, etc.) will be selected and seen. It will also provide psychological support, whose effectiveness will be evaluated (Fig. 3).

**INTR@MED: Medical Network between Hospitals**

Intr@med is a project for medicine developed in the frame of scientific and technological cooperation between Italy and Egypt. It is based on web portal in order to improve the dissemination of information among hospitals and to support teleconsulting concerning difficult clinical cases and the telediagnosics process on a specialist level (2nd opinion).

The heart of the virtual network is a multifunctional medical/health web portal, which enables physicians, health operators and other researchers in biomedicine to access the whole network and share clinical information and knowledge.

At the moment Intr@med network links the Italian hospital "Umberto I" in Cairo (Egypt) and the General Hospital in Palermo (Sicily). The ICT applications regard telecardiology (telecardiosurgery in paediatrics) and telepathology. Using the web portal the clinicians transmit and access patient’s medical records, data, biomedical images (radiological images, digital slides) and signal (ECG) in order to support processes of second opinion of telediagnosis and teleconsulting in real time (conference display) or in deferred time (send of clinical and next referral of information and diagnosis). The telepathology consulting activity, besides the two hospitals, also involves the University Hospital of Pittsburgh.

This network model has been applied to another web based project in the frame of another bilateral scientific cooperation between Italy and Romania.

In particular the telemedicine system is located in the hospital of Florence and Brescia (Italy) and in the Regional Hospital of Timisoara (Romania).

The aim of this project is to increase the quality of medical services provided by the Emergency Clinical Hospital Timisoara, Romania, in collaboration with some departments (cardiology, radiology, pathology) of the Italian hospitals involved.

Intr@med interface and network schema of the Italian-Romanian Telemedicine Project are shown below. (Fig. 4)
This project opens new perspectives regarding the development of the existing local infrastructures and support for telemedicine activities in Euro-regions. The dissemination of the results of this project is possible by various techniques (i.e. videoconferences, forums, e-mail, e-learning). The software, which is the core of this project, is Clinical Image Integra in which it is possible to generate a huge database, record images and video files; a software key protects the software and runs on commercial PCs and laptops.

**NEUROWEB Portal**

It is a project founded by the European Commission in the frame of VI F.P. and will start in June 2006. It involves neurological clinics and hospitals in four countries (Italy, The Netherlands, Greece and Hungary). The system is based on a web portal specifically oriented to neurosciences, with advanced intelligent tools to retrieve relevant information from different sources on the web, to integrate and to present it to the users, as elderly people are subject to several neurological diseases like Alzheimer, Parkinson and in particular ischemic stroke. This last disease is a major health problem in the developed countries and is one of the most complex with several subtypes as well as secondary risk factors, such as hypertension, hyperlipidemia, and diabetes, which, in turn, have genetic and environmental risk factors of their own. Improving knowledge in stroke pathophysiology requires a large number of clinical, cellular, molecular and genomic data to be integrated and analyzed.

The project aims at designing and developing a software tool, to allow:
1. integrating clinical and genetic databases of the participating centers, different for structure, language, territorial area and pathologies of interest, into a single virtual database;
2. being able to query the databanks present on the web containing human polymorphism profiles in normal and pathological populations.

NEUROWEB proposes to accomplish the above objectives within the framework of cerebro-vascular disease, defined by the WHO in diagnostic codes 433, 434 and 435 (ICD9-CM).

The four NEUROWEB hospitals will be built on genetic, biological, clinical, imaging data available according to each partner specializations, which will constitute the kernel of the project. Based on semantic web technology and on web services, NEUROWEB will perform tasks such as retrieving (throughout the web), integrating and delivering clinical information, medical images, as well as molecular and genomic profiles. The genetic database will be based on innovative technologies such as cDNA-microarray-based methods for single nucleotide polymorphisms (SNPs) genotyping (gene-chip). Improving vertical integration of biomedical information, NEUROWEB will generate new knowledge in order to ameliorate healthcare delivery achieving personalized health care in prevention, diagnosis and therapy: scientists with new hypotheses will be able to extract information from the database in order to evaluate the merits of their ideas.

NEUROWEB will also foster collaborative research practices among the research communities belonging to the hospitals involved in the project, to average knowledge in the neurological domain to facilitate the integration of heterogeneous data sets. A network based on Internet technology among the medical institutions involved in this project will be created. Doctors will use the system to access clinical information and knowledge from a networked computer regardless of regional or national boundaries and constraints.

NEUROWEB system will permit neurological doctors and researchers in neuroscience to share and to access the clinical information and medical knowledge in neurology working together.

The NEUROWEB project, coordinated by the National Institute of Neurology “C. Besta” of Milano, will be connected with the institutional web site of the hospital (see Fig. 5 below).
This website allows:
- To access the latest medical news in neurosciences;
- To access clinical trial news;
- To have links to other useful internet services and sites;
- To access clinical and new research opportunities;
- To share diagnostic and therapeutic guidelines and protocols;
- To organize teleconsulting sessions with specialists in neurology;
- To perform queries to databases on the web, following paths which are adapted to their prevalent behaviors or needs, as defined by an intelligent profiling tool.

Social Health Information System (SISS) in Lombardia Region

It is a large program developed by the Regional Health Authority and based on a smart card. Its aims are to improve Healthcare System efficiency, to enforce the pivot role of the citizen in the care process and to grant healthcare information security and privacy.

The SISS will allow to connect all the operators and the healthcare units through a network; to record in real time and by informatics means all phases of the process for healthcare prescription and supply; to create a healthcare events database, patient centre, that can be queried by every authorized operator and to have more access entry points to the services (ex.: booking from GPs and chemist’s shops).

The main services of SISS are:
- Recording of every prescription;
- Wide-used booking of health services;
- Recording of every service;
- Recording of out-patient service, first-aid and discharge reports;
- Signaling to GPs the health connected events that their patients undergo.

Together to SISS project there is the ‘Service Regional Card’ which will be the only way of access to the information services provided by the Region and by the Lombardy local Public Administration. The Service Regional Card is based on a microprocessor technology yielded by the Lombardia Region which is the access key to the services by means of a "digital signature" using cryptographic algorithms with asymmetrical key (RSA) (Fig. 6).

The whole dimension of the SISS project, involving the Region, regards about 9.500.000 inhabitants, 100,000 healthcare operators, 8,000 General Practitioners, 2,500 chemist’s shops, 200 hospitals and 2,600 private structures with a budget of about 11 billion dollars of annual expenses.

The impact on Regional Healthcare and Administrative Systems will be related to the increasing of the efficiency and in particular:
- The abolition of every management process for service recording;
- The actual capability of expense control, based on real time data;
- The ability to link the administrative record of the service to its health content;
- Means to check the behaviour of the expense generators.

The efficiency increase for the Healthcare Unit:
- Automatic recording of the provided services;
- Capability to avoid diagnostic duplications;
- More suitable treatment process;
- More homogeneous demand distribution.

The impact on citizen will be a better access to the services, an integration in just one system of all the participants to the healthcare process and a quickly access to the complete offer of healthcare services and more suitable treatments.
Conclusion

eHealth and Telemedicine deliver a more cost-effective solution for health care systems, providing better clinical outcomes as well as improving a patient quality of life. Cost-benefit studies should be conducted properly and include all known benefits-both direct and indirect-as well as the economic and social benefits. (Tests on these topics are widely available). The impact of these applications can permit features as disease management, reduction of costs, management of ageing populations (telecare systems), reduction of waiting lists, second opinion, improving data collection and epidemiological data bases, etc. (in order to analyze medical database many Italian projects, in developing phase, refer to Grid Technology applied to health care and biomedicine).

In general, the benefits associated with the introduction of e-Health and Telemedicine services can be:

- Health education of professionals operators and also of people and users;
- Employment opportunities for health operators at a peripheral level;
- Diffusion of medical knowledge;
- Availability of normal (or on demand) health treatments, in distant areas to prevent the population from moving away;
- Improvement of health indicators used by WHO and by national government structures.

But some problems remain, mainly related to organizational and not to technical aspects. In Italy we want to remove these kinds of obstacles and, as @ITIM, we want to involve the large world that stays around the health sector (biomedical research centers, hospitals, ICT companies, health authorities at local, regional and national level) in order to have the best conditions for moving from experimental projects and prototypes to real e-health and telemedicine systems and services for the citizen.

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Telemedicine achievements in Lithuania

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Abstract

Telemedicine activities in Lithuania began from collaboration with Sweden in 1997. The main purpose was the development of technical infrastructure for telemedicine and training doctors of the leading hospitals to use telemedicine facilities in Lithuania and also communicating with Swedish and other colleagues abroad. The technical infrastructure for telemedicine in Lithuania and networking with foreign countries were prepared. Specific telemedicine services and a support organization for telemedicine development were formed. The use of telemedicine for patients, who are being presented for consultations is accessible; a world-wide distance education for medical staff in Lithuania is accessible and common international network and data bases ready for data exchange and research are created. The telemedicine network for integrated support of clinical practice, education and research were created. Telemedical support of clinical decisions is used in ophthalmology, otorhinolaryngology, cardiology, dermatology, pathology. The use of the system allows world-wide and fast distant consultations by high skilled specialists and distant education from the best European medical centers. It has a great value for improvement of the patient’s follow-up, qualification of specialists and education of medical students and residents.

Key words: telemedicine, civil and military medicine, clinical decision support.

Introduction

Modern technologies are widely used for early diagnosis and prevention of diseases at present. Information technologies give an opportunity for early diagnosis, treatment and permanent patient’s follow-up (home-care). The mission of Information Society is to serve the people, make their life easier and the highest priority, of course, are the vital needs. The human health is not only the main need, but the national wealth as well.

Teleophthalmology takes priority in this field: ophthalmological diagnosis is usually based on evaluation of anterior eye segment and fundus images. The main ophthalmic services in Lithuania are mostly concentrated in two biggest cities: Vilnius and especially in Kaunas, where the Hospital of Kaunas, the University of Medicine and Kaunas University of Technology are located. These institutions carry most of human and technical resources and provide the widest and most sophisticated services in Lithuania. In the countryside eye care is limited to the basic diagnostic and therapeutical level due to the lack of appropriate equipment and experience of local personnel.

On the other hand the costs of medical services today increase very fast, diagnostic possibilities stay lower than West European, Lithuanian medical reform has been just started.

Telemedicine in Lithuania started from collaboration between Kaunas University of Medicine and St.Erik Eye Hospital in Stockholm (Sweden) in 1997. The next videoconference between
Eye Clinic of Kaunas University of Medicine and International Telemedicine Conference in Visby (Sweden) was held in 1998. The first Lithuanian-Swedish telemedicine project Litmed 1 connecting medical societies of Sweden and Lithuania started in 2000 after these presentations.\footnote{1}

A telemedical infrastructure has been realized for the creation of high quality medical images, signal databases and development of clinical routines, teleconsultations, second opinion, distant education and clinical decision support. Telemedical support of clinical decisions is used in ophthalmology, otorhinolaryngology, cardiology, dermatology, pathology.

As a result of our telemedicine activities a Telemedicine Center of Kaunas University of Medicine was established (http://tmc.kmu.lt) in 2002.\footnote{3,9}

The aim of the Telemedicine Center is to initiate, form and introduce the politics of telemedicine development in the University and the country and to prepare recommendations for healthcare institutions and government institutions. Main tasks are:

- To provide methodical leadership for application of telemedicine technologies for medical diagnostics, consultation, monitoring and scientific investigations in all stages of the studies and postgraduate studies; and coordinate them;
- To provide the search for programs and financing sources which stimulates the development of telemedicine;
- To organize sessions and conferences on telemedicine;
- To organize and participate in national and international telemedicine and e-health projects.

Analysis of the state of the problem showed novelty of the ideas in worldwide context. All the telemedicine experience was generalized in the project NetLit realized by the Telemedicine Center of Kaunas University of Medicine and Kaunas University of Technology. The project concerned patient oriented IT solutions and was presented at the European IT Society contest and the Minister level conference and exhibition held in Brussels, EU (22–23 of May 2003), and won the Finalist Diploma. That makes the basis for future development and integration to European Research Space.\footnote{7,11,12}

### Methods

The created telemedicine infrastructure oriented into:
- Teleconsultations and second opinion for clinical practice;
- Distant education of medical staff and population in Lithuania using the existing distance education facilities of the Telemedicine Center;
- Research and creation of international medical databases, information exchange based on medical and technological sides.

The Telemedicine Center of Kaunas University of Medicine has arranged rooms for small (about 10 persons) and big (about 140 persons) videoconferences.

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**Fig. 1.** A Swedish-Lithuanian telemeeeting and a distant multispeciality consultation from Kaunas Eye Clinic.
The system for telemedicine service consists of:

- Computer net (1 server, 6 computers);
- Telemedicine workstation Eurotel I with Zydacron videoconferencing board: codec Z360 and ISDN communications Z280, 2 robot video cameras Sony EVI-D3, framegrabber, video swicher;
- Slit lamp Topcon SL8Z with Sony 3CCD camera attached;
- Digital fundus camera Canon C60UVi (6.3 MPxls);
- Ultrasound diagnostic equipment (Mentor Advent AB system);
- Dermatoscope;
- Surgical microscope.

Videoconnection by 3 ISDN lines (384 kBps) or IP.

Software:

- for videoconferencing – Zydacron OnWan;
- for image management and collection into database – Olympus Migra (Euromed AB, Sweden). Migra is a software client with high resolution picture grabbing, live picture/voice (30 frames/s), e-mail with compression functions, microscope measurement "White Board" ("live pointing and writing in the same picture") and database storage (ODBC). Transmission of pictures during a video conference session is possible (dynamic bandwidth);
- for image management, processing and videoconferencing – MediPas. Medipas is MS Windows multiple document interface (MDI) based software for image management and online telemedicine applications created in Biomedical Engineering Institute of Kaunas University of Technology. The technical possibilities for storing, processing and wide accessibility (distance data exchange) of ophthalmological, dermatological, cardiological and pathological information and for creation of multi-objective analysis based on clinical decision support strategy were established.

Distance education

Distance education in ophthalmology started with live lectures from Stockholm St.Erik eye hospital to Kaunas Medical University Hospital in Lithuania and Kaunas Medical University Hospital to St.Erik Eye Hospital in 2002. This experience facilitated the development of new distance educational programs in ophthalmology.

A web site "Digital Ophthalmology – Informating System for General Practitioners" in English and Lithuanian sponsored by Open Society Fund Lithuania (http://www.bmii.ktu.lt:8081/unrs/akys) was created (Fig. 2). The Internet web site has been created in order to promote and facilitate consulting and training of medical students and general practitioners. The web site includes a diagnostics-focused database built on the differential diagnostic tables with comprehensive visual information (biomicroscopic, ophthalmoscopic images). All visual materials are original and stored in Telemedicine Center of Kaunas University of Medicine and Institute of Biomedical Engineering of Kaunas University of Technology. The Internet application of this site is based on Java Servlet technology, using Velocity template engine and Tomcat Servlet container.

Internet based distant education courses for general practitioners including dictionary and movies "Eye Diseases for General Practitioners" (72 hours) were prepared in Lithuanian in 2004 (Fig. 3). It consists of:

- Acute painless visual loss (18 hours);
- Red eye (18 hours);
- Eye and systemic diseases (18 hours);
- Eye trauma (18 hours).

The program has been approved by Lithuanian Ministry of Health as a CME (Continuing Medical Education) program.

Each course is held two times per year for 15–20 general practitioners. About 20 cities are connected (multipoint) to this course.

Teleconsultations and second opinion

International distant consultations started in 2002. The use of existing infrastructure of Telemedicine Center allows the live (on-line) and delayed (off-line) international distance medical consultations.

More frequent are off-line consultations, images transmission via Internet.
Fig. 2. Windows of the website “Digital Ophthalmology”.

b) lokalios drumstys (infiltratai) būdingos keratitui arba ragenos opai,

c) precipitatai arba uždeginių laiptelių sankaupos ant ragenos endotelo, lydintys raištelės bei krumplynio uždegimąs.

4. Ragenos epitelio defektai randami traumos (erosio cornea) ir ragenos uždegimų metu. Nustatomi pagal ragenos reflekso iškraipymus bei dažant fluoresceinu.

5 paveikslės. Ragenos epitelio defektas, nudažytas 1% fluoresceino tirpalu

Fig. 3. Internet based distant education courses for general practitioners.
**The use of telemedicine possibilities in massive casualty situations**

In order to expand the use of distant consultations facilities, it is essential to apply its possibilities in large mass casualty events, decreasing geographical isolation of the event’s place. We would like to share our experience in massive casualty situations.

On 23 and 28 July 2004 the Telemedicine Center took part in the RESCUER/MEDCEUR project exercise. RESCUER/MEDCEUR 2004 is a USAREUR led "In the Spirit of Partnership for Peace" (ISO PfP) exercise designed to train US, NATO, and Partner nations to respond to a disaster relief/mass casualty situation. 320 soldiers from 12 countries, namely Lithuania, Armenia, Azerbaijan, Bulgaria, Estonia, Georgia, United States of America, Croatia, Latvia, Moldova, Romania, and Ukraine, took part in the RESCUER/MEDCEUR 2004 exercises, alongside with 6 observers from the Netherlands, Poland, Luxemburg, and Germany.

The Telemedicine Center used appropriate telecommunication devices for joint activities of civil and multinational military services in critical situations such as mass casualty events. ISDN lines and IP radio-connection were used.

On 28th July, the final and most intensive day of the anti-terrorism drills, the multinational force of medics at the Kairiu Training Range in Lithuania reacted to a large mass casualty event – treating hundreds of victims from a simulated train crash. On the place of the event the Telemedicine Center arranged live, direct high level medical multispecialists teleconsultations from Kaunas Medical University Hospital (Fig. 4). The most complicated cases were evaluated and selected by Kaunas Medical University Hospital specialists at the event place using telemedicine facilities. All those cases were transported to Kaunas and Vilnius Universiteis Hospitals by helicopters (200 and 300 km from the event place).

The use of existing telemedicine infrastructure shows the possibilities of the military medicine personnel’s capability to provide medical service for casualties, as well as their ability to cooperate with the civil institution during the rescue operations.

These results show the facilities of existing telemedicine infrastructure and needs for further development of the existing system into International Integrated eHealth Network for very fast international exchange of medical information, remote consultations of high skilled specialists.
in emergent or large mass casualty events from the best European civil and military medical centers and distant education.

**Research and Clinical decision support**

Research is based on clinical practice and provided both on medical and technological sides. Research areas are ophthalmology, otornolaryngology, pathology, dermatology, cardiology, obstetrics-gynecology.

Clinical decision support system is understood as an information system that supports and assists health care professionals in clinical decision making tasks like diagnosis, therapy planning and monitoring. The structure of such systems can be represented by several functional blocks, as shown in Fig. 5. Real implementation can be done in many ways and in various levels of complexity and versatility.15

A program "Information technologies for human health – clinical decision support – IT Health" supported by Lithuanian State Science and Studies Foundation started in September 2003. The program is devoted to primary storing, processing of biomedical information and to the creation of multi-objective analysis based clinical decision support strategy. The aim of the program is to access the use of telemedicine for patients, make accessible world-wide distance education and create a common international network for data exchange, research and clinical decision support in ophthalmology and cardiology. The storing and processing of ophthalmological and cardiological images and signals into databases with integration to international telemedicine network has been started in aspiration to find the most informative parameters for clinical decision support. The main purpose is to join the efforts of experts and researchers from both areas to improve the health care quality by focusing attention directly to the needs of the patient and the physician in supporting them by making an individual diagnostic decision for the patient.

The development of information technologies in this project makes processing and systematization of big amount of different information and assessment of data possible, what creates problems for a physician.

Objectives and tasks of the project are oriented into three interrelated clusters:

1) Development of clinical decision support strategies based on multi-objective analysis methods using pilot databases of medical images and signals, telemedicine networks;
2) Modelling physiological status of a human as a complex adaptive system with the aim to predict, support and evaluate clinical decisions impacting him;
3) Development and evaluation of information systems for making the preventive clinical decisions in decreasing the risks of disability causing diseases.
These objectives and tasks are related with a new scientific problem – the development of clinical decision support strategies based on multi-objective analysis methods.

The technical possibilities for storing, processing and wide accessibility (distance data exchange) of biomedical information and for the creation of multi-objective analysis based clinical decision support strategy were established. Created databases of ophthalmological images and cardiological signals and telemedicine networks serve this purpose (Fig. 6).

The storing of ophthalmological images and cardiological signals into databases with integration to international telemedicine network has been held. That data is used for parametrisation and training of the decision support algorythms. First results of ophthalmological images and cardiological signals processing and classification by the digital parameters and expert assessment methods are developed.

The directions for future development and advancement of IT methods (mathematical methods, algorythms, computer network decisions) helping in formation of preventive and clinical decisions developed (Fig. 7).

Connection between physician– user and expert – diagnostic – information system for clinical decision support is based on the storage of patient’s data in the high capacity ophthalmic and cardiologic data and digital image base. After classification processing and parametrization, the clinical and experimental data is stored and used for the creation of new multicriterial decision strategies for analyzing patient – population data and creation of clinical decision support with links to Internet information (e-library). A physician makes a final diagnostic decision.

**Ultrasonic diagnostic applications for ophthalmological eHealth subsystem**

The extraction of knowledge from medical information is a very important tendency in eHealth development. The amount of information increases constantly. It has to be concentrated in valuable knowledge which is useful in medical decision making and developing electronic patient’s health information. Developing eHealth system properly creates a unique possibility to collect and integrate medical knowledge.
The main objectives (Fig. 8):
- Creation and evaluation of processing methods of informative ophthalmic ultrasonic diagnostics signals;
- Estimation of the relation between ultrasonic parameters and biomechanical characteristics of eye tissue for clinical decision support;
- Development of the eHealth subsystem using informative data of ultrasonic ophthalmological diagnostic signals and images, telemedicine technologies and networks.

A functional teleophthalmological system for collecting and processing of informative ophthalmological diagnostic parameters has been created (Fig. 9). This is an input for developing the ophthalmological eHealth subsystem, using appropriate telemedicine technologies, forming ophthalmic records from the beginning: creation of methods for the collection and saving of information, development and improvement of informative processing methods and algorithms.

Realization of the operative teleophthalmological system is a complicated task. It is very important to adapt medical diagnostic equipment, receiving, saving and processing of medical information and network for getting correct, high quality diagnostic results.

**Conclusions**

According to our experience in developing infrastructure in Lithuania the worldwide telemedicine network could be created.

Development of telemedicine services in Lithuania has a great importance for the Lithuania health care system as there is great potential to reduce preventable disease, improve quality of health care and increase professionalism of doctors by using distant training, consultations with modern telemedicine techniques and clinical decision support.

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Fig. 9. The teleophthalmological system.

References


Telemedicine achievements in Lithuania

Moldova’s Experience in National e-Health Projects

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Abstract

Implementing information-communication technologies in health care is an effective way of solving various problems of management, diagnostics and treatment in the developing countries. In Moldova, after studying the best practices and the most efficient models used worldwide, the National Concept of Medical Integrated System has been developed. This National Concept laid the foundation for all the projects dealing with IT in health care. Moldova chose the way of developing a basic informational platform – electronic medical records, the structure of which allows expanding and replicating, depend on the field used. At present, following the Concept of Medical Integrated System, a project, dealing with the creation of a National Network of perinatological services, has been successfully launched.

Key words: Medical Integrated System, e-Health, electronic medical records.

Introduction

Nowadays the progress in Public Health can be achieved only by means of introduction of up-to-date scientific innovations into the healthcare practice, by use of new perspectives and cutting edge technologies in branch management, including the information-communication technologies (IT). The widespread adoption of information technologies in medicine and healthcare at the frontier of centuries created the perfect environment for a new kind of healthcare – electronic healthcare (e-Health).

As used here «e-Health is a new term used to describe the combined use of electronic communication and information technology in the health sector OR the use of digital data – transmitted, stored and retrieved electronically – for clinical, educational and administrative purposes, both at the local site and at a distance» ¹

Today more and more developing countries are becoming familiar with the technical progress, including the field of information technologies. Moldova is no exception in this regard. Therefore, it may count on certain success in the case of adopting information technologies in the Public Health.

However, in many of the countries a lot of expected benefits from the use of IT in the healthcare have not been felt yet. One of the major causes is the non-coordination of actions and lack of a common development strategy for e-Health as a whole. That is why the development of successful models designed for identifying and understanding the factors that measure the efficiency and the stability of e-Health projects, requires the coordination and the integration of various organizations and moreover, the need of introducing complex IT applications.
Moldova’s Experience in National e-Health Projects

National system of e-Health and telemedicine

The purpose of e-Health application in Moldova

The benefits, provided by the IT application in Public Health, are various.\textsuperscript{2,6} The benefits of introducing e-Health in Moldova are the following:

\begin{itemize}
  \item providing medical data to the medical specialists and other users via telecommunication channels and the Internet;
  \item creating the conditions for collecting real time data about the Healthcare System;
  \item creating the conditions for improving the professional qualifications of the medical staff;
  \item ensuring the «transparency» of the activity of public medical institutions;
  \item providing equal access to high standard medical treatment for the whole population.
\end{itemize}

The main stages of implementing informational technologies in Moldova’s Health System

The launch of IT applications in Moldova’s healthcare has passed through several stages within a short period of time; their successful implementation allows us to count on certain progress in this field.

At the first stage, the establishments most concerned with e-Health projects were figured out, amongst which the following are to be mentioned:

1. Ministry of Health and Social Protection
2. National Medical Insurance Company
3. State Medical and Pharmacy University
4. Ministry of Information Development
5. Drugs Agency

All these organizations are involved in e-Health programs on the national level.

At the same time researches on the most successful and acceptable models for e-Health programs and telemedicine used worldwide were conducted.\textsuperscript{3,4,5,7} The process of adopting the IT programs and concepts to healthcare was carried out in many countries worldwide. It is worth mentioning that the main disadvantage of most of these projects, in our opinion, is the separate application of single modules and tendencies. This comes from a certain interest of various groups of healthcare professionals or local healthcare bodies for a particular application.\textsuperscript{6,8}

Preliminary conditions

An important stage was the in-depth analysis of the conditions and opportunities for the development of information technologies in healthcare.

Amongst the most important factors identified, there are the following:

\begin{itemize}
  \item the low level of IT use in the public medical institutions,
  \item the existence of national electronic registries, as basic platform, allowing the low cost use of such information in other fields,
  \item the adoption of a national program for the development of Information Society, including the healthcare computerization.
\end{itemize}

Taking into consideration these preliminary conditions, as well as the initiative and the auspices of Ministry of Information Development, a complex process of developing and implementing an IT application into healthcare was put into practice.

This process is based on the following principles:

1. A unique optimal solution for all the areas of Public Health services, including the financial control and drug management.
2. Creating the conditions for developing a National Public Medical Institutions Network.

As a result, the Concept of Integrated Medical Information System has been elaborated and adopted. This Concept became the key guide in executing the process of integration of all e-Health projects across Moldova (Fig. 1). The Concept provides the main platform for carrying out different IT projects in various fields of Moldova’s healthcare system. This concept generated a technological solution which was the development of Electronic Medical Record (EMR), which configuration may be adapted to a particular task and project.
For Moldova, as a small state, this Concept means the creation of a National Healthcare Information System in the form of a Medical Information System for public medical institutions. In this context, the issue of standardization and interoperability of various systems becomes insignificant, since in all public medical institutions the application of united technological platform – EMR is foreseen.

**IT-projects in Public Health**

One of the first practical projects was the development and the implementation of a computer based system that allows access to information and ensures the efficient functioning of the National Medical Insurance Company in Moldova (Fig. 2).

This program’s purpose is not only to ensure the efficient monitoring of spending the bankroll, but also to set up the conditions for elaboration of efficient mechanisms for updating the entire system of Public Health at different stages of healthcare services. In this project EMR is used as the basic module, where the primary data like information about patients, healthcare services, diagnosis, etc is recorded and stored. Additionally, the use of information from state registries such as personal identification code – IDNP and organizational identification code – IDNO is very important. This mechanism allows the identifica-
tion of any person throughout Moldova and consequently, makes a link between the medical attendance services of any healthcare institution and the patient, to whom this service is rendered.

At present, the given system is being implemented on the whole territory of Moldova and this will allow the creation of a National Public Medical Institutions Network and a database of the medical services, available to the population (Fig. 3). By the end of 2007, all public medical institutions are expected to be connected to a single network.

The next project undertaken on national level was the setting up of an automated system of pharmaceutical products and drugs’ registration in Moldova (Fig. 4). This project is part of the general strategy of computerized healthcare system that will ensure the legality and the transparency of the market for pharmaceutical products. This will also guarantee the quality of pharmaceutical products on all stages, starting with manufacturing and importing to retailing in drugstores.

The realization of this project will enable the creation of the National Drug and Medical Products Register. The project was launched at the end of 2005 and its completion deadline is set for 2008.

The successful introduction of this project, as well as that of the previous project for National Medical Insurance Company, has enabled the introduction of the mechanism of sale of partially compensated medicines. This is an important social step in the state’s realization of social policy concerning the low-income part of the population.

The most important and ambitious part of healthcare computerization is the development and implementation of medical information systems for public medical institutions. This particular element will lay the foundations for setting up of The National Healthcare Information Network. This transition will be the most difficult and time consuming part of the entire program, as the initial level of using computer based technology in the public medical institutions is very low.
There were a number of attempts to introduce and implement medical information systems for public medical institutions over several past years in Moldova, but they were not systematized and had no large-scale character.

Two projects have been launched in the current year: the elaboration of medical information systems for the Primary Care and setting up the medical information systems for the Mother’s and Child’s Care. These projects became a basic platform for the creation of specialized programs on introduction of IT for Primary Care and Perinatology as most important part of Public Health in Moldova.

**Conclusion**

Moldova has chosen the long and uneasy path of healthcare modernization where introduction of IT applications into healthcare is an essential and unavoidable part of the whole process. The results achieved so far encourage the success forecast on further developments in this area. Successful introduction of the first IT-projects, creation of the National information network where all medical institutions are joined up, will allow to use it as a basis for the future development of various telemedical projects.

The state authorities have the opportunity to apply the e-Health technologies and the telemedicine as a tool to fulfill its informational needs and learn the requirements of medical care and in particular, to apply e-Health and the telemedicine in the general development of plans of healthcare and education development, carrying out research programs of healthcare as well as the expansion of telecommunications. As soon as they become technologies immediately useful for the healthcare, e-Health and telemedicine will enhance the access to the medical services, will contribute to the setting up of an Integrated National Healthcare System.

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The Creation of a National Telemedicine/eHealth Association in Nigeria and its impact on the Federal Ministry of Health ICT-Committee

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Abstract

The national telemedicine/e-health association in Nigeria called the Society for Telemedicine and e-Health in Nigeria (SFTeHIN), was created in April 2005. The association is an organization formed to keep up with the global trend in health-care delivery – the use of telemedicine and e-health as a tool to improve health-care delivery system in Nigeria. The Society for Telemedicine and e-Health in Nigeria serves to promote the cause of telemedicine/e-health in public and private institutions in Nigeria. The society educates the government about telemedicine/e-health as an essential component to the delivery of modern healthcare. The Federal Ministry of Health (FMOH) inaugurated its ICT-committee in 2003 and charged it with the responsibility to deploy ICT facilities for the ministry in order to make information about its activities available and accessible to its workers, other arms of government; its development partners; private sector organizations, the Nigerian public and the world at large. Activities of the society since its creation, which included organizing national stakeholders meeting on developing national telemedicine/e-health program, first telemedicine/e-health workshop in Nigeria have led to a good working relationship with government agencies and nominated the society a member of the FMOH’s ICT-committee. The committee is devoted to working with the society and its partners on how to deploy ICT in the ministry, which include; electronic linkage between FMOH and its hospitals; FMOH e-learning center/ e-library; facilities for telemedicine and human resource development implications of these projects. The national awareness raised by the society on issues of developing e-health in Nigeria contributed to the decision of the committee, resolved to implement some of this project in the next fiscal year (2006). To complete the computerization of FMOH’s administrative and programmatic functions it was necessary to carry out a feasibility study of telemedicine in Nigeria with the society in view to facilitate its development in the country. One of the components of the Health Sector Performance issues addressed by the Health Sector Reform Program is to improve the stewardship role of government by deploying information and communications technologies (ICTs).

Introduction

As the healthcare market continues to evolve, technology will play an increasingly important role in an integrated delivery system’s ability to provide high-quality, cost-effective care. Healthcare leaders must be proactive and forward thinking about their technology investments. The financial investment of successful projects establishes proof of concept to demonstrate the validity of remote delivery systems. Health services and education are both critical issues in
rural economic development, and can both be delivered over an infrastructure which has been
developed to deliver either one, for technology innovation can be significant. *Telehealth is the use of electronic information, imaging and communication technologies to provide and support health care when distance separates the participants.*

- The planned health systems and services would be such, that offer quality health care services and provide protection from risk for the poor against the catastrophic economic effects of an illness.
- Reforms would not only enhance the financial and cultural access of the people to health care, particularly the poor, but also their physical access which, in a majority of Nigerian communities, remains a substantial challenge.

**SFTeHIN**

At the last ordinary General Assembly of ISfTeH held at Luxexpo, Luxembourg on April 6, 2005 Nigeria was proudly represented by Dr. Joseph Adebola. The congress generally agreed that individual members should get eHealth associations started in their respective countries to help facilitate the development and dissemination of knowledge in telemedicine and eHealth worldwide.

The Society for Telemedicine and eHealth in Nigeria (SFTeHIN) was established in April 2005 and presided over by Dr. Joseph Adebola who became a national representative member of ISfTeH in July 2005 with the vision of introducing Telemedicine and creating an e-Health network in Nigeria for the aim of providing the nation as whole with a rapid, reliable and cost effective way of healthcare delivery services; medical education including research, development, practical application and supplementary training to promote national health telematics particularly telemedicine and eHealth.

The Society (SFTeHIN) is a non-governmental and not-for-profit society; a national representative member of the International Society for Telemedicine and eHealth (ISfTeH).

The Society is in collaboration with the WHO collaborating centre on Telemedicine, Norwegian Telemedicine centre, Norway, National Information Technology Development Agency (NITDA) and National eGovernment Strategies (NeGSt) on developing telemedicine in Nigeria in 2005 and will be involved in many more in 2006.

As a way of fulfilling part of its objectives, SFTeHIN took the initiative of organizing a multinational stakeholders meeting on “Developing Sustainable Telemedicine and eHealth Programme for Nigeria” invoking the public private partnership. The key points of the meeting were: the need to support the Federal Government of Nigeria policy for Information Technology (IT), to invest in IT-based health care systems to ensure that Nigerians have access to good health care delivery and strong emphasis on the need for high level collaboration among stakeholders as the most critical success factor in any telemedicine and eHealth initiative.

This meeting was soon followed by the premiere telemedicine/eHealth workshop in Abuja in October 2005 organized by NEGST under the auspices of NITDA with SFTEHIN actively involved in the organization and facilitating the program. One of the key guests at this event was the Minister of health who said “Government recognizes the need to support and promote telemedicine and eHealth to the limit that competing interests for funds will permit. Furthermore, in keeping with global trends in health education, telemedicine and eHealth will be included in the curriculum of medical education in Nigeria for capacity building. What’s more, what I call the National Telehealth Project will be synchronized with international efforts and standards”, he was later capped as the National eHealth Champion. Also present were various stakeholders including Medical directors of the Tertiary institutions, captains of industry and IT chieftains. The video conference offered the participants an opportunity to interact with the best minds in the field such as Dr Shetty, Tove Sorensen and Dr Alexander Leis. Overall, it was a huge feather in the Society’s cap as the vision was making headway.

The Federal Ministry of Health (FMOH) created its ICT committee in 2003 and charged it with ICT related duties. Based on the track record of the society it was nominated to function on the committee with a view to help the FMOH achieve its ICT related reform goals.

On the backdrop of the Nigerian health sector being rated 187th in the World, the need to put the sector in order appeared to exist. Seven (7) strategic areas of work have been identi-
fied, through a nation-wide consultative process that started during the first term of President Obasanjo’s administration. It is within these areas that the Ministry intends to undertake various reform initiatives. The areas of work are:

– Improving the stewardship role of Government;
– Strengthening the national health system and its management;
– Reducing the burden of disease;
– Improving availability of health resources and their management;
– Improving access to quality health services;
– Improving consumers’ awareness and community involvement;
– Promoting effective partnership, collaboration and coordination.

The stewardship role of government is the key that holds the other parts together with the planned deployment of ICT as one of its strong points. This is because the next 5 areas are directed towards developing a functional primary health care system that can be more effectively managed, monitored and developed with the proper implementation of telemedicine/eHealth in a mainly rural economy where poverty and distance play a major role in limiting people’s access to qualitative and quantitative health care. The last area of multi-sectoral involvement and cooperation also requires Government’s diligence and dedication to the cause, as political will is a paramount for collaboration. The crosscutting areas of work that will also receive focused attention include an effective health management information system (monitoring & evaluation) and a communication strategy for mobilizing and sustaining the reforms.

With this foundation, the ICT committee with the Society’s inspiration is actively working with other stakeholders on achieving the following goals this year:

1. Electronic linkage of the FMOH with its hospitals with the aim of creating something similar to a Wide Local Area Network (WLAN) whereby the tertiary hospitals can all access one another, exchange information and create a reliable central database. NeGST is saddled with the responsibility of developing a program that would be the template for the database and where work is actually on advanced stages.

2. Creation of an e-Library/e-Learning center for the purpose of increasing the level of information dissemination concerning common health problems, activities of the ministry and its programs and to train medical and paramedical personnel.

3. The execution of a nationwide feasibility study with a view to provide recommendations to the major stakeholders in tandem with the government on the discovered needs and focused plans of action. This project will benefit from the planned national census and may take off with a state serving as the template.

4. Capacity building exercises and acquisition of facilities to enable to achievement of aforementioned goals.

However, there are some daunting challenges facing these lofty goals that actually are the bane of health care delivery within Nigeria:

– The poor definition of the roles and responsibilities of key actors. Government has a responsibility, through various statutory instrumentalities and in a coordinated manner, to ensure that all key stakeholders (Federal, State and Local Governments and the wider civil society organizations and development partners) know and play their roles and assume their responsibilities for the management of the health system for overall health development, as well as accept responsibility for the role of the health system in the overall poverty alleviation and macro-economic development of Nigeria;

– The need to strengthen our various Ministries of Health’s role and responsibility in their stewardship in health by providing the requisite enabling management and stewardship tools, such as relevant policies, operational health sector strategic development framework, legislation, financing, human and physical resources, etc;

– The challenges of fostering inter-sectoral collaboration with other arms of the government and the wider society to ensure that all aspects of our stewardship roles and responsibilities are effectively carried out;

– Poor dissemination and enforcement of health policy implementation;

– Absence of legal and constitutional backing for some major policy thrusts, including the misleading assumption that health is on the concurrent list in the Constitution;
- The fact that current policies are not inclusive of the definitive roles and responsibilities of the private sector;
- The generally depressed state of evidence-based budget and plan management practices;
- Inadequate funding of the health sector.

These problems however can be surmounted if the following can be ensured:
- National health institutions re-profiled with well-defined roles and responsibilities.
- Structural reform of the Federal Ministry of Health carried out to make its bureaucracy more efficient and effective.
- National Hospital Agency established to enhance effective coordination in terms of policies, standards and performance of tertiary/specialized hospitals.
- Devolution of ownership and/or management of tertiary health institutions.
- Establishment of a National Blood Transfusion System, which shall be located on the national level, each of the six geo-political zones, and the military.
- A revitalized /functioning PHC system.
- Teaching Hospitals regaining their status as centres of excellence for the provision of quality tertiary care, training of high quality doctors/nurses, etc., and the conduct of relevant medical/health research
- Development of the National Health Management and Information System (NHMIS).
- Construction and institutionalization of a National Health Account (NHA).
- Development and implementation of a comprehensive health care financing strategy.
- Development of a performance-based human resources management system.
- Supporting and promoting the HSR process by leaders, through practical activities and involvement.
- Communities’ participation in the design, implementation, monitoring and evaluation of health care delivery as it affects them.
- Communities and consumers being well informed about their rights to quality health care.
- Communities becoming co-owners and co-financiers of health care delivery.
- Health consumer protection groups formed and actively engaged on health issues.
- Consumers and communities imbibe practical actions.

The need to create a national committee that would consist of representatives of the federal Ministries of Health, Science and Technology and Communications

1. After discussing the issues on the implementation of telemedicine/eHealth in Nigeria, the next steps to be taken will be that:
2. The National committee should consider the following points:
3. Proposal of a framework for rational development and deployment of national or organizational capacity for telemedicine systems in Nigeria.
4. Establish core principles to ensure coordinated, cost effective and integrated approach to telemedicine in Nigeria.
5. Consider ways to assess effectiveness, efficiency, and whether or not telemedicine is improving, equality in the access to health services for all Nigerian citizens.
6. Recommend a long-term process for addressing issues as they emerge with changing technologies and patterns of health care practice in Nigeria.

Conclusion

Since it’s inception in April 2005, the Society for Telemedicine and eHealth in Nigeria has moved in leaps and bounds with the two groundbreaking meetings it organized last year – in September and October. Its incorporation into the ICT committee for the Federal Ministry of Health is in recognition of the importance of Telemedicine and eHealth to the development and improvement of existing healthcare delivery systems in Nigeria and the immense International support from the parent body is a good omen of things to come. This however is not the time to rest on its oars but rather to consolidate on its gains and build a lasting framework for telemedicine and eHealth in Nigeria and Africa as whole.
The Creation of a National Telemedicine/eHealth Association in Nigeria

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E-learning as instrument to fight HIV/AIDS in Peru

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Abstract

Latin America is providing antiretroviral treatment to approximately 68% of its HIV/AIDS population in need of treatment: together with the Caribbean it has the highest coverage of any region in the developing world. Peru is between the 13 countries in the Latin America region treating more than half of its HIV population in need. To facilitate the introduction of those newly available drugs for HIV/AIDS patients living in remote areas in Peru, the Institute of Tropical Medicine Alexander von Humboldt in Lima, started an online course for clinicians working in those settings, providing adequate technical support on antiretroviral therapy (ART) and management of Opportunistic Infections (OIs).

Key words: E-learning, distance education, HIV/AIDS, and low resource settings

Introduction

Peru with its 28 million people has a concentrated HIV epidemic with an adult HIV prevalence of < 0.5%, but with HIV prevalence in men who have sex with men (MSM) of 11% and in female sex workers (FSW) of 2%. It has been showed that HIV treatment can be delivered effectively in a wide variety of health systems, including those in low resource countries and rural settings [...]. We hereby describe a project to provide clinical support and continuous medical education to physicians treating HIV positive patients in remote areas in Peru.

Body of Paper

It is estimated that 82,000 people are living with HIV/AIDS (PLWHA) in Peru of which 12,000 are in need of antiretrovirals and 6,000 are currently under treatment.

Peru’s HIV epidemic is concentrated in vulnerable populations. Most HIV transmission occurs through sexual contact. Among both men and women, those most affected are between 20 and 39...
years of age. Men account for the majority of reported HIV infections (40% in heterosexual men and 42% in men who have sex with other men). Heterosexual HIV transmission appears to occur in women whose partners are bisexual men or clients of sex workers. The people mostly at risk of HIV and other infectious diseases, including tuberculosis, are the urban poor in metropolitan Lima/Callao as well as in other urban centers along the coast, and in eastern Peru.

Launched by WHO and UNAIDS in 2003, the "3 by 5" initiative aimed to provide treatment with ARVs to three million people in low- and middle-income countries by the end of 2005. This ambitious target was based on a 2001 analysis of what could be accomplished with an optimal combination of funding, technical capacity building, health systems strengthening and political will and cooperation.

To facilitate the ARVs scaling up process in Peru, the Institute of Tropical Medicine Alexander von Humboldt and the faculty of Medicine Alberto Hurtado, supported by Global Found, set up a distance learning project in 2004 to facilitate the use of ART in Peru. Target population of this online training are physicians working in remote areas with PLWHA.

Out of 24 Peruvian Regions, 20 were involved in this online training with specifically 68 physicians, responsible for the management of HIV/AIDS patients and ART administration (Figure 1). From April till November 2005, 55 out of 68 physicians successfully completed the training.

This online course consists of 12 modules covering several aspects of ART as adverse effects, antiretroviral schemes, resistance, ART in children, ethics.
Each module lasts 2 weeks and consists of pre and post test, presentation, discussion forums, clinical cases and summaries of scientific articles available on an electronic platform (Figure 2).

A front of 68 students admitted to the course, 12% have quit the online training, although solicited by e-mail and telephone.

The first group of trained students has been assessed after the training and 88% affirmed that the operational system has been easy to use, 100% liked the methodology and 98% classified the course as good/very good (Figures 4 and 5).

90% of our students thought that 2 weeks per module was an appropriated or well appropriated timing for each module. It gave them time to review and to practice with all the course content. We should always consider that those students are physicians managing a fully clinical activity during the same study period.

Each module consisted of different HIV/AIDS care topics as general introduction to antiretroviral therapy, second line treatment, immune reconstitution syndrome, HIV co-infections, etc.

In Table 1, the pre- and post-test scores showed that in all the modules the students had an average increase of knowledge.

<table>
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<th>Post-test</th>
<th>Variation</th>
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<tr>
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<td>16.62</td>
<td>↑ 21.5%</td>
</tr>
<tr>
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**Conclusion**

Telemedicine is an effective and practical method of providing clinical support and continuous training for physicians treating HIV positive patients in remote areas. Those preliminary data has substantial implications on the way to address the eLearning and continuing medical education evolution in Peru.

Several academic institutions are now looking to expand their teaching programmes using online courses and these findings could help in tracing a pedagogical model and a suitable way of communication between professionals working in remote areas and central stations delivering information.
E-learning as instrument to fight HIV/AIDS in Peru

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Abstract

This paper overviews a general situation of telemedicine and eHealth in Poland seen from the Polish Telemedicine Society perspective. The telemedicine has been developing in Poland for over a decade. First concepts of telemedicine as a new approach to medical care were published in 1996. Many local and unique applications have been built since that time, based mostly on “islands of enthusiasm”. Main directions of the telemedicine development are parallel to the general specificity of telemedicine. Telediagnostics is widespread in many medical specialties – mostly based on professional videoconferencing systems. Internet serves as a main communication platform for newly created interactive teleeducation systems. Periodical conferences are broadcasted online including congresses for telemedicine.

Telediagnostic plays an enormous important role in clinical settings. Historically cardiologic applications using teleECG devices were represented as first on Polish commercial medical market. Teledermatologic and teleradiologic consultations are frequent in many centers. Telediagnostic services are often supported with Computer Aided Diagnostics, Decision Support Systems and combined with Picture Archiving and Communication Systems (PACS) and Radiology (RIS), Laboratory (LIS) and Hospital (HIS) Information Systems.

Telediagnostic and teleconsultations are provided in various specialties including orthopedics and traumatology of the locomotor system, oncology, cardiology, thoracic surgery, laryngology and many others.

Telerehabilitation is evolving in Poland, providing services for musculoskeletal diseases and cardiologic patients. E-Health services are aimed mostly to share medical information not only among patients or potential medical services clients but also among physicians, in order to rise up the access to medical resources. Some services are dedicated to certain groups of users, namely medical students learning medical topics. The contact with eMedicine for new beings in medicine should begin during the first course of medical studies. Anatomical web services for students are developing intensely leading to better knowledge gain as well understanding and acceptance for the expanding telemedicine in daily practice.

Many medical centers in Poland are involved in the national, European and international projects devoted to telehealth, eHealth and telemedicine. The main feature behind the progress of further development of the telemedicine and eHealth is foreseen with more engagement of the government and National Health services.

Key words: telemedicine, eHealth, attitudes toward telemedicine, telediagnosis, telediagnostic, telescreening, teleradiology, telerehabilitation, mobile telemedicine.
**Introduction – Understanding telemedicine, teleHealth, eHealth**

Space research programs are undeniably one of the most crucial factors stimulating the development of telemedicine. The development of biotelemetric systems is also connected with exploring distant areas of the globe. Remote monitoring of physiological symptoms is also the basis of contemporary telemedicine. The growing interest includes legal aspects of actual delivery of medical services at a distance as well as providing services which give the doctor a completely independent position without his direct contribution. Expanding the possibilities of telemedical system application is often the result of implementing highly developed information technology. Medical telematics is also a term connected with telemedicine. Even the WHO adopted this term for remote actions in health protection. This and other consecutively created terms variably define the mutual relations between doctors and patients in the aspect of distant medical help. In the last decade of the 20th century there has been an explosion of services regarded as "e – commerce" which created new ways of making financial and business transactions with the use of the Internet. Many new "e – ..." terms have been created, and among them was eHealth. E-Health has been introduced as a consequence of the popularized e-applications and the development of the telemedicine concept. The terms eHealth and telemedicine, though not properly distinguished, are widely used by academic institutions and other organizations. Understanding these terms strongly depends on previous educational experiences. The unification of these terms requires standardization of approaches, discussions and arrangements. Definitions adopted by the Polish Telemedicine Society are clinically oriented. It is hoped that a better understanding and defining perspectives of telemedicine and eHealth will lead to an improvement in communication and cooperation between various specialists in the field of technology and medicine. Definition of eHealth is based on many various terms connecting medicine with technology. It includes the Internet and all technologies related to it. eHealth represents a new concept in medical care and it integrates medical, communication and information technologies. Telehealth covers therapeutic, preventive and promotional aspects. Therefore, the definition also describes offering medical and information services with the use of technology and telecommunications. The term eHealth, especially in Europe, is used as a "protective umbrella" covering telehealth, patient’s electronic history and other components of health information technologies. Telehealth can be used not only for clinical services but also for nonclinical including matters connected with medical education, administration and scientific research. Telemedicine focuses on therapeutic aspects. The idea of eHealth provides unique possibilities for the development of public health. The WHO and other UN organizations set strategies for eHealth, which materialize goals in areas such as public health, providing of medical services and even management. The main parts of these strategies focus on "eHealth for everyone until 2015". eLearning plays a crucial role here. Currently the term eHealth has been adopted and used by many medical specialists, academic institutions and representatives of technology in medicine. Telemedicine focuses on similar goals but is restricted to the patient – doctor relations that is those where the patient becomes the final beneficiary. The term eHealth has been created as a substitute for telemedicine. At the beginning of the 21st century terms such as "online health" and "eHealth" have become more popular due to the expansion of the Internet. The meaning of eHealth, focusing on offering distant medical help, is in some parts the same as the meaning of telemedicine. The main strategic lines for telemedical societies include integrating applications in the field of eHealth in medical care systems together with the development of standards, guidelines and information and education materials. National Centers of Excellence in the field of eHealth and telemedicine induce cooperation for developing Evidence Based eHealth. E-Health for citizens, patients and medical personnel should meet the quality and safety criteria as well as ethical standards. The specific description of telemedicine as an "integrated use of information and telecommunication technologies in the medical care sector" induced the definition of eHealth as an "umbrella" describing the integrated use of electronic communication and information technology in that sector for clinical, educational and administrative purposes. Rational explanations of Rosen present some differences between telemedicine and eHealth. Allen 2 stated that telemedicine is tightly connected with professional personnel whereas eHealth is usually related to patients, consumers or other non–professionals. Although telemedicine is not the "panaceum" for solving problems in medical care, it is a new, interdisciplinary approach to
medical practice offering huge potential and development perspectives. The aspects of work responsibility, legal permission for doing a certain job and other clauses have significant meaning for the definition of telemedicine.\textsuperscript{6,18,35,39,73,74,82,87,95,96,99,100} The mobility of information, not of the patient is still the core of actions undertaken in telemedicine. Some of the advantages of telemedicine are: improving access to information, enabling the delivery of medical services which were earlier impossible to deliver.\textsuperscript{64} Along with new technologies (the Internet, smartcards and satellite communication) telemedicine develops and there is a notable increase in its potential and social awareness of it. Although the final organization of teledical services is slower than the simple delivery of new equipment,\textsuperscript{94} telemedicine progresses and is directed towards supporting Evidence Based Medicine.\textsuperscript{2,7,19,39,50,63,73,82,96,99} However, ethical and legal aspects as well as the influence of human, cultural, linguistic factors and other current problems have not yet been fully solved. One of the issues on the way to progress is financing of the services offered with the use of telemedical systems.\textsuperscript{2,18,23,82,94} A lot of attention is given to the security of medical data systems so that no one can access confidential medical data without authorization. Further expansion of telemedical solutions depends on joining efforts in order to develop legislative and organizational basis. The area of research in telemedicine progresses mainly thanks to groups of enthusiasts, which can be replaced with clearly defined and explained programs in the future. This approach should widen the scope of using telemedicine with a simultaneous cost reduction. A better understanding of the meaning and perspectives of telemedicine, eHealth and telehealth will certainly improve the communication and integration among specialists who are thought to belong to two "different" worlds – a medical and a technological one.\textsuperscript{35}

**Attitudes towards telemedicine in Poland based on various surveys**

The expansion of information technologies induces an increase of interest in distant services not only among doctors but also patients. Medical services based on internet technologies or mobile phones are known as telemedicine. Teleconsultations, telesurgery, telediagnostics or telerehabilitation are an attractive enrichment of the traditional healthcare system. However, little is known about how patients regard these new ways of offering medical services. Various surveys analyzed the need, willingness to use and attitudes towards new phenomena typical for telemedicine as well as citizens’ needs in this matter.\textsuperscript{83} Interviews carried out among 1005 respondents aged 15 and more showed that the term "telemedicine" is not at all familiar with as many as 42% of the people questioned. A completely wrong understanding of the term was noted in a group of around 10% of the respondents who thought it meant either telepathic or parapsychological services (5%) or that it was a TV program (5%). Quite often (21%) in May 2006, the respondents associated telemedicine with advice given on the Internet.

Knowledge about telemedical services proved to be quite satisfactory as 44% of the people surveyed have heard about at least one of the actually offered telemedical services. However, on the other hand as many as 56% of the respondents have never heard about any of such services. The majority of the people interviewed (25%) thought that such services were information about the availability of various specialists e.g. on the Internet. A general acceptance of telemе-\textsuperscript{11} 5 26 37 49 12 14

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<tr>
<td>76-85</td>
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Fig. 1. Chęć uczestniczenia w telerehabilitacji w zależności od rodzaju telekomunikacji (tak – zainteresowanie, nie – brak zainteresowania).

Fig. 2. Poziom zainteresowania uczestniczeniem w telerehabilitacji w poszczególnych grupach wiekowych.
Selected telemedicine and eHealth applications, initiatives, surveys and reviews

...medicine reached 46% of the respondents. A limited willingness to use telemedicine and the range of existing telemedical experiences in Poland can change providing that many initiatives will be implemented and many research programs will successfully be completed. The lack of interest in telemedical services (regardless of their type) is the result of a lack of confidence towards such services and belief that direct contact between a patient and a doctor is necessary.

It is reassuring though, that there is a lot of interest in phones, which are devices potentially easy to use in telemedicine. 42% of the respondents would be willing to use telemedical services on the phone. It is even more promising due to the fact that around 70% of people in Poland have a mobile phone. Even in the group of people above 60, 20% use a mobile. The interest in telerehabilitation was examined in a group of 251 orthopedic patients and the results showed that 81% of those surveyed, was interested in telerehabilitation especially on the Internet or with the use of TV programs.

The age of the patients is one of the factors influencing the level of interest in telerehabilitation. The biggest interest in this form of therapy was noted among professionally active people between 36 and 45 years old, whereas the smallest, among people over 76.

It also turned out that the level of interest in telerehabilitation is not connected with sex, but with patients’ education (the higher it is, the bigger the interest).

Review of selected initiatives of telemedicine and eHealth in Poland (beyond the society)

Many specialists continue their debate about how to implement telemedicine, telehealth and eHealth. Many applications are developed by researcher’s teams spontaneously and enthusiastically. Those teams may not necessarily be associated to particular institutions or other organizations.

A lot of discussions are undertaken by various specialists how to implement telemedicine and eHealth across the country. Many of the telemedicine applications are developed spontaneously by enthusiasts associated or not to Telemedicine or Medical Informatics societies. Their efforts improve significantly overall understanding of telemedicine needs and influence on attitudes toward telemedicine and eHealth among either patients or physicians.

Many initiatives require being mentioned, awarding or even following. The great and multiply awarded already successes have been noted in ENT telemedicine and eHealth. Skarżyński et al. have developed program of early identification of hearing loss in newborns. That idea expanded by using various telecommunication modalities including GSM mobile network and the Internet as well. Currently, the www service offers eHealth solutions for hearing loss, vision impairment, tinnitus and speech disorders. Many other valuable telehealth initiatives are continuously under development by International Center of Hearing and Speech, Institute of Physiology and Pathology of Hearing. The service is operational in two languages. The GSM operated Noninvasive audiometric service become available since July 2002.

Projects in telemedicine often utilize devices capable to transmit electrocardiographic signal. New innovative constructions are designed and manufactured as homeborn products, i.e. device made by PRO-PLUS. The device and CardioScp software allowing medical data acquisition is the work of domestic technology as Turczynowicz emphasized. Above mentioned teleECG system permits the cardiologic patients monitoring during their daily private life activities, where the ECG signal achieves cardiologists computer in real time. Patients are supplied with multipotent transmitters that are able to use locally available telecommunication media: Internet, GSM network (CSD, HSCSD, GPRS, EDGE, and UMTS), Bluetooth, and others. The devices used to permanent patients monitoring and diagnostics, medication control, rehabilitation or monitoring of patients who are transported to hospital. All new, available Technologies are implemented and used by the Internet, GSM or bluetooth operated teleECG service. Cellular network operator has actively and significantly influenced on new Polish telemedicine studies and development.

Fig. 3. Poziom zainteresowania telerehabilitacją w zależności od wykształcenia.
Telemedicine systems are often developed for use in cardiology. Cardiologists lead by Piotrowicz, have found that use of teleECG devices increases safety of the rehabilitation of the cardiologic patient at home. Their pilot study has confirmed the decrease of anxiety level, rise of patient’s quality of life, and general fitness improvement.

Telepathology has found its own way of development in Poland. Szymaś et al. have presented online Internet-based robotic telepathology diagnostics of neuro-oncology cases. Their approach was based on the neuropathology, operating a robotically controlled motorized microscope over the Internet from 3 different Polish cities who individually reviewed the cases using computer workstations. Telepathology diagnoses were compared with conventional paraffin section diagnosis. High diagnostic accuracy for telepathology diagnosis and user acceptance of robotic telepathology was achieved.

Glowacki et al. have developed a fast and efficient neurosurgical teleconsulting network to improve acute neurosurgical patient care, to reduce transport costs and unnecessary occupation of neurosurgical beds. Simple to use and accepted by operating physicians Neurosurgical Teleconsulting System has significantly improved acute neurosurgical patient care. Network connects Department of Neurosurgery, Polish Academy of Sciences in Warsaw with hospitals in Ciechanow and Ostroleka.

The team of specialists, deeply involved in Medical Telematics, from AGH-University of Science and Technology in Cracow presented architecture migration aspects of contemporary telemedical systems. They discussed the medical teleconsultation systems Konsul I, II and III designed and successfully implemented under Krakow Center of Telemedicine at the John Paul II Hospital. Additionally, the TeleDICOM teleconsultation system was presented as effective for clinical teleconsultations.

Duplaga et al. developed teleconsultation services for respiratory medicine. They implemented remote consultations to bring high-level competencies to peripheral hospitals through telecommunication links as one of the key aspects of Krakow Centre of Telemedicine (KCT) activities conducted in 2002–2003. Peripheral centers at pulmonary wards situated in local hospitals or policlinics were joined to referential center located in the Division of Interventional Pulmonology, Jagiellonian University Medical College through PC-based telemedical workstations and ISDN lines (256 kbps). The team of researchers from the same center have presented the strategy employed within the project called PRO-ACCESS directed to facilitate the e-health development in Central and Eastern Europe countries (CEEC). The project initiated in the late phase of fifth Framework Programme as supporting action focused on the medical Telematics to countries remaining in the pre-accession phase to European Community. The Krakow Centre of Telemedicine was involved in the process of dissemination of up-to-date approaches to e-health environment development.

Integrated Medical Informatics Systems and Computer Aided Diagnosis methods are also developed targeted to support teleradiology. Piętka et al. have developed remotely accessible e-atlas for bone age assessment.

Holynska et al. have predicted that introduction of telemedicine programs in the health service units of local and specialist levels should make possible to evaluate the applicability and advantages of using these technologies in the whole Polish health care system in the future. The wide range of possibilities in providing cancer care at a distance has been presented by Wysocki et al. They have discussed the theoretical and practical aspects of teleoncology including a multidisciplinary approach to cancer patients.

More practical approaches were also documented. Rules of telephone poison information service for general public and telephone toxicological consultation for medical staff; mainly physicians were presented by Targosz et al. They described guidelines for call management: necessity of caller assessment while dealing with information given to the general public and factors that influence successful telephone encounters as well the types of questions that are appropriate to ask about patient, considering both the patient state and the toxin(s) involved while dealing with a telephone toxicological consultation. Simplest kind of teleconsultation is serviced by many Toxicology Departments. Telephone informative service has been implemented to respond to inquiries children 15 years old and less. Specialized systems have been developed by various groups of scientists devoted to telemedicine. Krzystanek and Opala have analyzed 281 electronic mails
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to a neurologist concerning medical consultation finding this kind of teleconsultation services at referential centers as an important area of telemedicine development. Electronic mail is used as the successful tool for telepsychiatric medical service. The uses of electronic mail in psychiatric advices performed anonymously have shown that 75% of patients referred their own psychiatric problem. The most frequent reasons of consultation were: a cry for help (44%), question about a disease (27%), consultation of a diagnosis (16%) or a therapy (13%). The biggest groups of symptoms related to fear (38%), mood disturbances (18%), schizophrenic symptoms (13.5%) and sexual dysfunctions (10.5%). They concluded that psychiatrists on the Internet may expect an increase of electronic mail applicability in psychiatric advising. They reported also a need of medical, legal and ethical regulations of by-Internet doctor-patient relationship. They observed that electronic mail may be treated as a source of knowledge on psychopathological symptoms and epidemiology of mental disturbances amongst the internet users.

Telemedicine is considered as an attractive tool for the family physician. Kasztelowicz have pointed out network security aspect of medical information transfer looking for the optimal security solution.

Bożewicz et al. have developed the telecardiotocography system designed for outpatient evaluation.

University of Medical Sciences in Poznań, Poznań University of Technology and Poznań Supercomputing and Networking Center utilize opportunities created by the PIONIER optical network and build a range of advanced distributed teledical services enabled through a web portal interface "Telemedycyna Wielkopolska". The unique and innovative "The Integrated Emergency System" has been designed by Plus GSM network. This system allows lifeguards and rescuers to reach the injured and provide emergency services effectively. The emergency numbers, 0601 100 100 (water emergency services) and 0 601 100 300 (emergency services in the mountains), are available not only to Plus GSM subscribers but also to all interested parties, and are accessible to each mobile or fixed telephone. Upon dialing a relevant number, emergency calls are directed to Regional Rescue Coordination Centers to immediate dispatch of its rescuers to the site.

Above mentioned selected examples published already in the literature do not describe all of much longer list of projects and initiatives in telemedicine and eHealth, by non society members in Poland.

Review of selected initiatives and Project by Polish Society members

Teleeducation in (tele) medicine

Tele- and eEducation, eLearning are becoming a new practice in studying medicine. Moreover, teleeducation and eTeaching may be considered as an introduction to telemedicine and eHealth. Web based teleeducation include undergraduate courses and postgraduate Continuing Medical Education (CME). eLearning techniques can help students acquire clinical skills in the safety of a simulated environment within the context of a problem based learning curriculum. In anatomy, Web based materials form practical exams ("pin tests") and are available 24/7 helping medical students to improve their practical skills usually shortly before the exam what is noted by a sudden rise of web page visiting. Overall visitor’s number usually doubles every alternate year.

Internet-based CME programs are just as effective in imparting knowledge as traditional formats of CME. Szymaś has described his experience in creating and using telepathology system and multimedia database for education with some modules which are available through the Internet.

Newer forms of eTeaching and refreshed educational materials lead to a continuous improvement of skills in Internet resources utilization. Rise of interests and educational activities are expected to increase positive attitudes toward telemedicine among healthcare professionals. Continuous Medical Teleeducation (CMT) is going to evolve in various specialties. Demartines et al. have analyzed the value of teleconferencing for patient care and surgical education by assessing the activity of an international academic network. In their study, eighty-six percent of the surgeons expressed satisfaction with telematics for medical education and patient care sho-
wing benefits of teleeducation in surgery. Webcasts and Webinars are becoming more and more popular due to their cost effectiveness, almost equal value but no travel expenses. Web service of Center of Excellence "TeleOrto" not only inform about new conferences but also remain the streaming source for physicians willing to attend orthopaedic and trauma courses. On site eConferences are webcasted online. Chat online allows the attendees to actively ask questions to the presenter. Attendees are logging utilizing password. Visitors from distant countries Far East, Africa or Europe have already become an almost monthly routine. Tele-education broadcasts may supplement other CE activities but may not replace them. Multimedia computer-aided learning in medicine will introduce important changes in surgical education. Utilizing telemedicine videoconferences distance education can be provided for medical students, physicians and other health-care professionals, such as nurses, physiotherapists and pharmacists. Improvements in videoconferencing systems, accepted by lecturers and participants, permit interactive distant communication and decrease its costs. Teleeducation videoconferencing seems to enable providing and receiving CME credits without traveling long distances. Web based seminars may not replace conferences or lectures in person but teleeducation broadcasts may supplement other Continuing Education activities.

**Regional activities – Lower Silesia**

Initiatives and telemedicine and eHealth projects are developed on local, regional and international scale. There is a main concern in telecardiology, eLearning, Family Medicine and primary care, eHealth portals and consumers surveying. Some examples will present the wide spectrum of regional telemedical/eHealth activities. The project "E-health Network" is conducted by Lower Silesian Centre for Advanced Technologies (DCZT), located within Wroclaw University of Technology.

The main goal of this project is an improvement in accessibility to health services of the region’s inhabitants. Another important aim is to enhance contacts between physicians, hospital management and administrators, as well as IT and IS managers and consultants.

The key element of the "E-health Network" is the development of the Internet platform for telediagnosis, teleconsulting (e.g. telespirometry in children asthma, telecardiotocography in prenatal telemedicine), telecardiology (e.g. teleECG in coronary heart disease), teleradiology, e-prescribing, Regional Medical Data Centre, e-health management, patient education, and further telemedicine applications. Several R&D projects have recently been selected for carrying out in the nearest future.

The Karkonosze Mountain Centre for Interventional Cardiology began its teleECG activities in June 2001. The Centre is located in a brand-new 600-bed regional hospital in the city of Jelenia Góra, and comprises a unit for coronarography and other interventional procedures, a 14-bed ITU and an outpatient clinic. In November 2001, the first Polish telecardiology system for emergency ECG data transmission (teleECG) was initiated in cooperation with the local emergency ambulance service. Eight ambulances with resuscitation equipment have been provided with defibrillators containing diagnostic ECG modules. Both cardiologist at the Centre and emergency physician in ambulance make a joint decision about the patient’s transfer to hospital if an interventional procedure is required or thrombolytic treatment right away. Another teleECG application has been carried out for early detection of cardiac arrhythmias, by a non-public Lower Silesian Centre for Cardiac Diseases "Medinet" in Wroclaw, since October 2004. The telemonitoring system was invented and developed by an enthusiastic medical student with a special interest in medical informatics.

The Department of Family Medicine of WMU has developed a few telemedicine applications for primary care in Lower Silesia since 2000. In the years 2000–2002, the Department of Family Medicine of WMU, together with the Department of Computer Systems and Networks (Faculty of Electronics, Wroclaw University of Technology) developed the TelFam – a prototype system of telemedicine services for family doctors’ practices. The entire project was funded by a grant from the State Committee for Scientific Research (KBN). The TelFam, Lower Silesian system for primary care teleconsulting and patient telemonitoring that link 10 practices of Family Physicians (both urban and rural) within a range of 200 km, servicing for local population of 25,000 individuals to Academic Family Medicine Center. The real-time consultations among health care providers are supported by a computer network. The ongoing pilot project "Telemedicine sup-
port for diabetes management" is carried out by the Department of Family Medicine, WMU, since 2003, to demonstrate and evaluate a telemedicine system for management of diabetic patients. The system consists of a patient’s unit and a doctor’s unit connected by the telecommunication network. Both modules can communicate over the Internet or the public switched telephone network (PSTN). The pilot study has demonstrated the feasibility of this telediabetology support. The cross-border co-operation has been established within the thematic sub-network "Health service provision" consists in providing health care by specialized medical institutions in the area covered by project "EU-MED-EAST", increasing patient mobility through the introduction of an electronic health card, and joint purchasing (as a cross-border health care logistics). (The tripartite project "EU-MED-EAST – Regional cross border networking in the health and social sector", designed for the health and social sectors, of the "ENLARGE-NET – Regional cross border networking between cities and regions", and co-financed under the EC initiative for border regions (INTERREG) in the years 2004–2006[28]. The Lower Silesian e-health portal for the public "e-medyk" (http://www.e-medyk.info) was set up in autumn 2005, and launched on October 1st. The design and development of this portal by health professionals only remains its unique feature.

The researchers from Lower Silesia (Wroclaw Medical University) are involved in two other European eHealth projects: "E-health consumer trends survey" and "European MedSkills".

The main objective of the international project “WHO/European e-health consumer trends survey” co-funded by the European Commission is to monitor European health consumers’ use of, their attitudes to, and their needs with regards to information and communication technology for health purposes.14 Seven European countries: Norway (leading partner), Denmark, Germany, Greece, Latvia, Poland, and Portugal ensure a broad European coverage and to compare different regions.

The "European MedSkills" is a pilot project co-funded by the European Community Vocational Training Action Programme ‘Leonardo da Vinci’ for 2004–2007. Its main aim is to create a unique World Wide Web realistic training and learning environment for evidence-based medical skills, with the use of multimedia educational material and virtual reality [86, 69]. The promoter of this project is the Free University of Brussels (VUB), and the partners come from six different European countries: Belgium, Greece, Italy, Poland (Wroclaw Medical University), Spain, and the UK.

**Telediagnostic screening in posture, spinal and thoracic deformations**

Sitnik et al.[84] have invented the completely new approach to body surface digital acquisition, what has fund its implementation in orthopedics for further analysis. The interdisciplinary team of University of Technology and Medical University of Warsaw has conducted pilot studies, for posture evaluation which aim was to study telemedicine oriented system and methodology of three-dimensional (3D) measurement of the man’s posture and automatized analysis’ of acquired to use in diagnosis and monitoring of progresses of treatment and rehabilitation. The investigation of posture and spinal deformations in children is of special interest in a frame project of National Programme of Health for years 2006–2015.

The occurrence of scoliotic and other thoracic deformations may become apparent in teenage years and elderly, with both cosmetic and functional consequences. Screening tests are recommended for evaluation of the problem scale in the entire population. Spinal deformations may also appear later in older population due to osteoporosis. The developed concept of telediagnostics system based on 3D shape measurement system is designed for posture evaluation that may be applicable to children, adults and elderly. Structured light measurement method is utilized. Proposed system can work in two states: stable laboratory installation with direct connection to database system or remote measurement unit with slow and limited connection to database by GPRS/EDGE/UMTS protocol.

Diagnostic stands connected to database give the possibility to review patient’s records for better posture diagnosis. On the other hand, there are many mobile systems manufactured with one or two directional modules which can be operated by technical staff only. These modules are connected to database by slow GSM network. The concept is to put on-line smaller patient’s image and calculate final features from whole measurement data. Accurate measurement data in the form of cloud of points will be updated in database when measurement system will be connected...
to the Internet by broadband connection. The developed system consists of Digital Light Projector (DLP) and matrix detector (industrial CCD camera) and operates on high resolution images. The evaluation is based on sinusoidal fringes and Gray codes projection. The cloud of \((x, y, z)\) points is received as a result of measurement. On the base of automatic analysis of these clouds, positions of characteristic areas and relative features of measured shape are calculated. Described features describe 3D posture status. Otherwise healthy children were selected for the preliminary study. Optometric system (3D MADMAC) was utilized to measure and evaluate the human back shape three dimensionally. Fringes projection by 3DMAD/MAC system is significantly accurate that allows to measure whole examined surface as well as small eminences located on the body of examined patient. Preliminary assessment presents only the example of measurement technique, its applicability and highest accuracy.

**Teleradiology**

Teleradiology is a means of electronically transmitting radiographic patient images and consultative text from one location to another.\(^6\)

**Integration of digital and networked world for diagnosis**

Medical diagnosis and intervention increasingly relies upon images, a growing range of which is available to the clinicians. Undoubtedly, radiological exams are becoming an essential source of diagnostic information. Full radiological interpretation process involves image-based detection of disease, defining disease extent, determining etiology of the disease process, assistance in designing clinical management plans for the patient, based on imaging findings, and following response to the therapy. Diagnosis making routinely employ a variety of imaging modalities. The fundamental and vital aspect is the interpretation of the collected image data, referring to the physician’s knowledge and experience. The physician’s knowledge is based on normal and pathological anatomy, physiology, pathophysiology and specialized clinical data of examined organs and structures, completed by experience and cognitive intuition \(^12\) is the only key to their proper understanding and assessment of medical images. However, limitations of the human observer are widely known and computer-based aid is sought to be an essential remedy for challenges of revolutionary changes of the medical imaging world.

Nowadays the purpose of computer-aided radiological interpretation is improving the efficiency of interpretation process of large image data sets, decreasing diagnostic errors, improving the integration and time-effectiveness of radiological information exchange (communication), and the development of standardization and medical interoperability. The ultimate goal is to enhance the quality and safety of patient care.\(^3\)

The Concept of integration derives from meaning that radiology is not an image information-based island, but a part of the human-oriented world-wide ocean. The Integration of various factors can help to determine what information and knowledge that a user does not have but requires is really needed. Those factors include:

- widely distributed databases, networked local knowledge environments and global access tools based on semantic web services and grid technologies,
- configuration of current best evidences in making decisions about the care of an individual patient based on the standardized procedures, diagnostic protocols, formal and explicit specification of conceptualization, i.e. ontology, to effectively represent specified domain knowledge,
- shared decision-aiding tools, the diagnosed and verified reference image exams, content-based indexing tools for effective image data retrieval and extraction of required information,
- procedures of telediagnosis and teleconsultation, rules of responsibility, accessibility and diagnosis objectivation, inter-dependences, etc.

Information such as the reason for the imaging examination being ordered by the refer-
ring clinician, laboratory data, and patient clinical history, in addition to cross-specialty and cross-modality imaging should be both, integrated through domestic information systems with telemedical support and easily accessed. Optimized decision support tools will provide more valuable information to end-users, but need to be more integrated into the world-wide initiative for diagnosis.

The purpose of designed computer-assisted medical systems is the completeness of supplied aid to improve the diagnosis. However, the visualization and navigation of all accessible medical information requires the efficient selection of all the information necessary to make effective clinical decisions without distracting the user, followed by the information synthesis in territorial and distance barrier-free world-wide environment. Automation by integration can improve database information quality, as well as facilitate improved user interfaces, computer-aided tools, and pre-emptive detection of errors before they propagate. The importance of provided information quality, a support of computer-aided diagnosis (CAD) systems and teleradiology, flexible adjustment to various needs, and easily accessible examples of pathology cases, quick and precise retrieval is crucial.

Advances in integration may require new open standards, the continued evolution of the National Electrical Manufacturers Association (NEMA), Digital Imaging and Communications in Medicine (DICOM) standards, and increased adoption of the framework of Integrating the Healthcare Enterprise (IHE) in imaging systems. Greater acceptance of IHE initiative concepts means the integration of hospital and radiology information systems (HIS, RIS) with picture archiving and communication systems (PACS). Real-time CADs at the PACS display and tele-consultation desktop with web-based reference systems (e.g. content-based indexed image databases) will be useful through better integration and verification of information richness.

End-users want more functionality but simpler user interfaces. Intelligent user interfaces (IUI) should be designed with the following features and demands: efficient and reliable visualization of all useful information, adoption to human performance and limitations, intuitiveness and consistency, flexibility and easy configurability (to accommodate different types of users and different types of imaging examinations), appeal and idiot-proof. IUI is based on effective models and metrics for function task lists to read different case types, workflow guidelines, common language and best practice for hanging protocols.

For any medical condition, there would be huge gains if one had a pan-national database – as long as that (federated) database appears to the user as if it were installed in a single site. Such a geographically distributed (e.g. pan-European) database can be implemented using the so-called Grid technology. Interesting initiative of integration was done for mammography. MammoGrid project was developed towards providing a collaborative Grid database analysis platform, in which statistically significant sets of mammograms can be shared between clinicians across Europe. Mammogram standardization system was applied to enable the comparison of mammograms in terms of tissue properties independently of scanner settings, and to explore its place in the context of medical image formats (e.g. DICOM). Such initiatives provide a channel to make software solutions available to a large number of telescreening centers, with the aim to perform quality control and set a common ground for epidemiological and other reference studies. Access to image databases with large numbers of verified cases for training and testing of CAD algorithms and a reliable optimization of decision support tools is a priceless benefit.

Implementation of integration

The integration is essential for the improved diagnostic data evaluation, decision-making and finally high-quality patient care. However, data gathering, flow and exchange standardization, IUI design and communication of the results are a great challenge for life science community. Multidisciplinary team of engineers (Warsaw University of Technology and cooperative informatics enterprises), radiologists (Departments of Radiology from Wolski Hospital and CMKP CSK MSWiA in Warsaw) and mathematicians (Warsaw University) studied and developed concepts of integrated diagnosis support. The realization of integrated teleinformation system for clinical and research purposes is permanently developed and optimized according to the integration philosophy and criteria presented. Technological integration made on different levels including the functionality and structure is presented in Fig.
Fig. 5. Designed TeleInformation Radiology System (TIRAS) with surrounding networked environment.

Fig. 6. General concept of mammographic ontology tools.
The fundamental, as integrated as possible, elements of TIRAS system are as follows:

1. Ontology based platform as a source of objective knowledge for computer-assisted diagnosis, optimization of CADs and content-based image indexing (Fig.)

Generally, ontology formulates Knowledge Base for integrated radiology support. Its role driving to evidence-based medicine seems to be extremely important for development of reliable teleradiology applications. The efforts directed to medical knowledge standardization, objectivation and at the same time to making interactive consultations and collaboration of experts with full functionality possible and reliable seem to be especially valuable for telemedicine.

2. CAD tools for mammography (Fig.)

The aims of the study were to make progress in the development of a computer-based system for the automatic detection of microcalcification clusters and segmentation of individual objects on mammograms (Wróblewska in 78). Optimized detection and classification methods were validated in clinical tests using diagnosed databases (Digital Database for Screening Mammography from the University of South Florida and exams collected from 2 hospitals in Warsaw, Poland). Microcalcification detection technique which is developed by us is a combination of a) wavelet–based methods and convolutions with Laplacian filters of different scales for localization of bright spots (potential microcalcifications), b) DBSCAN (Density Based Spatial Clustering of Applications with Noise) for grouping signals and thus verification of detection, and c) finally morphological and region growing methods for shape reconstruction. Sensitivity of close to 90% was initially achieved with a mean number of 1.6 false positive clusters per image (within tests localization threshold was selected manually).

3. Reference database of image exams with indexing of semantic data content and fast retrieval

Effective ways of image local features computing for selective characteristics of different modalities, lesions and pathologies were studied. The original concept of wavelet-based semantic points was proposed by Boniński 4 to indicate diagnostically important regions in order to extract effective attributes of image index.
4. Teleinformation system integrating PACS, RIS, HIS and telemedicine tools with useful IUIs.

One of the goals of radiology management should be encompassing of the development of a robust practice environment that emphasizes workflow enhancements with seamless integration of decision support and task automation tools. It is developed by our idea of the teleintegrated information system where the conclusive role is design of useful and reliable integrated human-computer interface.

Concluded condition of integration is ontology-like support. Nowadays roles played by ontologies are multiple. Primary goal of ontology is to effectively represent domain knowledge, adequately and exhaustively define relevant concepts, object characteristics and relationships between them, to provide a common, standardized vocabulary meaningful to humans and machines by which users and computer systems can communicate. Thus ontology means systematization, objectification and verification, knowledge base of the model populated with concepts’ instances constitutes standard diagnostic knowledge database. Ontologies are the foundation of the Semantic Web, where integration and interoperability of heterogeneous sources of information is needed. Ontologies form also the basis foundation of evidence-based-medicine and standardization efforts.79

Standardized terminological system in mammography already exists; it is BI-RADS (Breast Imaging Reporting and Database System). But BI-RADS have not been univocally accepted, and what is more important there is no clear evidence that its use improves completeness or accuracy in mammogram descriptions, 101 moreover there are indications of its limited expressiveness for encoding mammography findings in databases. Other shortcomings of BI–RADS are: lack of hierarchical terms organization, simplified, lesions descriptions and inconsistent diagnostic criteria. More exhaustive, consistent and formal system for lesion description classification and interpretation is necessary. Ontology is the best candidate to face these problems, and help building useful and necessary computer-based aid in mammography.

For that purpose mammographic ontology has been constructed by Podsiadły-Marczykowska.9,79 It has three main goals. The first: to provide standard vocabulary and formal, exhaustive definitions of concepts for description and interpretation of mammograms. The second: modeling of mammography report. The third: to use ontology as specification for designing a database of mammography reports and graphical editor for pathologies description. Other potential uses of mammographic ontology are: educational tasks, as an assistant tool for diagnosis in mammography, and content-based indexing of mammograms database. Knowledge for ontology construction has been extracted from three sources: corpus of routine, free-text mammography reports (close to 400), long-term interviews and consultations with radiologists at local hospital and careful wide range analysis of medical literature. During the phase of knowledge acquisition manual methods have been used.

Despite of its known draw-backs BI-RADS is a good starting point in construction of mammographic vocabulary. It contains rudimentary lexicon for allowing description of basic visual features of masses and calcifications. Mammographic ontology incorporates more detailed and more diagnosis–oriented, definitions of such concepts as: breast composition, calcifications, architectural distortion and axillary lymph nodes.

After gathering a relatively complete vocabulary of mammographic terms, an initial set of concepts, their properties and relationships between them have been identified. Concepts have been structured into subsumption hierarchy, properties of concepts have been modeled and described in natural language. This informal model has been formalized using ontology editor Protégé-2000 version 3.1, allowing export of the ontology to machine readable formats (RDF, XML). Ontology has been divided into small, internally coherent components-modules. A goal of modular design is to achieve explicitness of the ontology and to support knowledge reuse and maintainability. Definitions of all concepts used in the model and their instances form Knowledge Base of the ontology. Part of the Knowledge Base containing instances of classes from module Breast Lesions deserves special attention, because it is a described set of images of different mammographic pathologies.

At the moment mammographic ontology contains 141 concepts-classes, arranged on 7 hierarchy levels (breast lesions is the most nested module) and is permanently developed. To enable feature description of ontology concepts 145 slots were defined and total count of objects in the model was 687: classes, slots and instances of classes. Assumed and target advantages of our system are:
reliable and sound knowledge representation based on diversified acquisition sources, use of frame-based knowledge representation which is cognitively simple, intuitive and easy to understand for radiologists, domain knowledge sharing between applications such as: database and editor for mammography reports, CAD and system for indexing mammogram reference database.

To sum up, the ontology exists in a tree format, structuring key mammographic features of breast disease, linking directly both with the methods a radiologist would use to identify the abnormality as well as how a CAD method might also identify, measure, classify and understand the abnormality. The ontology further enables the inference of breast disease according to the visible features of the abnormality as it appears on a mammogram. The ontology, initially, may be used as a common platform for the comparison of a radiologist’s and a CAD’s effectiveness at identifying breast pathologies on a mammogram. In addition, the ontology may be used as a foundation of content–based data exchange between humans and computers to make human knowledge more objective and computers more “human” (i.e. understanding the semantic information). Other potential uses of mammographic ontology are content-based description and indexing of mammogram reference database, educational tasks, modeling of exam reports and GUI for description of pathologies.

Fig. 9. Conception of integrated IUI for telediagnostic support (a) and current implementation (b).\textsuperscript{55}
This IUI is supported by Image Shark10 system consists of several modules, which are fully integrated. The most important modules are CBIR, semantic indexing based on ontology and CAD procedures, distributed searching, DICOM server, compression utilities. All key functionality is available via web service, thus integration possibilities with other PACS and telemedicine systems are greatly wide. The part of Image Shark functionality related to the content is currently encapsulated.

**Orthopaedic Trauma Telediagnosics**

The system of telediagnostics and decision support in treatment the fractures based on analysis of diagnostic imaging data, quantitative and qualitative is developed in the Center of Excellence "TeleOrto". The possibility to assess the image by consultants from distant Medical Center Specialized in Fracture healing evaluation seems to be the next logical step in progress of diagnosis of fracture healing. The remote diagnosis of fracture union uses the numerous analytic tools the Computer Assisted Decision Support System. Analytic tools developed already are incorporated into the system, already.
PDA phones in telemedicine

New technologies enter very widely the field of telehealth. New developments in IT technologies have recently emerged to bridge the traditional gap between imaging, reporting and consultation processes. Physicians involved in the treatment of injured patients require rapid access to images. Advanced telecommunications technology as higher resolution PDA phones handsets with multi-media messaging (MMS) service as well as videocall capabilities may enhance simple store and forward and direct telemedicine system for transfer of the medical images and to support accurate management decisions. Our study confirmed that PDA phones equipped with digital cameras for image and video capture can be used as an efficient tool facilitating rapid diagnosis in multiply injured patients. Nowadays diagnostic equipment used for diagnosis of politraumatized patients generates large number of images. Cooperation among various specialists is time consuming when not efficient system for data and image transfer is available. The adoption and use of PDA phones to images accessing, collecting and transfer in clinical setting for decision support in trauma cases.

PDA phones are becoming increasingly popular among medical professionals, however radiology-specific applications installed on PDA devices are not commonly used. Imaging information evaluation is demanded by radiologist and clinicians dealing with emergency medicine and traumatology, where no PACS/RIS/HIS environment is available. The resolution of a typical single slice of CT image of resolution 512 × 512 pixels consumes around 0.5 MB. This size file requires resizing for further transmission. This process will reduce the image detail to less than half of the image detail of the original DICOM image. The DICOM is the most common image format in PACS61 designed for imaging scanners, computed radiography, film printers, and display workstations. At present there are a little display capabilities for PDA phone to present DICOM images. The images of conventional radiograms and CT scans were sent as MMS images. Teleconsultations were made between PDA phones through direct communication. Transferred image size was limited to 100 Kb. MMS messages were created and sent to provide fast teleradiologic consultation. The accuracy rate of 95% for image interpretation using a PDA was higher in the studies of Yaghmai et al. than that, reported by Reponen et al. The advent of wireless or GPRS/EDGE/UMTS operating PDA phone introduces the possibility of remote image interpretation and medical consultation. Evaluation of medical image by medical specialists based on remote transmission requires adequate, clinically relevant image quality. Our study evaluated the capacity of the PDA phone to serve as a medium in the diagnostic interpretation of plain X rays and CT scans of patients with multiple injuries. We have found that implementing MMS has the potential to facilitate the rapid, relatively inexpensive teleconsultations to make an accurate management of politrauma and musculoskeletal injuries. MDA and mobile phones images are rather informative than diagnostic now, however the fast technology progress will probably change it. Display quality on PDA phones improves progressively. Similar improvement is observed through image transfer speed while utilizing these devices rather than fully operating PDA device for teleradiology should be expected soon. A new method of portable image interpretation and display devices will able to revolutionize the field of radiology and subspecialty medical consultation. Our data suggest that high-quality images from a radiogram or CT scan can be successfully displayed on a PDA pho-
Telerehabilitation

Telerehabilitation is considered as the delivery of rehabilitation services over telecommunication network. Clinical assessment, clinical therapy and physical therapy are mostly utilized in telerehabilitation. The rehabilitation practices in some specialties have explored telerehabilitation namely: speech-language pathology, occupational therapy, musculoskeletal and physical therapy. Telerehabilitation can deliver therapy to people who cannot travel to a clinic because of the patient, environment or other reasons. Webcams, videoconferencing over telecommunication (POTS, the Internet, ISDN, GPRS and UMTS), videophones and WebPages containing Internet applications are used to deliver telerehabilitation services. "TeleOrto" Center of Excellence has provided a pilot study utilizing Internet based application and 3G mobile phone videocall for telerehabilitation. The 3G network has speed relatively approaching to the current broadband network, but the mobility is far greater than that of the broadband network. The types of rehabilitation services offered by telerehabilitation are limited. Telerehabilitation services are rarely reimbursed but many health insurers consider to cover them. The use of haptics and virtual reality may broaden the scope of telerehabilitation practice in the future. A real-time web-based monitoring system may greatly enhance the capability of the clinician to direct rehabilitation therapies. Distance monitoring of rehabilitation exercises has been primarily conducted using two-way video conferencing. Wireless videoconferencing technology has the potential to meet in-home rehabilitation needs because it is mobile and allows two-way communication.

"Telerehabilitation System v.1.0" is based on remote Server. Eligible person may connect to his server from any location on Earth. Verified user is logged to the system and connects to remote server – Internet operating Flash Media Server.

A physiotherapist, who leads the session, has the opportunity to regulate communication parameters, which allows focusing on exercises and attending telerehabilitation sessions. The referring physician may attend the session as well. The application makes it possible to choose the camera (Web camera or professional) or webcasting parameters – i.e. compression quality, frames per second, etc. The application may operate "1 to 1" or "1 to many" that means one physiotherapist may supervise single or many patients. Additionally supervised telerehabilitation sessions allow

![Fig. 12. Web site of telerehabilitation application logging page – therapist site.](image1)

![Fig. 13. MDA 3G telerehabilitation session through Videocall.](image2)
Selected telemedicine and eHealth applications, initiatives, surveys and reviews

instructing the patient how, when, where and how long to apply physical therapy using the home therapy device (i.e. portable PEMF device). Most of all sessions were positively assessed by attending patients. 3G videocall telerehabilitation sessions were well accepted. Mobile Digital Assistant (MDA) Qtek 9000 and 3G enhanced mobile phones (i.e. K600i) were utilized. Despite small overall dimensions of the devices rehabilitation sessions were efficient and satisfactory for the patients.

Patient’s fitness (endurance) as a final telerehabilitation treatment outcome may be evaluated by mobile phone application – “PulseTester”\textsuperscript{98}. This application seems to be the first application developed for mobile phone, allowing simple physiological tests performance without other additional equipment. That makes the mobile phone with specialized software capable to serve instead of simple equipment required for endurance testing. The usefulness and functionality of this application has already been tested. Results could be stored in the phone’s memory or send via GPRS and stored on dedicated server for further retrieval and analysis. An application, realized in Java technology MIDP may operate on almost all mobile phones with implemented Java.

**Conclusions**

Not only around the world but also, inside the country, telemedicine becomes an interdisciplinary environment, that enhances to transform health care. There are some chances to improve the quality of health services by reducing waiting time for specialist’s consultation, shortening consultation time itself and finally raising its accessibility. The reviewed selected domestic achievements in telemedicine and eHealth allow drawing an impression, that telemedicine is gaining more and more advocacy that shifts into quantity and quality of new inventions and applications. Its development is not dependent on organizational framework. However, cooperation may support its direction toward research and applications into the whole health care system. Further development requires meeting particular technical and organizational conditions and overcoming barriers standing on its way to expansion. Modern technology implementations, particularly teleinformatic, not only increase accessibility to specialized services, and fast "second opinion", but also support diagnosis verification for optimization and treatment rationale. In real telemedicine direct physicians engagement remain essential. That affects not only telemedical procedures, but also professional liability (responsibility), even while using Clinical Decision Support Systems. Follow-up of many implemented telemedical solutions to health care sector allows concluding, that we become witnesses of the giant qualitative and substantial improvement in health care as well in its organization and legal aspect.

Fig. 14. “PulseTester” menu: A – option selection, B – fitness test selection, C – Result.
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Telemedicine and Space Technologies Applications for Health in Romania

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Abstract

The paper intends to provide a survey of the space application domain, strategic and operational contribution to the development of the Telemedicine, Health-Care, eHealth, e-Government, e-Inclusion and related fields in Romania. Some already developed, significant projects and the work intended to be done in perspective are reported.

Key words: Telemedicine, Mobile Telemedicine, Satellite Communications, Satellite Navigation, GRID Computing, Human Performance.

Introduction

As in many countries, around 2000, an increasing interest for telemedicine as an operational tool for medical assistance and medical education began to rise in Romania. There where several initiatives, as small demonstration projects emerging from the medical, educational and societal context, attempting to pioneer the telemedicine in Romania. Although successful, most of these first projects were bilateral international cooperation, poorly correlated and based on conjectural opportunities and funding.

A new opportunity rose at the moment of the launch of the public-funded, National Research, Development and Innovation Programme "AEROSPATIAL" managed by the Romanian Space Agency (ROSA) as Contracting Authority. In the frame of this Programme was defined, among others, a strategic direction, the Space Applications Sub-programme, dealing with terrestrial spin-off’s of Space Technologies such as satellite communications, Earth observation, disaster management, and of course, telemedicine.

By the time the national beneficiary community as well as the international cooperators manifested interest, reported results and where published overall surveys on the telemedicine in Romania.¹²

At the present moment, the telemedicine and subsequent applications for eHealth, e-Government, e-Inclusion and other societal applications of medical act at a distance and medical data management through means of the IT&C technologies are in rapid progress based on the endeavor of several scientific, technologic and managing communities, both public and private.

Further, in this paper the roadmap of telemedicine, health care and human security applications developed under ROSA coordination will be submitted to attention.

The Telemedicine Need in Romania

The telemedicine need in Romania is controlled by the characteristic environment displaying remote undeveloped/inaccessible areas, disaster (flood, seismic activity) hazards, medical assistance
to be improved, as well as new threats to human health and security as epidemics, (bio) terrorism, border security, etc.

The conditions above lead to critical requirements as better resource sharing and management, mobile and remote medical assistance, integration of clinical databases, improvement of continuous medical education and, last but not least, national, regional and international integration and compatibility.

To efficiently fulfill the needs, the ROSA’s vision is related to a coherent approach and a strong strategy implementation that were forged into its own approach of telemedicine and proposed to partners outside the space research and applications.

**The Strategy**

**Space Technologies vs. Telemedicine**

The space technologies spin-off is deeply implied in terrestrial applications that emerge from space research and applications. Even that, basically, a colloquial phone consultation with a medical doctor would be telemedicine too, we do target more sophisticated applications aiming to clinical, diagnostic and education medical act performed at a distance through specific means of the information and communication technology. More than that, presently, most human biological wellbeing and human security applications require, are based or are related to space spin-off’s or imply telemedicine. Our vision on this interdisciplinary and interdependent landscape is shown in Fig. 1. and the strategic implication of ROSA as coordinator of telemedical and health space technologies applications is suggested in Fig. 2.

![Fig. 1. Space Technologies Spin-off.](image1)

![Fig. 2. The ROSA Umbrella.](image2)

In order to propose and promote a coherent strategy and a fertile scientific and technological pool of specific competences reliable instruments were created.

**The Strategic Instruments**

Beginning developing projects, mainly under "AEROSPATIAL" Programme, ROSA fostered the establishment of a first collective infrastructure dedicated to polarize the interest and pool the competences in telemedical and health applications. Consequently, the Excellence Center for Space Applications in Medicine and Human Biological Welfare was created as a virtual scientific organization. The Excellence Center engendered the present Association for Telemedicine and Space Applications for Health (ATASS – according to the acronym derived from the name in Romanian language) aiming to act as a professional association with NGO statute.

ATASS³ has basically the mission to coagulate competences and R&D interest in the field of telemedicine and other space technology applications for health such as human performance,
countermeasures for degenerative physiological affections and communicational integration of medical data. Figure 3 shows the roadmap of ATASS.

The development of projects was made, through competitive tender, by consortia putting together research and development, medical and technological organizations, public and private. The major member organizations of these consortia grew experience and comprehension of the ROSA’s strategic approach coherence in such a manner that their research directions are compatible and comply with the developing strategy of space technology applications for health. This phenomenon leads to complementarities and sparse effort and resources to develop new projects aiming at the strategic objectives. In fact, an informal Consortium for Space Applications for Health was defined, including organizations and companies, Romanian and foreign, that had already cooperated to develop projects. The consortium is open and, we hope, should act as an attraction pole for new competences and new excellence in the field of developing applications and new concepts aiming to put together Space Technologies, Information & Communication Technology and Sciences of Life in the benefit of health-care, health recovery and preservation, as well as the human biological wellbeing.

The current composition of the Space Applications for Health consortium is as follows:

Romanian Public Partners:
- Fundeni Clinical Institute (ICF);
- Institute for Space Sciences (ISS);
- National Institute for Sports Research (NISR);
- Constanta County Hospital;
- Floreasca Emergency Hospital;
- Tulcea County Hospital;
- Institute for Aeronautics and Space Medicine (INMAS);
- "Lucian Blaga" University – Sibiu;
- National Institute for Aeronautics and Space (INCAS).

Romanian Private Partners:
- Medisystem Hospitals S.A;
- InterNET srl;
- RARTel SA;
- OnlineSolutions Media srl;
- Bio-Consult srl;
- Donna Maria srl;
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- Motrix Asistent srl.
International Partners:
- VCU-MITAC NASA Research Center (USA);
- Microsystems srl (Italy);
- Eindhoven University of Technology (Netherlands).

The projects referred further in this paper are developed in teams that are subsets of the above composition and, for the sake of the present report will not be mentioned explicitly. The above list is a recognition of the participation to an overall endeavor to develop space applications for life in Romania.

Some Significant Project Directions

Permanent Telemedicine Facilities

Naturally, at the very beginning, we were preoccupied to establish major nuclei of telemedicine facilities, included in important hospitals, in such a manner that our developments, complying and completing other’s initiatives could lead to a first framework of a National Telemedicine System capable to connect with similar facilities in regional and international networks. In this respect, our Space Applications for Health Consortium significant contributions are installed in Fundeni Clinical Institute in Bucharest,4 in Floreasca Hospital in Bucharest and in Constantza County Hospital.

Figures 4 and 5 presents synthetically the Fundeni Clinical Institute Telemedicine Pilot.

Fig. 4. Fundeni – functional environment.

Fig. 5. Fundeni – technological support.
Monitoring and rescue service

The SMOPERR project is intended to simulate a rescue service for persons with high risk of survival (cardiovascular patients, diabetic patients, persons with disabilities, aged people, etc.) based on monitoring and transmission of vital parameters, in cooperation with global positioning and navigation. The goal was modeling a pilot of the service in simulated conditions in order to evaluate its potential for other social spin-off, as further applications in sports, health care and security.

Figures 6 and 7 are comprehensive for the functionality of the pilot.

Fig. 6. SMOPERR Principle of Operation.

Fig. 7. SMOPERR Functional Landscape.
True Mobile Telemedicine

The major preoccupation of our partners now is to implement true-mobile telemedical facilities. That means to have mobile, autonomous, infrastructure of independent medical equipment that must be plug-and-play into the existing telemedicine communication system. The good premises for developing such equipment/functionality are based on an already mature practice in “classical telemedicine” such as telediagnostics, teleradiology, teleconsulting and continuous distance medical education, good IT&C infrastructure and know-how, wireless data communication resources including Mobile Telephony and Satellite Data Communications, WEB based technology and applications expertise. The application intended to be used in rescue, critical medicine and emergency fits the landscape presented in Fig. 8.

The equipment developed is, basically, a portable, autonomous, consulting kit defined as the Mobile Telemedicine Unit (MTU) that deploys in field and enters the telemedicine communication system (through mobile data telephony or satellite communication) in less than 10 minutes. It has facilities for vital parameter acquisition and transmission (ECG, temperature, SpO2, heart rate, blood pressure), multimedia online communication between the in-field location and, virtually, any major medical facility connected to the telemedicine system. The system and service was tested in the Danube Delta, in a context presented in Fig. 9, as well as in several locations all over the country.

Using new, emerging technologies and concepts
GRID Computing Medical Applications

GRID computing, as defined in the reference, is seen from the medical perspective as an intensive IT resource for the management and analysis of medical and human performance data in digital format. The goal is to better manage huge amount of information and extract scientific knowledge.

Turning the existing experience in Romania on GRID computing into profit, we proposed, in cooperation with other GRID application developers, to establish Life-GRID Virtual Organizations (VO) oriented to medical or human performance applications.

The infrastructure available on what relays our present GRID application is presented in the Fig. 10. The first project developed as VO with medical research benefit was InGRID, an interdisciplinary bitmap/vector image-processing application with a medical data section.

Human Performance Applications
The Human Performance Concept is, presently, intensively referred, in different contexts, all over the world. Each context has its own specific perception of the concept and we have forged
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our own: The HUman Performance – HUP – is a holistic concept referring the human being capabilities to face and adapt to conditions beyond its physiological and ontological conditioning. The Human Performance, in this respect, can be assessed, trained and enhanced.8

This concept is used by us in the context of interdisciplinary cooperation between medical knowledge and sport performance, biomechanics and neuro-muscular control knowledge in the benefit of neuro-motric recovery, countermeasures to degenerative affections, protection of the human being in hostile, extreme condition environments and, last but not least, personal human being wellness.

Two human performance and GRID computing related projects have to be mentioned here: HUP-GRID and ETREM-GRID that deal with research for general human performance enhancement and, respectively, with better management of the health protection of people professionally (firemen, divers, pilots, astronauts, etc.) or occasionally (extreme-sports practitioners, explorers, etc.) subject to extreme environmental conditions.

Ethical Issues

All the projects developed under ROSA strategic coordination, including the examples reported, are in strict compliance with bioethical and privacy requirements of the EU regulations.

The reported developed projects are intended as research pilots, designated to be transferred to final medical beneficiaries. The medical data privacy, if the case, is strictly observed at the level of pilot application and, if transferred or used as they are in real medical application, are provided with means of restricted, authentication-based access for observation of patient personal privacy.

Future Expectations

We do expect a further development of the telemedicine and space applications for health domain in Romania, relying on the societal demands, the public benefits awareness and on the national and international political will context.

There are good opportunities for international cooperation based on bilateral scientific community’s agreements of cooperation as well as on institutional ones:

– Romanian Government – NASA Agreement;
– Romania’s admission as Cooperating Member State of ESA;
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– ROSA – Virginia Commonwealth University (NASA Research Center) Memorandum of Understanding;
– ATASS – AITIM (telemedicine associations from Romania and Italy) Memorandum of Understanding.

We are committed to enhance the international cooperation to support and foster our Space Applications for Health domain development into a regional and global context.

Acknowledgments. Intellectual Property Rights

The author of this paper reports the mentioned projects from an overall point of view of the strategic, coordinating body of Telemedicine and Space Application for Health activity, namely ROSA.

Gratitude and acknowledgment have to be expressed for the contribution of specialists, organizations and companies to the development and implementation of the projects and applications reported. Unfortunately they are too many to be individually named in this paper, even though some have outstanding contributions.

It is also to be acknowledged that some pieces of equipment, concepts and applications referred to in this paper are subject of intellectual and/or industrial rights belonging to persons and/or organizations, members or not of ATASS and of the Space Applications for Health Consortium. These rights are, according to the particular situation, in different phases of protection process.

References

Abstract

The problem of creation and operation of universal telemedicine systems is historically connected with space medicine that has an extensive experience in development and application of biotelemetry systems. The successful experience of space physicians with support of the Russian Academy of Science enabled to start systematic activities on telemedicine that directly or indirectly defined telemedicine as one of the long-term trends of Russia’s national policy in the public health area. Today we’re at the beginning of an utterly new stage of Russian telemedicine development – establishment of a telemedicine service system on the base of telemedicine technologies. This work is supported by the Russian Academy of Medical Sciences and participation of its leading institutions. The article focuses on modern approaches to formation of state policy and unified methodology of telemedicine service system development in Russia. In modern society science and technology are quickly progressing. It’s essential to make a base for coordination of promising scientific programs, to elaborate ethical and legal principles of new telemedicine achievements application.

Key words: telemedicine technology, telemedicine service, telemedicine system, space medicine.

Medical informatics has come to being as a domain of basic and applied research after fertilization of medicine, the oldest human occupation, by informational technologies. In the history of mankind information of the medical nature was passed on using every way possible. However, it was emergence of modern informatics and telecommunications that provided technologies for a broad variety of remote medical services. In our days this is certainly the mainstream toward an intellectual breakthrough and new success in healthcare. Medical informatics and telematics offered boundless opportunities to healthcare which is why in 1997 the World Health Organization felt it relevant to put into circulation the term "medical telematics".17 The concept of medical telematics encompasses different functional aspects including tele-education, telematics for medical researches, healthcare services management, and telemedicine proper.

Historically, evolution and exploitation of universal telemedicine systems is inseparably linked with space medicine which has extensively tested capabilities and functionality of the biotelemetric systems.2,3 The first application of telemetry in space flight was monitoring of the physiological parameters of dog Laika flown on Sputnik-2 in November 1957. In the ensuing period of manned space programs real-time monitoring of crew health status, medical prediction and management, and evaluation of effectiveness of health maintenance procedures were fulfilled by the ground medical personnel on the analysis of data received remotely with the help of telemetric facilities for medical examination and orbital therapeutic and preventive instruments and supplies. Enhancement of the telemedicine system for piloted space vehicles by integration of high-grade informatics and telematics technologies is one of the prioritized approaches to increasing the effectiveness of medical care in current and future space programs. At present, Russia advances space telemedicine in close international cooperation in conjunction with the International Space Station and projected Mars exploration programs.
The importance of assimilation by health services of the technologies applied in medical care of space crews was demonstrated in Russia first during a series of telemedicine "bridges" thrown across the ocean under the auspices of the USSR-US Working Group on space biology and medicine. Of particular value are records of telemedicine practicalities at the sites of the earthquake in Armenia in 1988 and gas pipeline explosion in Ufa in 1989. This joint project will go down in history as the laying of the Russian telemedicine infrastructure and also as the first-ever experience of enlisting international medical experts to assist to victims of catastrophes by the instrumentality of telemedicine. Follow-up of this project implemented at the Space Biomedical Center for Training and Research (SBC) was popularization of telemedicine for ground applications, demonstration of advantages of reliable and low-cost technologies like the Internet for the needs of telemedicine, and setting up a base to provide fundamental training in telemedicine to students of medical schools. From the outset the Russian Academy of Medical Sciences (RAMS) displayed its commitment to bolster and advance telemedicine technologies and sponsored several interesting and successful telemedicine projects. A program of building a corporative network of the Federal medical centers was launched in cooperation with the Government of Moscow. Bakulev’s Research Center of Cardiovascular Surgery (RAMS) and the Research Institute of Pediatrics and Children’s Surgery (Russian Ministry of Health) commenced a cooperative project known as “Moscow to the regions of Russia” to extend the field of telemedicine to the country periphery. Thus, the Academic community helped assimilate patterns developed by space physicians which, both in the direct and indirect ways, raised telemedicine into one of the long-range challenges of the national healthcare policy. There was nothing accidental in that in 1996 the Collegium of the Ministry of Health commissioned experts in space medicine with the development of the national telemedicine program.

The program of building up the telemedicine system in Russia (TELEMEDICINE) was drafted at the SBC jointly with the State Scientific Center – Institute for Biomedical Problems (IMBP). Discussion of the program sparked active interest of and was backed up by leading clinical, scientific and educational centers within the RAMS structure and found support of regional governments. To accomplish the program, the Telemedicine Foundation was established in 1997. The Foundation was then constituted by RAMS, Ministry of Health, Ministry of Science, Russian Space Agency, Ministry for Catastrophes, Russian Academy of Sciences. Among the founders were big medical, educational and scientific Centers. The Foundation embarked upon implementation of the TELEMEDICINE program taking it for its action plan.

Superimposed for digital and radio communications, the Moscow sector of the Foundation telemedicine network was used several years in field testing of telematics technologies with involvement of the best clinics and regional telemedicine centers. The telematic systems have been actively exploited by medical information centers in Russia and CIS members. Under way is preparation for opening centers in some other Russian regions and expansion of the federal distributed telemedicine center. A medical data electronic exchange technology has been tested within the unified network of the State electronic system "Elections" of the Central Election committee of Russia. Now there are a medical imaging technology to provide distant consultation and a network to link together the authoritative narrow specialty federal consultation centers, and capabilities for on-line (video conference) and off-line consultation. Regional centers and some clinical hospitals can now receive consultative services of almost 20 medical centers in Russia and other countries.

Practicality of the telemedicine technology with respect to emergency medical care and life sustenance in extreme conditions was evaluated with the use of the mobile telemedicine system originally intended to subserve the needs of space medicine. According to the administrators of regional and local hospitals, ground modification of the system would be of great utility in medical examination of the population in regions which are difficult of access, for family doctors, sanitary aviation, and rescue services. The recently developed infrared telemetric tool can be used as in hospitals, so in homes, and to monitor health of employees at potentially dangerous industries. Very successful was a project on transtelephone ECG monitoring co-sponsored by the International Telecommunication Union (ITU). Other aspects of telemetrics application in health services were explored, too.

Special effort was given to training users of the telemedicine technologies. To this end, the course in telemedicine was delivered in the Foundation quarters to medical students and also
to general practitioners and technical and information personnel from clinics and hospitals. Besides, the first Russian textbook on clinical telemedicine was published.\(^6,15\) Information distributed through the Internet is constantly updated and augmented. The Foundation pursues broadening of the Russian involvement in international programs in this area. The Foundation represented Russia in WHO telemedicine consulting sessions, the telemedicine ITU group and in the Telemedicine project of the "countries of the eight".\(^19\) There are tight contacts with the International Society for Telemedicine and eHealth and the American Telemedicine Association, research and clinical centers in the neighboring and remote countries. The Foundation came up with the initiative to hold the Moscow International symposium on Telemedicine convened jointly with IBMP (1998), the ITU (1999), and the Medical Center of the Administrative Department of the President of Russia (2000). The latter was supported by all international telemedicine organizations and prominent experts in the field from all over the world. About 300 participants from more than 25 regions of Russia and 13 foreign countries attended the symposium. The symposium of 2001 was held under the auspices of the President representation in the Far-East federal region (Khabarovsk).

In recent years, medical personnel of the leading clinics of the country, many of whom had been earlier suspicious and doubtful about the telemedicine technology, seemed to feel its attractiveness. Those were patients who put trust in the capabilities of telemedicine. It is far in the past when telemedicine was an occupation for single devotees, especially among the doctors infatuated with the computer techniques. More and more clinical and educational centers deploy telemedicine capabilities to provide health services distantly. To our knowledge, in the Russian Internet alone nearly 40 institutions announce availability of teleconsultation services. Telemedicine centers function in more than 60 subjects of the Russian Federation; many clinics procure equipment to deploy own telemedicine network. There are a number of local (territorial, regional, self-rule district) telemedicine programs.\(^11\) In full swing is development of methods for distant training of medical professionals and patients. The global Internet network gives medical people and patients access to more than 20,000 resources of information, and the number goes on to grow headlong. Attempts have been made to expand the telemedicine application domain by dynamic observation of patients in homes. Some institutions undertake internal telematic health management projects.\(^10\) The telemedicine boom in recent years speaks for recognition of the effectiveness and good prospects of telemedicine in improving quality of health services. It is a realistic statement that we are on the threshold of a qualitatively new phase in the evolution of Russian telemedicine which is construction, based on the telematic technologies, of a national system of telemedicine services.

Apparently, the future telemedicine system will not have a uniform structure; neither will it belong to a sole department. The strategy of moving the telemedicine services to the Russian market suggests creation of a matrix managerial structure that will coordinate an association of enterprises and institutions varying in the form of territorial-functional affiliation. The government should keep an eye on that telemedicine makes progress toward a better satisfaction of health care needs of the most indigent or insufficiently served population. No less important is integration of telemedicine into the medical systems for emergency and catastrophes. Being a product of concerted efforts of different governmental and regional programs and exploited by institutions of varying form of property, the system of telemedicine should be technologically and structurally homogeneous to take up the call of the government in case of emergency or hostilities.

There were multiple attempts to set up an inter-institutional coordination of the activities aimed at introducing telemedicine into health services. Since 1997 this has been responsibility of the Telemedicine Foundation. The Telemedicine Association was established in 2000. Also that year the Ministry of Health appointed the Telemedicine Coordinative Board which, co-operatively with RAMS, worked out and endorsed "The concept of telemedicine technologies development".\(^8\) In 2001, the Foundation suggested to the Committee on Health Protection and Sport at the State Duma an idea to establish a Review/consultative board to provide a legislative basis to telemedicine and informatics within the Russian healthcare system. The Foundation action plan was used by the Board to outline the concept of telemedicine services in the Russian Federation. On 20.05.2002 the conceptual document\(^12\) was approved at the Parliamentary hearings and recommended to the
Russian government as a basis for defining a federal program. Recommendations of the Parliament circulated to the Russian government and relevant departments contain also the guidelines concerning priorities of the national policy in telemedicine. Following these recommendations, the Ministry of communication and informatics took a decision to support the telemedicine section of the program called "Electronic Russia". Yet, the major goal, i.e. establishment of the national policy and standards of the telemedicine system in Russia still remains unresolved.

Today, «telemedicine services» are interpreted as provision of medical information and health services through the use of telematics, and associated structures. Depending on the character of contacts between users telemedicine services can be classified as teleconsultation and remote diagnostics, monitoring of patients, telemedicine training, and what is known as Internet-medicine. Telemedicine raises a broad range of legislative, ethical, technical and regulation issues.

The objectively existing legal vacuum already now puts hurdles to the diffusion of telemedicine technologies. On the analysis of the legal field of telemedicine in Russia and international regulations on this issue, members of the Foundation and the Review/Consultative Board drafted telemedicine legislation accepted favourably at the Parliamentary hearings. Text of the act "On telemedicine and telemedicine services in the Russian Federation" has been streamlined and we hope for its enactment in 2006. The act is supposed to baseline the legal framing of telemedicine in Russia. In future, the legislative base will be refined and elaborated, and its execution will be promulgated and enforced.

As for now, in the high light is development and introduction of basic technologies and setting structures for providers of telemedicine services. The Foundation and the Central Research Institute for Healthcare Management and Informatics drew up guidelines to facilitate planning and control of telemedicine projects using the strategic management technologies. These include methods of telemedicine services management and information interchange, sequential increase in the range of services, and involvement of off-budget sources of financing in anticipation of investment earnings. Winning potential of the telemedicine market, teleconsultations in particular, has been clearly demonstrated by the results of our investigation. Medium of patients officially referred for consultation and treatment outside the region of abode amounted to 0.38 per 1,000 population as was revealed by the random interrogation of regional medical administrations in 1997–1998. In the opinion of some of the administrators, the numbers were belittled as a part of patients left for treatment on their own and, therefore, fell out of the official statistics. Also, there were those who could not afford to go. We have to admit it that the necessity to consult a patient elsewhere is not always accepted by the doctor in charge. Given appropriate equipment, we may anticipate increasing of the number of medical indications for teleconsultation, improving of the quality of diagnostic and therapeutic consultation, and other services.

With this trend of developments, the scope of inter-regional teleconsultations may exceed two million recourses a year. It is supposed that teleconsultations at international clinics may reach 100 thousands a year. Even a very conservative estimation of the demand for remote consultation within a region suggests as many as 15 million recourses a year.

The investment strategy of moving telemedicine services to the Russian market involves optimization of both own and borrowed capital on different phases of the program to make it alluring for external financial creditors. However, at the start of the proposed TELEMEDICINE project first investments will most likely be made by governmental agencies to pay expenses on the program conceptualization, development and preliminary review, and on pre-investment efforts, i.e. research & development, putting into operation and early running. On the investment phase the amount of credits needs to be approximately 87.8% of the total cost of the phase. Early on the running phase the compensation system will be set in motion as is customary in all market-economy and most of the developing countries. Further into the project we plan a step-by-step changing to the principle of economic accounting and self-repayment and subsequent re-investment into expansion of the system of telemedicine services.

Cuts in prices on communication systems and service lines and reduction of the computer power as well as appearance of Russian hard- and software will ensure the highest social and medical effect from telemedicine diffusion with relatively low capital investments. For example, the estimated cost of equipment for the working place of a doctor to start giving telemedicine consultations is several thousands of USD or a little bit more expensive as may be required for
the imaginary scope and types of consultative exchange. A part of equipment (computer and scanner) can be used for other purposes and, therefore, the risk to investment will be lowered. The economic efficiency of telemedicine is often considered by the comparison of costs of, for instance, arrangement of patient’s consultation in a federal medical center in the ordinary way and using the telemedicine capabilities. Of course, the farther patient who lives, for example, in Moscow may save more money, particularly on tickets. Another common approach is estimation of the recoupment of investments into replacement of the well-established technologies by telemedicine. Thus, introduction of no-film radiology into clinics is money’s-worth as because there is no expense on the film, so due to a more efficient distribution of manpower resources. Evaluation of the economic efficiency cannot not be restricted to the above approaches and should be made on each level of the healthcare structure. Preliminary evaluation predicts improvement of the quality of medical care through intensification of the diagnostic-therapeutic process and more prudent use of the labor and physical resources. Indeed, the latent potential is high here. For example, three years of teleconsulting under the program of high-tech medical assistance to only three nosologic categories (congenital heart disease, surgical tuberculosis and oncologic hematology) in the Irkutsk region (Siberia) brought an economic effect of almost five million rubles as a result of reduction of the period of treatment and hospitalization, and appropriate expenditure of the federal quota.

Factors objectively influencing evolution of a healthcare sector should be sought for in general trends of the national policy, economy, social life and technology within the observable timeframe. Acceptance of telemedicine is preconditioned by the nonuniform distribution of labour forces, including medical professionals, which is present in varying degrees in all countries Russia not excluded, and worldwide. The ground for this is economic disproportions and continued urbanization. It is believed that in foreseeable future these trends will become even stronger. For this reason, telemedicine services like teleconsultation and distributed education will be of growing demand. Aging of the earth population increases objectively the number of patients who require permanent monitoring by medical personnel. Modern healthcare systems place emphasis on the competence of family doctors, medical assistance in dispensary, and benefits of preventive medicine. This stirs up the demand for remote monitoring of patients in homes. Economic expansion onto new territories, employment of modern patterns of work management (shift work), emergence of new markets of medical services triggered by, in particular, the growing mobility of population will speed up promulgation of mobile telemedicine services. Recognition of the role of human factor in breaking out of extreme situations and catastrophes puts on the agenda the problem of medical monitoring of employees of potentially dangerous industries. These and other factors objectively underlie the growing demand for the telemedicine services. At the same time, the brisk development of technologies and formation of a universal information space on the planet lay a solid ground for successful assimilation of informatics and telematics in healthcare. Distribution of information to patients, reliance on prophylaxis and self-treatment and inoculation of the health style at large motivate population to resort to the help of telemedicine services.

Telematics is supposed to essentially improve the quality of medical care, contribute to strengthening of the structural and functional links within the system providing healthcare services to the people of Russia, and expedite achievement of the state of the art technological level and integration into international networks. The governmental agencies should demonstrate their commitment to forwarding telemedicine by participation in, among others, long-range planning of development of telemedicine and associated areas of social life including healthcare, education, communication and technology and budgeting at different levels, and to draw up and adhere to a complex program of telemedicine diffusion into the regional healthcare systems. There should be incentives for medical employees, students, and physicians to learn and practice telemedicine technologies, and specialized research programs to inquire into the role of human factor in telemedicine maturation and assimilation. A matter of importance is to make a structure that will design and validate hard- and software for use in telemedicine systems, and oversee compliance with requirements to the quality of services, confidentiality of medical data and interoperability of telemedicine applications.

The modern society witnesses the onrush of scientific progress and technologies. Future of telemedicine will lie with miniaturization of monitoring equipment, introduction of smart-tech-
nologies, robotics, and advanced informatics. However, a real break-through in the this century is likely to occur at the junction of life sciences with physics, mechanics and computer engineering, and to be sped up by achievements of applied nanotechnology. Therefore, already now we should embark upon setting ground for coordination of forward-looking research programs and define ethical and legal principles of application of recent developments in telemedicine.

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Telemedicine in East of Taiwan

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Abstract

The mountainous aboriginal villages in Taiwan share similar characteristics with other rural and remote regions in developing countries, the most significant one is the shortage of doctors. Though circuiting medical service has been developed for years, the lack of data communication reduces the efficacy of the service. In 2002, some rural clinics had been connected to the Internet with M-Taiwan project to improve quality and efficacy of the circuiting medical service. The ADSL and WLAN-based system was deployed for each of 34 village health centers where the outpatients are diagnosed by the circuiting medical service periodically. This paper examines the approach used to design the network and concludes with lessons learned that could be applicable for other rural regions.

Key words: telemedicine, wireless, aboriginals.

Background

In Taiwan, telemedicine is indivisible from health of aboriginals. The reason is that almost all inhabitants in remote mountainous regions are aboriginals. According to a report,¹ 37% of 432,516 aboriginals in Taiwan live in these mountainous regions where telemedicine is demanded most.

Taiwan is one of few countries that deploy overall health insurance to nationals in the world. There were 21,869,478 individuals that enrolled in the NHI program, with a coverage rate of 96% in 2002. Though BHNI (Bureau of National Health Insurance) reported that the public satisfaction levels had reached 59.7%² we urge that overall satisfaction rate and that for aboriginals should be evaluated separately due to following different life styles and medical characteristics:¹

1) Death causes: The top 3 of aboriginal death causes were the same as those of the general population (malignant tumors, injury by accidents, and cerebrovascular disease). However, tuberculosis death rate for aboriginals was 6 times of that for the general population; cirrhosis death rate was 4 times of the general population.
2) Infant death rate: The infant death rate for an indigenous infant living in a mountain village is twice of that for infants living in plain areas or cities (the rates are 1.2% and 0.599% respectively).
3) Average life expectancy: The average life expectancy of indigenous peoples was shorter than that of the general population for 10.19 years in male and 5.96 years in female.
4) The usage of medical resources in health insurance: Each indigenous person used 11.36 times of outpatient services in 2001, higher than people living in plain areas and cities. Mountain indigenous people used outpatient services even more often.

The telemedicine investigated in this paper is a program deployed in Hua-Lien county (enclosed by curve in Fig. 1). Hua-Lien is a unique county in Taiwan and featured by following facts:
1) Geography: It is surround by the Pacific Ocean and Central Mountain Range. Though longitude distance is only 170 km, 70% of the area is mountainous, as can be seen from Fig. 1. The rural villages are considered to be the remote mountainous regions in Taiwan.

2) Population: The county’s population is only 1.589% of Taiwan’s population among all cities and counties. However, more than 25% of inhabitants (88,773/347,475) are aboriginals. Furthermore, 20% of Taiwan aboriginals live in this region. This makes Hua-Lien County very representative in aboriginal medical quality.

3) Beneficiary of NHI: Only 1.41% in NHI’s Beneficiaries. The number can even be lower in rural area (no statistics is obtained).

4) Payment by NHI: Only 1.51% in the total payment. No specific statistics for aboriginal regions are obtained.

5) The medical resource distribution: The medical institute distribution is not proportional to population distribution. Instead, about 60% medical institutes are located in metropolis (about 30% population) as indicated in Fig. 2, whereas less than 40% medical institutes are distributed to 12 rural regions.

The unbalanced medical resource distribution causes most rural villages to be short of doctors. It takes several hours for rural inhabitants to approach a regional hospital. To conquer this problem, four regional hospitals have developed a unique "circuiting medical service" to deliver medical services. In this program, each regional hospital is responsible for some remote mountainous sites (each site is a rural clinic in a mountainous or aboriginal village). Medical personnel in most demanded departments are requested to march into and station in these public clinics in scheduled periods. The vehicles for the circuiting service (called "mobile hospitals") are equipped with medical equipment (for example an X-ray and supersonic imaging machines) so that some medical images, samples can be obtained during the circuiting trip.

Meanwhile, the EHR (electronic health record) and smart cards have been promoted and obtained successfully among Taiwan’s metropolitan hospitals and the NHI. While many faults
incurred by paper health record were resolved by the success of EHR in plain area, the circuiting medical service is not benefited with it. This is because most rural villages lack data communication channels. Consequently, following problems are incurred:

1) Registration of outpatients can not be done on-line. A separate off-line store-and-forward mechanism is required. The process of applying benefits from BHNI (Bureau of National Health Insurance) was thus complicated.
2) A large volume of paper health records must be carried along with the circuiting personnel.
3) If a consultation is required, the only way is the voice conferencing on existing PSTN (public switched telephone network) because no communication facility for video or image is available.

Furthermore, since the EHR can not be used in these rural areas, labor works required: a) searching paper health record in rural clinics and; b) keying-in updated health record into hospitals’ information system after circuiting.

**The M-Taiwan Project in Hua-Lien County**

In 2002, Taiwan government launched a wireless technology promotion project to help regional governments in developing their own Internet applications with wireless technology. As for Hua-Lien County, 1.14 million USD are spent on connecting rural clinics and regional hospitals with VPN (Virtual Private Network) to resolve problems mentioned, as shown in Fig. 3.

![Fig. 3. Connecting rural clinics to hospitals.](image)

In Fig. 3, when a "mobile hospital" arrives at a rural clinic, the VPN router on the vehicle connects to the hospital’s VPN with wireless channels. Threefold advantages are achieved with the connection. First of all, the outpatients’ registration for hospitals and BNHI can be done in real-time. Secondly, the patients’ EHR can be accessed via the VPN channel with the terminals in mobile hospitals. Thus labors in searching health record can be eliminated. Finally, if a consultation is required, the medical images can be transferred in advance. Fig. 4 shows the location of the rural sites in which wireless access points are installed.

Unfortunately, the connection of hospital information systems to the Internet may incur security problems. Therefore part of the expenses must be used in renewing the information system of each regional hospital. One of the examples is shown in Fig. 5. As can be seen from Fig. 5, firewall and anti-virus system are integrated as "must have" devices.
Lessons Learned From The M-Taiwan Project

The M-Taiwan in east of Taiwan is still in its early days, and the results are preliminary. However, there are already several findings from this project that are relevant to other mountainous regions.

A. Saving Time
Telemedicine links between circuiting medical service teams and regional hospitals eliminate patients’ waiting time. The waiting time includes paper health record searching time and regi-
stration form writing time. An estimation of time saved for each patient is 5 minutes in average. The total time saved is 3512 hours for 42,148 outpatient count during 2004.4

B. Improving Quality
Consultation is valuable in preventive care though further analysis of cases is required to determine impact on treatment and outcomes. The teleradiographic or supersonic imaging can be performed by circuiting medical personnel and transferred to associated regional hospitals. A consultation can proceed more smoothly with the image.

C. Saving Money
The integrated service (circuiting medical services and M-Taiwan project) can save money as well as time. An evacuation by helicopter can cost 10,000 USD. If it saved four evacuations for each of 34 rural clinics, it would pay for itself.

Even when medical evacuations are not required, scheduled transport to a regional hospital can be very expensive. Rural residents travel an average of 70 km one way to access to a regional hospital.

Telemedicine consultations may prevent any fatal result when a serious problem is identified that would have been missed by the health aide. In such a case, a trip can not be avoided.

D. More User Participation
The project increases cooperation and sharing among participating organizations. Besides, the clinical needs to use equipment are identified.

E. Designing for Sustainability
The planner selected or adapted equipment that is rugged to withstand field conditions, such as power and temperature fluctuations and landform barrier. They attempted to minimize capital and operating costs by choosing local-made equipment and communication channel.

F. Designing for Providing Universal Services
The integration of circuiting medical service and M-Taiwan project is incentive-based. The most benefited users are regional hospitals and patients. The benefit is widened in promoting the usage of the Internet, such as homecare services, tourism promotion, and so on.

Conclusion
The medical service that integrates circuiting and networking in east of Taiwan have shown major relevance in supporting health care delivery in other rural regions. The strategies are to plan the project emphasizing primary care on circuiting medical services.

Preliminary interview and data indicate that the project is effective in reducing health record processing time and labors. Besides, the consultation enabled by this project reduces travel costs. The program improves the access of health care for inhabitants in rural regions.

Evaluating true cost effectiveness remains difficult, as M-Taiwan project was funded by both Industrial Bureau and regional government. However, project planners made every effort in making equipment suitable for village setting.

The availability of a subsidy for Internet connectivity to school and rural health centers make these locations become tenants for a carrier in a community, creating an incentive in widening the service.
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Telemedicine experience in Ukraine health care system

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Abstract

The opportunity of an effective utilization of telemedicine has changed the modern system of public health care services. The article presents a short review of Ukrainian telemedicine achievements and a scheme for the most effective usage of telemedicine in daily clinical practice in the health care system of Ukraine. Main directions for Ukrainian telemedicine for the next years are: improvement of telemedicine in practice of rural and family hospitals, wide approach to specific information about eHealth, development of mobile and home tele-care, and, of course, involving of national government in the realization of telemedicine and eHealth projects.

Key words: teleconsultations, decision making, mobile telemedicine, home telecare.

Introduction

The opportunity of an effective utilization of telemedicine has changed the modern system of public health care services. With telemedicine it becomes possible to benefit immediately from clinical experience and knowledge of consultants located thousands of kilometers from the patient, and provide general and specialized care to patients wherever they may be.

Aims of the article – review of the main steps of telemedicine development in Ukraine, development of a scheme for the most effective usage of telemedicine in daily clinical practice.

Review

The first telemedical systems were used in Ukraine in the 1970s. These were telemetry systems for supervision of physiological parameters of miners in collieries. In the 1980s – a lot of telemetry systems were in use (transphone and radio systems for ECG, cardiology, pulmonology).1,3 In the 1990s negotiations were carried out between Ukraine and the USA about an opportunity of telemedicine usage. A few asynchronous teleconsultations on oncology have been led.18

1991 – Intermag Company (Kiev) created a web-server for teleconsultations in neurosurgery and neuroradiology.3 1996 – in Rivne Regional Treatment and Diagnostic Center teleradiology was implemented (protocols and software were created). During some years Regional Telemedicine Network was created on the base of ftm-technology (in 2006 – 10 rural hospitals and 1 Regional Center).7 1999 – in Kharkiv region a network for trans-phone ECG transmission was created. 2000 – distant education was implemented in Ternopil State Medical Academy (telelectures at the base of videoconferences).3,4
In the year 2000, "Telemedicine" working group was created in the Donetsk R&D Institute of Traumatology and Orthopedics (DRDITO). On 25th January 2000 we carried out our first teleconsultation: Professor M. Nerlich from Regensburg (Germany) consulted the patient with a serious pelvic trauma in Donetsk (Ukraine). In that year a Web-site "Telemedicine in Ukraine" (www.telemed.org.ua) was created.2,8

On 1st January 2001 in DRDITO a Department of Informatics and Telemedicine was created. It is the first structural division in Ukraine, combining research, clinical, methodical and learning aspects of telemedicine and eHealth services. Employees of the Department, for the first time in Ukraine, develop optimum schemes of telemedical systems usage in practical health care so teleconsultations were improved in daily clinical practice. During the years 2001–2002 about 200 teleconsultations were led, optimal sets for telemedicine work stations and protocols for telemedicine procedures etc developed. 2003 – introduction of telemedical systems in dermatology-venerology and obstetrics-gynecology (in big Donetsk hospitals). The telemetry system is developed for the emergency help in obstetrics.8 Improvement of teleconsultations in daily clinical practice in trauma and orthopedics (in DRDITO).9-16

In 2003 "Ukrainian Journal of Telemedicine and Medical Telematics" was founded by the Department of Informatics and Telemedicine (ISSN 1811-1688 [Online] ISSN 1728-936X [Print]). There are experts from 11 countries in the Editorial Board. Journal is an official media-partner of the International Society for Telemedicine and eHealth (ISfTeH). Official web-site: http://www.telemed.org.ua/wwwutm_eng/utmj.html.

2004 – creation of Donetsk Regional Telemedicine Network by supervising of the Department of Informatics and Telemedicine. During the first year, 15 telemedicine work stations were placed in regional and rural hospitals. A web-platform iPath was used for teleconsultations. For the first time in Ukraine telemedicine was implemented in maxillo-facial surgery (MFS) – mfs.dsmu.edu.ua.8

2005 – activity of the Department of Informatics and Telemedicine: first urgent teleconsultation in trauma surgery with mobile telemedicine stations, first steps in home telemedicine; in February the I International School & Conference "Telemedicine – Experience and Prospects" was organized (participants came from a few regions of Ukraine, Russia, Moldova, Norway). Distant education was implemented in Zaporijja State Medical University (telelectures at the base of videoconferences). Web-site "Telemedicine in Ukraine" (www.telemed.org.ua) was certified by Health On The Net Foundation.

2006 – continuation of the creation of Donetsk Regional Telemedicine Network, II International School & Conference "Telemedicine – Experience and Prospects" (participants from Ukraine, USA, India, Turkey, Egypt, Russia, Norway, etc.), meeting was supported by ISfTeH. Creation of the Ukrainian telemedicine server on the base of the iPath web-platform (Kiev, http://iPath.ukma.kiev.ua).

Main papers of the Department of Informatics and Telemedicine considering clinical experience with teleconsultations (in trauma, orthopedics, neurosurgery, maxillofacial surgery, etc), decision making in telemedicine, theory of telemedicine and eLearning, study of telemedicine efficiency were published in Journals and monographs in Ukraine, European Union, Russia, India, Turkey, Poland, also in the prestigious "Journal of Telemedicine and Telecare".2-3,8,17

Effective telemedicine usage

Aims of this part – the development of the scheme for the most effective usage of telemedicine in daily clinical practice.
Materials and Methods

Materials: results of 350 teleconsultations in 15 medical areas; telemedicine work stations; Best practice models recognized by ISfTeH; the web-platform iPath (telemed.ipath.ch); Melexis™ system for blood pressure and heart rate home telemonitoring; own protocols for teleconsultations.

Methods: synchronous and asynchronous teleconsultations, home telemonitoring, analytical analysis, investigation of telemedicine efficiency (according own classification).

Results and Discussions

In our opinion the scheme of telemedicine usage in daily clinical practice consist of:

– theoretical aspects (indications, ethical problems);
– technical decisions;
– medical aspects on pre-hospital, in-hospital and out-hospital stages;
– efficiency investigation.

1. Theoretical aspects – were included in two best practice models, recognized by ISfTeH. After analyzing the causes of referral of patients for teleconsultation, we have identified the following indications for teleconsultation:

– determination (confirmation) of diagnosis;
– determination (confirmation) of treatment;
– determination of diagnosis and treatment of rare, severe diseases or diseases with a non-typical course;
– determination of complication prevention methods;
– need for a new and/or infrequent surgery (for treatment or diagnosis) or procedure;
– lack of immediate specialists in the necessary medical field or lack of sufficient experience for diagnosis or treatment of the disease;
– the patient doubting the diagnosis, treatment or its results, or a complaint;
– reducing the diagnostic and treatment cost without impairment of quality and efficiency;
– search and selection of the most suitable medical establishment for urgent and planned treatment of the patient, coordination of terms and conditions of hospitalization;
– medical care for patients located at a considerable distance from medical centers, when transport is not possible;
– search for alternative solutions for clinical tasks;
– obtaining additional knowledge and skills concerning a given medical problem.

Main points of ethics for teleconsultations:

1) Observance of a principle of the informed consent. Before carrying out any telemedical procedure the physician should give the patient the precise and intelligible explanations concerning the necessity or desirability of telemedical procedure, and also its opportunities and restrictions. The physician is obliged to receive the written agreement of the patient to send personal health information by the telesystem.

2) Observance of confidentiality and anonymity. At transfer of the medical information it is necessary to observe medical secret; the information on the patient is sent only in an anonymous way; personal information (a surname, number of the case record, etc.) should be "erased" from all images (x-rays, tomograms etc.). All personal computers of a telemedical workstation should have only authorized access (login/password). Folders and local discs containing materials of teleconsultation, should be closed to direct access by any network. The technicians should give a subscription about performance of norms, requirements and the rules of organizational and technical character concerning the protection of the processible medical information, and also on its nondisclosure.

3) Observance of laws and ethical norms. Teleconsultation is used for help in acceptance of the clinical decision. Last decision must be accepted by the attending physician (inquirer). The "face-to-face" physician should bear the responsibility for changes in the conditions of the patient’s health due to the using or non using of recommendations of the distant adviser. Standardization and careful recording of all telemedical procedures as well as creation of reserve and "hard" copies are necessary. Using the digital signature for identification of the participant of the telemedical procedures is desirable. The impo-
ssibility of access to the electronic data on the patient by the third parties is essential. Information can only be given under the letter of enquiry from the state structures (i.e. police, etc.).

4) Teleconsultation by second-opinion. It is necessary to explain precisely the impossibility of an objective estimation of a state of health of the patient in the form of teleconsultation. In conclusion, general information and basic approaches to diagnostics and treatment in the given situation is stated only; at doubts in completeness with the knowledge. It is necessary to redirect inquiry to another expert, having notified the patient about it; it is necessary to advise the patient to address to the "face-to-face" physician.

2. Technical decisions – consider creation of telemedicine work station (aim of another Best practice model¹).
   Mobile Telemedical work station for pre-hospital stage:
   – PDA/Communicator with built-in digital camera;
   – mobile GSM phone with camera, Internet access and MMS;
   – communications (GPRS, HSCSD, dialup or wireless Internet, "mobile phone+SMS+MMS").
   Telemedical work station for in-hospital stage (room unit):
   – PC (SVGA monitor, multimedia equipment, CD/DVD, network adapter);
   – high quality scanner;
   – digital photo/video camera;
   – web-camera;
   – high quality color printer;
   – microphone, dynamics;
   – modem, connector to the hospital information system;
   – sets of special digital equipment for diagnostic and treatment and auxiliary equipment (optional);
   – communications (dial-up, leased Internet, xDSL, ADSL, corporate networks).
   Telemedical work station for out-hospital stage:
   – call center;
   – personal home telemitters;
   – communications (phone and mobile phone lines, dial-up Internet).
3. Medical aspects at:

- **pre-hospital stage** – the use of mobile telemedicine for urgent teleconsultation and telemonitoring during transportation and first minutes in the hospital. Classical mobile telemedicine means using portable mobile computer sets with medical equipment and satellite links. Such systems are usually used in military medicine, during technological and ecological disasters, in transport. On the other hand, the modern medical doctor is very active in daily clinical practice. So, the new conception of mobile telemedicine means quick, easy and useful access to telemedical technologies in the necessary time and place. Telemedicine should be in the pocket of the doctor’s dressing gown near the stethoscope, pencil or scalpel. The development and wide improvement of mobile technologies (PDAs, smart- and camera phones, communicators, GPRS Internet etc.) allows medical doctors to be on-line 24 hours per day. It is a system for "telemedicine in dressing gown’s pocket" – the medical doctor can lead the telemedical procedure anytime and anywhere (ward yard, surgery room, car etc.).

Our experience – in 2005 for the first time in Ukraine we used urgent synchronous teleconsultations for patients with acute traumas. Nine urgent teleconsultations (patients: male – 6, female – 3; age 9–40 years) were carried out. Diagnoses: serious isolated trauma – 56%, polytrauma – 22%, maxillo-facial trauma – 22%. Technologies: scheme "MMS+E-mail" (2 times), mobile phones’ services (2 times), e-mail (3 times), mailing lists (2 times). All advice had high relevancy (especially when we used a professional mailing list). However, in urgent cases the time factor is very important. Median time between the request for teleconsultation and receiving of advice: scheme "MMS+E-mail" – 25 min, mobile phones’ services (MMS/SMS + voice + GPRS) – 15 min, e-mail – 360 min, mailing lists – 30 min. From a professional mailing list we received very good advice but we could not be sure about time factor. E-mail (direct request to the expert) is not very effective because for urgent cases there is a need to create a call-centre. Mobile phones services (like MMS/SMS messages, GPRS Internet) with e-mail and integration of mobile devices (PDA, smartphones etc.) looks like the most effective tool for urgent teleconsultation, because it offers: possibilities for fast exchange of medical information and images; possibilities to find an expert any time and any place (real mobility of the telemedicine); economical efficiency (cheap devices and communications, better results of treatment, no special workers and centers). For the preservation of the patient’s right we used information consent and anonymity. Mobile telemedicine "in dressing gown’s pocket" allows providing effective and fast teleconsultation. We believe that an optimal scheme for urgent teleconsultation for acute trauma on the hospital stage consist of: telemedical work stations at the base of mobile computers with in-built digital cameras (PDA, smart phone, communicator etc); general telecommunication lines (Internet, GPRS, mobile telephone etc); protocols and standards; best technology: "Mobile services (MMS/SMS/voice) +E-mail". Urgent teleconsultation for acute trauma are very effective because of the fast advice of the expert (maxillo-facial surgeon, neurosurgeon, specialist in pelvis trauma etc.); fast choice of the most effective surgery; best treatment results; possibilities for telemonitoring for the next few days. There is a necessity for the development of special protocols and standards for urgent teleconsultation. We will continue our telemedicine activity in this field for more statistically valuable results.

- **in-hospital stage** – asynchronous and synchronous teleconsultation according to the indications (see before). Our experience – earlier, we presented a study of our own experience with teleconsultations. The study covered the period of 2000–2004. During the study period, 210 teleconsultations were carried out. In 91 cases (43%) the DRDITO was the referring party and in 119 cases (57%) it was the one providing the specialist expertise. Teleconsultations were carried out for 137 male and 73 female patients, aged from one month to 85 years. The median interval between the request for a teleconsultation and it being carried out was less than one day. In the majority of cases only a single adviser was required; in 11% of cases, more than three advisers were required. 210 teleconsultations were conducted by a total of 207 experts. There were 142 hospital physicians and 65 university employees involved, 19 of the 210 teleconsultations were formal (9%), 174 were informal (83%) and 17 (8%) were provided for a second opinion. The majority of the teleconsultations (70%) were for trauma and orthopedics. Asynchronous teleconsultations were the most common (over 90%).
Synchronous teleconsultations were based on videoconferences (NetMeeting) and the ICQ email scheme. We believe that asynchronous teleconsultations are the most expedient for routine clinical practice, supplemented by real-time consultations where appropriate. Data transmitted through different telecommunication systems during teleconsultation included: 210 digital case histories, 64 digital clinical photographs, 461 X-ray images, 541 MRI images, four ultrasound images, 15 graphical images, five digital cytological micrographs, 14 3D tomography scans, 4 ECGs and 70 other documents (e.g. bone marrow test results, blood tests, consultation reports, an encephalogram, biopsy data, clinical tests). Most consultations (about 90%) dealt with treatment strategy and specification of a range of peculiarities and terms of surgery. That is, in the majority of cases consultants confirmed the diagnosis previously made by the referrer and confirmed or corrected the treatment scheme. Sometimes teleconsultation implied answers to several questions, e.g. "treatment strategy and place of treatment", "diagnosis and treatment strategy". Social issues connected with the cost and place of the future treatment are often important. Usually problems of this kind are dealt with during teleconsultation for self-referring patients. As stated above, we received 91 requests for teleconsultation. Sometimes a single specialist provided a response; sometimes it was necessary to obtain replies from multiple specialists. For each question we received from 1 to 8 answers (average 2.6 replies per clinical case), which was enough to make a final decision on the scheme of treatment. Teleconsultants gave their advice independently from each other. After that, the face-to-face physicians collated their opinions and decided on the best treatment. The treatment suggested by the consultant was accepted in 88% of cases and refused in 12% of cases (including 5% of cases where it would have been accepted if we had had all the necessary tools and fixing devices). Thus, the efficiency of implementing the treatment methods suggested by teleconsultants was over 88%. Teleconsultation is a valuable technique to assist clinical decision-making when a doctor meets a complex and rare pathology. Informal teleconsultation allows an appropriate expert to be found and an opinion to be obtained. During a formal teleconsultation, it is possible to solve organizational questions of the treatment, such as terms of hospitalization, important clinical tests and investigations. With the help of a second opinion, it is possible to make a pre-hospital diagnosis and to prevent certain complications. It is also a good service for patients who can select physicians, discuss different forms of treatment and costs.

Investigation of telemedicine efficiency

The telemedicine is promptly integrated into the system of public health care. It is very important to investigate telemedicine efficiency for better decision making and creation of "evidence-based telemedicine". Dr. Noriaki Aoki et al. propose classification of "telemedicine results":

We developed our own classification for methods of telemedicine efficiency investigations (MTEI):
1. Clinical MTEI:
   - investigation of establishment activity efficiency;
– investigation of diagnostic and treatment activity, outcomes efficiency;
– investigation of diagnostic accuracy;
– investigation of moral efficiency.

2. Non-clinical MTEI:
– investigation of economical efficiency;
– investigation of psychological status;
– investigation of technical efficiency;
– investigation of management efficiency.

We hope this classification will be useful for planning of scientific research in telemedicine. Statistical methods for investigation: comparison, analysis, kappa, receiver operating characteristics (ROC) curves, mathematical modeling.

At the base of classification we want to create some TOOL (complex, system, and algorithm) for telemedicine efficiency investigations for clinical, scientific practice and decision making.

**Conclusion**

In the article, we presented a short review of the Ukrainian telemedicine achievements and a scheme for the most effective usage of telemedicine in daily clinical practice in health care system of Ukraine.

The main directions for Ukrainian telemedicine for the next years are: improvement of telemedicine in practice of rural and family hospitals, wide approach to specific information about eHealth, development of mobile and home telecare, and, of course, involving the national government in the realization of telemedicine and eHealth projects.

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Fig. 4. First step in home telecare.
Abstract

Telemedicine programs in the United States have been increasingly active and some have been successfully operating for nearly twenty years. Some clinical specialties have progressed further than others in terms of how well they have been implemented, but overall the scope of telemedicine has increased dramatically in recent years. Some of the more interesting projects and developments in telemedicine in the United States will be discussed, as will some of the challenges still facing the field.

Key words: telemedicine, United States, progress, barriers

Introduction

Successful telemedicine programs that went beyond demonstration efforts started appearing in the United States in the late 1980s and early 1990s and many of them are still providing valuable services to a variety of patient populations. In the early days of telemedicine, the focus was mainly on providing services to rural or remote populations and environments with special needs such as prison populations. Today telemedicine is much more far reaching and we have seen substantial growth in such areas as urban, school, occupational, first responder and home telemedicine activities. It is impossible to review all of the telemedicine activities occurring in the United States today because they are quite extensive and varied. Some of the more exciting or unique applications will be discussed in this paper, followed by a brief discussion of some of the challenges still being faced.

Combining Specialty Services

Many women in rural areas do not have reliable or adequate access to breast cancer evaluation facilities and care. With the advent of digital mammography it is possible to send high quality mammographic images across teleradiology/telemedicine networks for interpretation at certified mammography centers. The University of Arizona has a statewide telemedicine network upon which telemammography is conducted with a number of very rural locations. To enhance these services we are testing the concept of adding to this service ultra-rapid pathology clinics for women with positive mammograms and real-time consultation with oncologists to reduce the time it takes for rural women to receive care.

Breast cancer is the most common cancer of women in the United States and second leading cause of cancer deaths. Most women do not have findings on mammography and do not require a biopsy (2–5%). Of those that do require a biopsy, the majority (65–80%) result in benign diagnoses and malignancy is found in only 1 in 10 women. In rural, medically underserved areas, mammography rates are lower (lack of dedicated screening facilities and/or personnel, poor compliance and large distances between patients and clinics), making it difficult to return
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for follow-up care (biopsies for pathology and oncology care if cancer is detected). The concept of ultra-rapid clinics combines telemedicine services from a variety of specialties to address this problem.

The complete breast cancer detection process from mammography to clinical consultation with the oncologist is usually about 28 days. If an abnormal mammogram is diagnosed a biopsy is performed at the mammography center or by a surgeon, and it is read by a pathologist who generates a report and sends it back. If it is malignant, the patient meets with the medical oncologist for consultation and a treatment plan. The timeframe is even longer than 28 days for women in rural areas who typically need to travel to an urban hospital for many of these procedures. Many of these women simply do not seek follow-up care. Whether urban or rural, the long wait time between initial diagnosis, pathology results and possibly oncology consultation can be extremely stressful. Telemedicine and digital radiology and pathology are ways to reduce those waiting times and the time it takes for a woman with breast cancer to receive definitive care.

The Arizona Telemedicine Program is carrying out pilot studies to assess the possibility of establishing ultra-rapid breast clinics in rural areas. The first study surveyed patients at the university breast clinic to determine if and how much women would be willing to pay for faster pathology results if they needed a biopsy. The willingness to pay for pathology services study had 312 responses. If diagnosed with cancer, 92% of the respondents in this study reported they would seek an expert second opinion. The data were unevenly distributed ($\chi^2 = 51.14, df = 4, p < .001$) with 33% of the participants reporting a willingness to travel over 50 miles and 47% willing to travel between 11 and 50 miles. When asked if they would pay a co-payment for a second opinion if their insurance covered the benefit, 97% of those surveyed responded affirmatively. Thirty-five percent of respondents reported they would pay more than $50 for such a service. The distribution of values suggested that significantly more of the individuals surveyed would be willing to pay $25 or more than those willing to pay less than $25 ($\chi^2 = 139.52, df = 5, p < .0001$).

The second pilot study tested the teleoncology component. Patients requiring a core biopsy were approached. Following biopsy, tissue was processed by Vacuum Histoprocess and ultra-rapid fixation, converted to a digital image by the DMetrix scanner, and sent via the telemedicine network to be read via telepathology. The patient then went to the telemedicine suite to receive the results. The teleoncologist presented all results and questions were answered.

The elapsed time (from mammogram to definitive oncology care) data were analyzed comparing the control (patients receiving traditional care) and pilot groups (ultra-rapid) using the non-parametric Mann-Whitney U Test. There is a clear trend towards the ultra-clinic telemedicine group having a shorter elapsed time to definitive oncology care. The median elapsed time (see Figure 1) for the pilot group was 2 months and for the control group was 2.5 months. The "whiskers" on the bar graph show the variability in the data, with 3 months being the longest elapsed time for the pilot group and 5 months being the longest for the control group.

By combining telemedicine services from different clinical specialties (radiology, pathology, oncology) we have the ability to reduce significantly the time it takes for women in rural areas to receive definitive breast cancer assessment and care.
Reaching Into the Home

Tele-home health is perhaps the fastest growing area within telemedicine. As recently as 2002, the emphasis in tele-home health was almost exclusively on chronically ill patients or those returning from the hospital who needed home nursing care. However, home monitoring devices are increasingly being seen in the marketplace that are not only directed at patients who are ill, but they are also being directed at patients who want to maintain a healthy lifestyle or prevent further illnesses from occurring. For the elderly especially, this means improving their overall quality of life since they can remain at home with their loved ones and eliminate or at least prolong the time before transferred to a nursing home or assisted living center.

For example, the VALUE (Virtual Assisted Living Umbrella for the Elderly) program at the University of Minnesota is providing a variety of telehealth services for elderly individuals living at home. The goal is to help them maintain their independence as long as possible. VALUE uses broadband technology to provide Internet service, physiological monitoring, teleconferencing and a web-based service portal directly into the home of elderly individuals. The service portal (which was designed specially to accommodate the needs of the elderly by using large font sizes, easy navigation tools etc.) provides educational materials, message capabilities and schedules/reminders for medical appointments, transportation, house chores and even meals.

The VALUE service is still being evaluated, but early results indicate that it can be an extremely beneficial service to elderly individuals. The first 13 subjects ranged in age from 77 – 93 years old (11 female, 2 male). Portal use was tracked and it was found that there were 155 log-ins per week over an average of 7.4 weeks. The majority (80%) of the portal activities were messaging (258 times) and accessing education materials (104 times). Teleconferencing about scheduling as well general conversations accounted for about 33% of the portal interactions. The study is on-going and it is expected that 100 patients will eventually be enrolled in the study. The longitudinal benefits of such a telemedicine program on elderly health and the ability to remain at home has yet to be confirmed, but the results of this and similar projects suggest that it is quite likely to have a positive impact.

Tele-home care is also proving to be a cost effective solution to monitoring patients once they return home. In one recent study, ostomy patient care was compared using traditional home nursing services versus a combination of traditional home plus telemedicine-based home visits. Table 1 summarizes the results of the study in terms of major parameters of successful transition to home living with an ostomy. Overall, patients in the tele-home health condition had higher satisfaction, fewer actual home visits from the nurse, and equivalent overall costs. The equivalent cost was observed even though the telehealth group ended up having more contact with the nurses (with combined traditional plus tele-home health visits).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Telenursing (TN)</th>
<th>Traditional Home Health (HH)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Mean visits</td>
<td>HH = 5.43</td>
<td>HH = 6.29</td>
<td>TN &lt; HH</td>
</tr>
<tr>
<td></td>
<td>TN = 3.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B) Mean days after surgery to independent pouch change</td>
<td>13.71 days</td>
<td>15.07 days</td>
<td>TN &lt; HH</td>
</tr>
<tr>
<td>C) Satisfaction</td>
<td>93% satisfied</td>
<td>81% satisfied</td>
<td>TN &gt; HH</td>
</tr>
<tr>
<td>D) Mean cost of nursing visit</td>
<td>TN = $18.90 (salary + airtime + equipment)</td>
<td>$63 + travel (salary + mileage)</td>
<td>HH costs $44.10 more than TN</td>
</tr>
<tr>
<td></td>
<td>HH = $63 + travel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E) Average pouch cost</td>
<td>$70.73/patient</td>
<td>$123.22/patient</td>
<td>TN &lt; HH by $52.49</td>
</tr>
<tr>
<td>Final cost</td>
<td>$377.31 HH</td>
<td>$444.52</td>
<td>TN more visits without increasing costs</td>
</tr>
<tr>
<td>Total</td>
<td>$67.50 TN</td>
<td>$444.81</td>
<td></td>
</tr>
</tbody>
</table>

In another study on home health with patients going home after surgery, substantial cost savings were found in the tele-home health group. This study used a home monitoring system that did not include videoconferencing capability. In this study as in most others evaluating
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Telemedicine services, satisfaction was high for all those concerned. The cost analysis accounted for such variables as personnel expenses, agency travel expenses, hospitalization expenses, and equipment. The total cost for the traditional care group was US$372,991 and for the tele-home care group it was US$267,214. This represented a very significant savings for the tele-home health group. Savings of this magnitude are being observed more often and in many more programs offering tele-home health care to patients in rural areas. Even patients on hemodialysis are starting to receive their dialysis care at home using tele-home monitoring techniques to insure proper functioning of the devices and remote help in operating the systems.

Telemedicine and Planning Disaster Response

In the early days of telemedicine one of the prime players was the military, using telemedicine to provide early response efforts to soldiers injured on the battlefield. These efforts continue, but they have also taken on a new dimension. With recent disasters around the world (e.g., earthquakes, tidal waves) including Hurricane Katrina in 2005 in the United States, efforts are turning towards using telemedicine in disaster response planning.

One of the main hurdles being faced in these efforts is integration of resources and information – or lack thereof as is the current situation. Because of this lack of integration, efforts are being made to develop integration tools. For example, the US military is working with the University of Pittsburgh to develop an "Integration Engine" to enable seamless semantic interoperability between civilian and military medical information systems. Should a disaster occur, it will be possible with this engine to transfer a variety of medical and personnel data between systems and organizations without having to deal with diversity in information systems, lack of universal data standards, different data formats for text video etc., and general mismatches between operating and data systems. At this point in time integration results are only preliminary, but this type of project sets the groundwork for other telemedicine organizations to develop integrated services across various platforms in order to be prepared to deliver medical services in an emergency. Another dimension that is being explored to help medical and other personnel be prepared for disaster scenarios is the use of virtual reality simulations to help in training. Although not directly a telemedicine application, products developed in these efforts can lead to tools such as anatomy simulators that can be used in remote telemedicine education scenarios.

Challenges Still to be Conquered

Telemedicine in the United States has come a long way in the past twenty years as the examples described above illustrate. There are many other areas in which significant progress and innovation has taken place, making access to medical care easier, more timely and less costly for many people in both rural and urban areas. At the 2006 Annual American Telemedicine Association Meeting, the Kenneth Bird Annual Distinguished Lecturer Bill Crounse, MD (Healthcare Industry Director, Microsoft Corporation) noted five trends to watch regarding the future of healthcare in the US: the end of employer-paid health insurance as we know it, commoditization of healthcare services (e.g., services such as blood-pressure monitoring in pharmacies and other stores), dumbing-down of healthcare in general and the need to re-think medical education, the wide availability of health information on the Internet, and globalization of healthcare services (e.g., radiology Nighthawk services). All five could impact directly on telemedicine and future possibilities for unique applications.

As a result of these probable trends in US healthcare, consumers will become much more involved in their healthcare and health decisions especially in the area of prevention. Wearable monitoring devices are being explored as a means to remotely track various physiological parameters. In the future such devices could warn individuals and clinicians about early warning signs of impending illness or disease without patients even seeing their physician for an annual exam. The challenge is to insure that monitoring devices being targeted to the general public, as well as those used or being developed for use in pharmacies and other retail environments, are rigorously tested and validated for reliable recording, transmission and interpretation of data by qualified professionals.
Some of the other challenges in telemedicine that we still face are ones that have been around for a number of years. Telemedicine is still often regarded as an alternative to traditional care and therefore something to be skeptical of. This attitude hurts especially in the area of policy and reimbursement for services. There are still numerous health services that are not reimbursable if they are carried out using telemedicine technologies or by the “proper” (i.e., Medical Doctor) healthcare provider. In many respects, this is still the single biggest challenge that we face in promoting widespread adoption of telemedicine services. As the public consumer is faced with the challenge of changing health insurance policies, however, we may see increased lobbying efforts from more patient advocacy groups to change reimbursement policies.

A related challenge is providing the evidence that telemedicine works to the regulatory and policy bodies that can change policy. To this end we still face the challenge of conducting not just more research, but research that will be valued by the healthcare community as being valid and reliable. Towards this end, the American Telemedicine Association (ATA) has developed an agenda to help guide research in telemedicine.

Three guiding principals were identified as well as four basic areas of investigation. The three goals are: a) If possible, established research methods and statistical analysis tools should be employed. b) If validated models exist, they should be used and tested for use in the telehealth context. c) When documents supporting or formulating standards and guidelines exist they should be used to guide research questions as well as provide tools for designing the research protocol. The four areas where research is still needed are technical, clinical, human factors and ergonomics, and economic analyses. The main focus of technical research is on seamless integration of infrastructure components and development of technical and telecommunications standards. As in the past, the focus in clinical research should be on outcomes, using accepted experimental designs and robust statistical analyses. Human factors and ergonomics research needs to focus on both sort and long-term impacts of telemedicine on healthcare, especially as we move to a more consumer-centric model of providing healthcare services. Models of how to manage the changing healthcare environment also need to be studied.

In conclusion, telemedicine in the United States has probably progressed further than most people would have anticipated, but not quite as far as most people would have hoped. The variety of applications and environments in which we are seeing telemedicine applied is astounding, yet we still face some of the same challenges we have been experiencing for years. By developing guidance documents such as the ATA research agenda and ATA’s recent efforts towards development of standards and guidelines that encompass everything from technical to clinical practice, we should be able to overcome these challenges in the very near future.

References
ABSTRACTS

Telemedicine in South Africa
J.B. Fortuin, M. Molefi

Since the introduction of computer and the availability of broadband communication there has always been a possibility for the introduction of Telemedicine. Telemedicine is an evolving technology in South Africa. It has been described as "bridging the gap between the have and the have not's. This emerging technology has been implemented in various areas of health within South Africa. Some of the activities include teledermatology, teleradiology, health channel and telemedicine product development. The challenges and success of telemedicine activities in South Africa has also been described. The way forward for telemedicine includes advocating for policy, collaboration and ensuring the involvement of all role players especially those on the ground.

Key words: telemedicine, primary health care, teledermatology, teleradiology, health channel, HIV/AIDS.

Advances in Albanian Medical Informatics and Telemedicine
Dr. Edlira Xhemo, Dr. Erion Dasho

The purpose of this article was to describe current status and future approach to telemedicine and eHealth in Albania. No medical informatics or telemedicine or e-health activity have been implemented since 1993. Albanian experience with Telemedicine is rather small but good will and desire to work among the enthusiastic professionals in the field shall lead to new projects and development.

Key words: medical informatics, telemedicine, projects.

eHealth in Australia
S. Kolachalam

Information and Communication Technologies (ICT) provide the necessary infrastructure and software tools to make connectivity between all healthcare providers possible; thereby moving the concept of "Health" to "eHealth". eHealth is neither an event nor an overnight phenomenon but is a continuum of activities. This paper is a snapshot of key eHealth programs from 1984 to 2005 indicating the progress of eHealth in Australia.

Key words: Medicare, HCN, OAICS, MediConnect, HealthConnect.

Introducing the Electronic Health Record in Austria
Wolfgang Dorda, Georg Duftschmid, Lukas Gerhold, Walter Gall, Jürgen Gambal

The Austrian parliament has adopted legislation to introduce the electronic health record under the title ELGA. The present article first discusses several activities of other countries in this context. It then deals with the current situation of healthcare telematics in Austria and the next planned steps to introduce the life-long electronic health record.

Key words: Medical Records Systems, Computerized; Public Health Informatics; Computer Communication Networks; Standards.