ISSN : 0974 - 7435 Volume 7 Issue 3

Trade Science Inc.

BioTechnology
An Indian Journal
Review

BTAIJ, 7(3), 2013 [89-101]

An overview of telemedicine in Turkey

Canan Aydogdu[1], Ozgu Aydogdu[2]*
[1]Electrical and Electronics Department, Izmir Institute of Technology, Izmir, (TURKEY)
[2]Urology, Izmir University, Izmir, (TURKEY)
E-mail : cananaydogdu@iyte.edu.tr; ozgucan@yahoo.com

ABSTRACT

This study focuses on telemedicine in Turkey by the use of the Internet, where the potential for telemedicine of Turkey, telemedicine initiatives conducted in Turkey until now are examined first. The types of applications that the Internet can support in consumer health, clinical care, financial and administrative transactions, public health, health professional education in Turkey are investigated next. Finally, a discussion on the technical, legal and bureaucratic obstacles for realizing telemedicine in Turkey over the Internet and suggestions on how to overcome these obstacles are presented.

KEYWORDS

Telemedicine;
Health service;
Medical communication;
Internet.

INTRODUCTION

The internet is rapidly and radically transforming many aspects of society in Turkey. Businesses now sell goods and services over the Internet, governments disseminate public information on World Wide Websites, and consumers use the Internet to find information, communicate with friends and family, plan trips, shop, and pursue hobbies. Both the scope of applications and the number of Internet users will undoubtedly continue to grow in Turkey as technologies improve and innovators continue to experiment with new online applications.

Health-related activities stand to benefit enormously from the Internet. The development of telecommunications and computer technology since the 1960's has implications for the improvement of the quality of health care for those who live in remote or isolated areas where access to quality health care has traditionally been a problem. Telemedicine is defined as the "use of electronic signals to transfer medical data (photographs, x-ray images, audio, patient records, videoconferences, etc.) from one site to another via the Internet, Intranets, PCs, satellites, or videoconferencing telephone equipment in order to improve access to health care" by the Telemedicine Information Exchange[1], whereas Reid[2] defines telemedicine as "the use of advanced telecommunications technologies to exchange health information and provide health care services across geographic, time, social, and cultural barriers".

Telemedicine is considered to be a promising tool for serving health-related activities in the developing countries, where resources are scarce in terms of health personnel and equipment[3]. Turkey, which is considered as a developing country, has a great potential and need for telemedicine. Moreover, the use of two-way

Review

telecommunications technology, multimedia, and computer networks to deliver or enhance health care, has become a growing trend in Turkey in the last decade. Telemedicine applications that are using private networks and thereby serving a limited portion of people are extending in geographical coverage and number of possible applications. However there still exists technological, organizational, financial and legal obstacles which prevent the widespread adoption of telemedicine for different disciplines. The aim of this study is to present an overview of telemedicine potential for Turkey, the initiatives undertaken in Turkey up to now, the inherent obstacles and recommendations to overcome these obstacles.

This paper focuses on telemedicine in Turkey by the usage of the Internet. The next part consists of an overview of problems specific to Turkey which constitute a potential for telemedicine applications. Section III is about the studies and initiatives related to telemedicine that are conducted in Turkey until now. In Section IV, the types of applications that the Internet can support in Turkey in consumer health, clinical care, financial and administrative transactions, public health, and health professional education are examined in detail. Obstacles including technical and policy barriers are presented next. In the last part, conclusions and recommendations for the realization of telemedicine in Turkey has been proposed relying on the facts presented.

CURRENT TRENDS IN TURKEY TELEMEDICINE

The Internet may prove to be an ideal technology for use by willing health care organizations to simplify and standardize processes and collaborate more effectively with one another. The current trend in telemedicine applications in Turkey is the usage of the Internet – a public network - in place of private networks.

The value of open (i.e., public) networks in health care is rooted in the nature of the industry, which remains highly decentralized and involves a range of individuals and organizations in providing care, paying bills, analyzing health data, conducting health services research, and monitoring public health. Furthermore, Internet connections promise to be less expensive to install and maintain than private networks. Internet connections entail some costs, especially if high-bandwidth connections are needed, but they tend to be lower than the costs of leased lines and can be spread among a wider range of applications and users.

Despite the flurry of Internet activity within and around health care, many potential applications have yet to be realized. Many organizations in the health sector continue to rely on private networks (e.g., leased lines) rather than the Internet for many data communications tasks, and some health-related applications have not yet been deployed in Turkey across any type of communications network, public or private. Few health care organizations, for example, have integrated the Internet directly into the provision of care. Remote medical consultations remain a novelty practiced by a few institutions, typically over dedicated networks, for a small subset of their patients and with support from external financial grants. Most public health offices remain unconnected to the Internet and therefore are unable to accept electronic reports from testing laboratories or communicate health information over the Internet to neighboring jurisdictions. Private insurers have in general not adopted the Internet for financial and administrative transactions but instead continue to seek payment through paper-based claims or electronic data sent over direct connections via modems.

Representative applications conducted over the internet and private networks in Turkey

(a) Functions commonly performed today over the internet

- Search for consumer health information
- Participate in chat/support groups
- Exchange electronic mail between patients and care providers (limited)
- Access biomedical databases and medical literature
- Find information about health plans, select physicians (limited)

(b) Functions performed today over private networks

- Transfer medical records among affiliated health organizations
- Transfer claims data to insurers and other payer

organizations
- Conduct remote medical consultations (limited)
- Send medical images (Xrays,etc.) to remote site for interpretation (very limited)
- Broadcast medical school classes over campus networks (limited)

(c) Functions not commonly performed today over either the internet or private networks

- Videoconferencing among public health officials
- Remote surgery or guidance of other procedures
- Public health surveillance/incident reporting
- Home-based remote medical consultations, in-home monitoring of patients.
- Purchase pharmaceuticals and other health-related products

POTENTIAL OF TURKEY TELEMEDICINE

Turkey is a large country located between Europe and Asia accommodating 72 million people in an area of 783.000 km^2. Large cities in Turkey have well-equipped public or private hospitals with experienced doctors. On the other hand, health services in some cities are poorer and especially eastern and south-eastern regions have limited facilities in terms of medical equipment and staff. Hence, most doctors don't prefer to work in this undeveloped region. The ministry of health has made it necessary for recently graduated practitioners and specialists to work in cities with limited resources for a reasonable period. Although this obligatory task aims to promote health services in underdeveloped regions, it imposes an undemocratic compulsion[4].

The share of health expenses in GNP (Gross National Products) is 4% and the public health expenses share among the total health expenses is 63% in Turkey. Also these figures increase each year. The health sector is a growing area where the costs have to be cut down as early as possible.

The increasing population of Turkey results in insufficient service and health care conditions, despite the large number and variety of hospitals and health services. The increasing queues are unavoidable at any of the health services. And this has been the situation for so many years that people have become accustomed to being treated in such conditions. Also the health care providers being overloaded by much work are becoming inefficient, especially in public hospitals.

Telemedicine seems to be the solution to both the increased costs and insufficient health service. Until nowadays, it was an expensive method because of private networks' requirement, but by the widespread of the Internet it has become a cost effective process.

The developments on the technical side regarding internet, the internet speed provided today and the interest in the internet use, are promising factors for telemedicine in Turkey. Since the introduction of the internet to Turkey in 1993, a fast growth in the internet use has been observed. Today 41, 6% of residences are connected to the internet and Turkey is the 12th county in terms of internet use. The speed of the internet connection is about 5Gbps among three big cities, whereas each city has an internet connection. Health, as being a huge industry and as a primary problem of Turkey, has attracted attention quickly in this new communication medium. The internet speed provided today and interests in the internet use are promising factors for telemedicine in Turkey.

INITATIVES FOR TURKEY TELEMEDICINE

The acquaintance of Turkey with the Internet occurred in the year 1993. Since then, a very fast adoption to the new technology has taken place. Health, as being a huge industry and as a primary problem of Turkey, has attracted attention quickly in this new communication medium. The published studies and conference proceedings show that the studies on Telemedicine extend to the year 1997.

Several telemedicine attempts have been initiated by the government, academicians and civil society organizations since 1997. The first telemedicine attempt was the National Medical Communication Network Project named as UMEDIA (National Medical Communication Network, *tr*: Ulusal Medikal Iletisim Agi). UMEDIA was a project handled by ATO (Ankara Chamber of Medicine), AEO (Ankara Chamber of Drugs) in 1997 and was presented at the III.Internet Conference in Turkey[5]. The main objectives of

Review

UMEDIA were as following:

- Constituting a communication channel between health personnel.
- Providing access to main health related information.
- Forming a channel to obtain health related publications.
- Sharing of information and experiences between health personnel.

To realize these objectives, UMEDIA was divided into four subgroups named as

- National Medical Electronic Library (NMEL)
- National Medical Electronic Publishing House (NMEP)
- National Medical Electronic Database (NEMD)
- National Medical Electronic Forum (NEMF)

NMEL, aimed to form a 'Publication Service' by the combination of documents at a documentation center. A subscriber would be able to order publications after a documentation surveillance realized through the web. The idea of using the web to get some publications was fine, but the conveying of the hardcopy of the documents was cumbersome. Instead of conveying the hardcopies, a target for a downloadable publication would be much better, but the requirement for a database of publications which requires transforming the documents to the virtual media was seen as a problem in 1997.

NMEP, aimed to present health related documents by the technologies introduced by the Internet, such as using audio-visual supplements. One study realized by ATO, AEO and BTO (Balikesir Chamber of Medicine) is the 'Vademecun', which is web based software to search information on drugs. The prospectus is obtained using this software. Vademecun is still used today widespread over the Internet and one good thing about Vademecun is that it is updated regularly[6].

NMED, aimed to form a database of the doctors' addresses, pharmacies on duty, prices of drugs etc. Also there was an idea to keep track of blood banks and supply the communication between them. This idea roots from the lack of a common platform for sharing of the situation of the blood stocks and from the limited duration of blood usability. Finally, NMEF aimed remote home consultations and interactive medical education as further targets.

UMEDIA was unsuccessful in realizing most of these objectives and unfortunately the project has failed due to financial problems. The only solid outcome of UMEDIA, which served the aim of presenting health related documents by the technologies introduced by the Internet, was Vademecun, the web based drug search engine[6].

The importance of the UMEDIA Project lies in the fact that it is the only *group project* that outlines targets of telemedicine as a whole in Turkey. One significant aspect of this project roots from the consideration of the internet as the communication medium superior to private networks. That is the point developed countries focus today, and the coworkers of the project could foresee that in 1997. The project leaders of UMEDIA stated that 'these ideas being utopian today must be taken as targets to the project'. In this context, the goals of UMEDIA were very initiative to attract attention to telemedicine in Turkey 15 years ago.

After the UMEDIA Project, several attempts that have been performed by the academia that focus on remote consultations[7-11], distant medical education[12], a national medical database for journals[13], internet usage by civil care organizations[14], security and ethics on the internet medical sector[15] and telemedicine applications on various disciplines: tele-pathology[16], tele-radiology[17], tele-dermatology[18-21], tele-cardiology[22,23]. Today, nine universities in Turkey have graduate programs on medical informatics including the Bosphorus University and METU, whereas some more universities have research centers that work on telemedicine such as ISTEM (Istanbul University Continuing Medical Education and Research Center). Moreover, the Ministry of Health initiated the second group project named e-Health Project in 2003. The focus of the e-Health Project is mainly on the services used by the patients.

In additional to telemedicine research attempts in the academia and government, there is a civil organization named TurkMIA (Turkish Medical Informatics Association), which is a member society of IMIA (International Medical Informatics Association) and EFMI (European Federation for Medical Informatics)[24]. TurkMIA, which was founded in 1999, has more than 340 members and organizes the Turkish Medical Informatics Conference, the eighth of which was done in 2011.

Review

POSSIBLE TELEMEDICINE APPLICATIONS IN TURKEY OVER THE INTERNET

Turkey has a great potential and need for telemedicine and many initiatives are performed in order to realize telemedicine since 1997. In this section, the types of applications that the Internet can support in consumer health, clinical care, financial and administrative transactions, public health, and health professional education in Turkey are examined.

Consumer health

Consumer health refers to a set of activities aimed at giving consumers a more pronounced role in their own health and health care, ranging from the development of tools for self-assessment of health risks and management of chronic diseases, to home-based monitoring of health status and delivery of care. Telemedicine studies in developed countries show that, patients taking an active role in their own health results in shortened hospital stay, thereby less costs.

In Turkey, the number of health related sites show the increasing awareness of patients. In a search at Arabul.com which is a Turkish search site, a query of "health" results in 1710 websites, a query of "drug" results in 480 sites.[1] Also there are over 150 consumer-oriented Turkish health websites, a few of which are listed in TABLE 1.

TABLE 1 : Examples of Turkish health-related websites.

Site	Content
Saglik-info.com	A very comprehensive health site. Any kind of information about health-drugs, the administration units of health, hospitals, health statistics about Turkey, chat sessions, e-library available, drug prescriptions available, Q&A session.
Tip2000.com	Offers health information, doctors and hospitals list, and news on health.
saglikaktuel.com	Offers health news and information, a physician directory, brief information about diseases, and condition-specific support groups.
populermedikal.com	Offers original, peer-reviewed reports and journal articles organized by specialty and intended for both health professionals and consumers. A dedicated consumer site is under development.
dermatoloji.com	Offers free journals/news/links. Has an online digital image bank. Offers a free mail control system and online books.
medimagazin.com.tr	A medical website including recent news about medical life in Turkey, question and answer section for common health problems, and brief information about widely used drugs.

Nearly all of the websites have detailed information on illnesses and diseases. Most of the sites contain for nutrition and fitness information and a list of doctors and hospitals. Looking at the content of these Websites, it can be concluded that consumers seek for these kind of information at most. None of the websites have information about drugs and their interactions, which is found out to be looked for by consumers by 11.6%[25].

Unfortunately health related websites in Turkey lack accreditation, which deteriorates the reliability of information contained. In US, for example, there are some quality initiatives that define standards that a health related Website should have. Health on the Net Foundation (HON), Health Internet Ethics (Hi-Ethics), Trust-E, Internet Healthcare Coalition (IHC), The eHealthcare Association (TeHA), American Accreditation Healthcare Commission have defined standards of how an health related website should be and any accredited website having the logo of these organizations is considered to obey these standards and are therefore reliable. Thus, the websites in Turkey may potentially lack reliability and users may not know if the health related information contained is correct is not. There is a lack of such accrediting quality initiative associations for Turkey currently.

These websites also have e-mail services between patients and care providers. The efficiency of the e-mail services is not investigated. The answering rate of the e-mails, the correctness and the completeness of the response should be examined, figuring out the efficiency. There is a survey on this subject in US[26], but the situation in Turkey should be questioned.

The term telemedicine reminds one home consultation at first glance. The idea of having the care provider in your home, without a real displacement, has been very thrilling. This is an idea that would be deployed by almost everyone pleasantly: old people who don't have strength to go to the hospital, children who are exposed

Review

to catch infectious diseases easily in a hospital environment.

There are Turkey specific two more application needs for remote consultation. Firstly, Turkey is a country with chains of mountains and valleys that isolate many cities and towns, where people in rural areas who have to travel a long way to the hospital. Moreover bad weather conditions sometimes completely isolate such places from the health facilities. Unavailable transportation due to avalanche, snow or floods are frequent problems that hinder reach to health services. These Turkey specific geographical conditions make telemedicine the only communication with the care providers for such areas. Secondly, there is a governmental regulation applied in Turkey which can be solved partially with telemedicine. Large cities in Turkey have well-equipped hospitals with experienced doctors, whereas health services in some cities are poorer and especially eastern and south-eastern regions have limited facilities in terms of medical equipment and staff. Since most doctors don't prefer to work in these cities, ministry of health has made it necessary for recently graduated practitioners and specialists to work there for a reasonable period. Although this obligatory task aims to promote health services in underdeveloped cities, it imposes an undemocratic compulsion. The solution of this problem lies in telemedicine.

Remote consultation is at research phase in the academic media in Turkey. Remote consultations together with home monitoring systems are technologies that are worked on also by smart home projects. In Turkey, there are some smart home projects conducted by different companies including MRT Livtom, IBM Türk, Ericsson and Arçelik. One of the most challenging features of a smart home is its patient monitoring systems, which make them attractive for older people and people with disabilities. For example, a property of a smart home project of Japan is a toilet analyzing the sugar, fat and various substances in urine and thereby informing the resident. And smart home applications have many health related applications[27]. This may be an advantage for telemedicine media because smart home projects are ahead of telemedicine studies today in Turkey. Briefly, if the companies dealing with smart home projects work with the telemedicine media to provide remote consultations and patient monitoring the technology would be available in a shorter time.

Clinical care

The Internet offers several avenues for augmenting the health care services in clinical settings. Remote video consultation, for example, could give consumers greater access to skilled health professionals regardless of geographic proximity. The use of the Internet to transfer medical images to expert interpreters could accelerate and improve the diagnostic process as well as reduce costs. Virtual reality tools could help surgeons plan medical procedures and improve their use of information during procedures. The use of the Internet to access and assemble health records could give provider improved information for treatment purposes, regardless of whether the patient is a regular client or a stranger.

Online health records are one of the most important telemedicine applications. In an emergency case, a health record retrieved from other hospitals could save time and therefore save life. The examination of a health record by the doctor before patient inspection may clarify some facts about the patient and may lessen the tests to be done thereby reducing cost and reducing any misleading diagnosis.

There are some examples of telemedicine applications in Turkey. In a recent paper the use of telemedicine in decision making and follow up of burn patients has been investigated by Turk et al.[11]. In this study 187 patients admitted to a regional burn unit were consulted via audiovisual transmission of data (telemedicine) to the same burn surgeon at The Ankara Burn Referral Center. The authors concluded that telemedicine is appropriate and cost effective for treatment and follow up of patients in burn units with personnel with limited experience. In another study Onbay et al. introduced a distributed picture archive and communications systems (DIPACS) platform that was developed for sharing of radiological images for small and medium scale distributed medical networks. In the recent study DIPACS was tested between two radiology departments in Turkey. In the conclusion the authors mentioned that they planned to implement the next version of the current system on grid topologies which provide more powerful interoperability, security, fault tolerance and scalability features to support larger medical networks such as

nationwide distributed radiology networks[28].

In a previous study Coskun et al. aimed to develop a computer program to predict the existence of acute coronary syndrome (ACS) in patients with chest pain at home. This study proceeded in two phases. In the first phase, a computer- based decision protocol was developed using recursive-partitioning analysis to predict ACS in 250 patients with chest pain on the basis of their historical data. In the second phase, this protocol was tested in 115 patients for the diagnosis of ACS prospectively. Thirty-two of the patients answered the algorithm questions on the website. The accuracy of the algorithm in diagnosing ACS was found as 81%. The authors concluded the algorithm diagnosed patients with ACS at a high ratio and decreased the number of patients being unnecessarily admitted to the emergency with non-ACS[22].

In Turkey, a limited version of personnel health records is used by some private insurance companies. These records contain no medical images that occupy a large space, just some written data about personnel identification, blood type, passed on or chronic illnesses etc… These records are stored at the database of the insurance company and at a smart card given to the insured. Hospitals, either state, university or private have personnel records of their patients in their databases. But the databases of hospitals are not shared via Internet. Also, patients themselves have no access to self-record via the Internet.

In fact, the situation with the personnel health records is limited by the security concerns of the records. Once health information is divulged, its confidentiality cannot be regained; there is clearly a difference between the prospect of losing $50 when one's credit card number is stolen and losing privacy when one's HIV status is revealed to friends and co-workers. There are researches conducted on security on the internet by Turkish researchers also, which are promising in the future. However the importance of the combination of the databases of hospitals through the Internet is not emphasized in Turkey. Turkey also lacks the experience of combining the databases of various hospitals. Despite some small scale efforts, a national medical record system does not exist. Such a system is required in Turkey to allow the sharing of clinical information across the internet among emergency room clinicians. Such systems in developing countries are shown to reduce the time spent searching for records, time needed to admit a patient, number of admitted patients, length of hospital stays, and time spent in training. The impact on patient retention and member attraction is projected to increase revenues significantly. So, the medical records issue must be paid considerable attention also in Turkey. Studies to define a standard for representing and communicating data related to health care must be developed and security must be guaranteed.

One application related to clinical care is the transfer of medical records and images. This issue roots after the usage of online records. And also, a care provider may send a medical image to a specialist for advice. In this case, the bandwidth of the Internet connection becomes important because real time recording of the medical data requires bandwidths ranging from 128kbps up to 2.5Mbps, as given in TABLE 2[25].

TABLE 2 : Nominal bandwidth requirements for different telemedicine applications.

Type of Telemedicine	Needed Bandwidth[a]	Examples
High resolution, no motion	Store-and-forward	Radiology, dermatology, pathology
Medium resolution, low motion	128 kbps	Stethoscope, visual exams, psychiatric consultations, gastroenterology
Medium resolution, high motion	384 kbps	Cardiology, neurology, and emergency room consultations
High resolution, high motion	768 kbps	Cineo-angiography and echocardiograms
Very high resolution, high motion	Up to 2.5 Mbps	Gait analysis[1]

Some medical images can be transported by store-and-forward act. The bandwidth then, depends on the amount of time in which the image must be transmitted and the degree of compression that is allowable without degrading the image so much to impair interpretation and diagnosis. The size of images range from 0.26Mbyte-64Mbyte, where some examples are Digitized Electron Microscopy (0.26Mb), MRI (6Mb), digital angiography (4Mb-10Mb), digitized X-rays (16Mb), digitized mammography (184Mb), etc.

The network existing in Turkey was far from satisfying the medical image transfer a decade ago. Most of the

Review

eastern cities had connections only to universities and the bandwidths were 2048kbps or less. But today, most of the accommodations in the eastern cities also have high speed digital subscriber line internet connections. Moreover, third generation mobile internet connectivity is used nationwide. Although connectivity to internet is not an issue today nationwide, the speed provided is generally not adequate for real time medical image transfer.

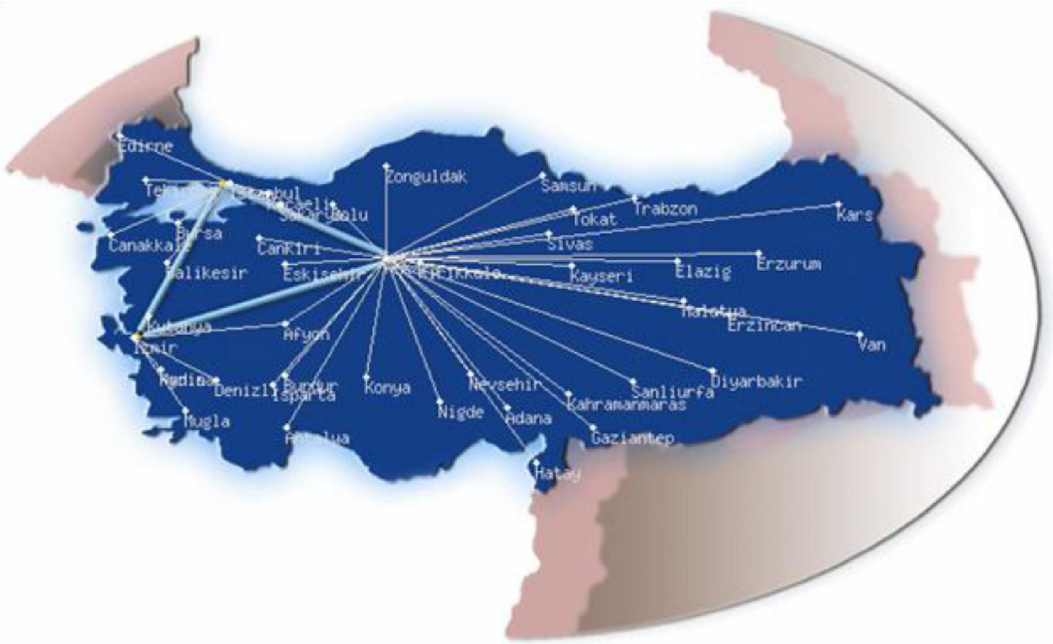

Figure 1 : The map of the internet connections in Turkey.

Financial and administrative transactions

The Internet could be used by providers to submit claims for payment or by individuals to enroll, cancel, and change their coverage. Payers could quickly confirm an individual's eligibility for coverage and convey any changes to the health plans, which, in turn, could quickly relay the information to the person's designated providers.

Research in US showed that the Internet could reduce misunderstandings and disputes among parties, hasten payers' premium payments to plans and plans' payments to providers, and reduce administrative costs which constitute 30 percent of all health care expenditures. By one estimate, paper claims cost between $2 and $18 each to process, whereas electronic claims have costs measured in cents[29].

The administrative expenses in Turkey must be figured out before a transformation. We could not find any data, but the situation might not be very different from the US. Apart from the US, the health expenses of Turkey increase dramatically. The figures of the government show that the health expenses per person have increased from $433 in 2000 to $767 in 2007. (http://www.medimagazin.com.tr/genel/tr-turkiyede-saglik-harcamalari-artiyor-2-12-36237.html. Access date 20.06.2012) The administrative expenses are expected to increase in parallel.

Financial and administrative transactions do not require special technical challenges. Bandwidth requirement is very low. The security issue can be solved by secure protocols, encryption, and various trusted systems, which are already available. Most of the administration units have access to the Internet. Regulations have to be set and legal issues should be enumerated nationwide for a complete telemedicine solution for financial and administrative transactions.

Public health

Public health workers promote health and the quality of life by preventing and controlling the spread of disease, injury, and disability. Also in a setting of limited resources, which may be medicine, non-pharmaceutical medical supplies, donated organs, blood products, and even medical personnel based on needs, mechanisms for identifying the need for resources and deploying them rapidly to affected populations are of criti-

cal importance. Turkey as a country facing frequent earthquakes, for example, might benefit from telemedicine if applied to public health area successfully.

There are some studies introducing the potential use of telemedicine in public health. In a recent study from China, Xu et al. designed the 'Beijing Eye Public Health Care Project' to screen all elderly subjects (age 55-85 years) of the rural region of Greater Beijing. The authors mentioned that the recent study was developed as a preparatory step for a telemedicine-based public health care system in ophthalmology in China. As a conclusion the authors mentioned that using a telemedicine approach, the 'Beijing Eye Public Health Care Project' developed, applied and tested an infrastructure for ophthalmic mass screening of >500000 elderly inhabitants with a response rate of >80%. Beside cataract, retinal diseases including diabetic retinopathy and glaucoma were found as major causes for visual impairment[30]. In another study the effects of a mobile phone based telemonitoring system on heart failure management and outcomes have been investigated. In this trial one hundred patients were recruited from a heart function clinic and randomized into telemonitoring and control groups. The telemonitoring group took daily weight and blood pressure readings and weekly single-lead electrocardiograms (ECGs), and answered daily syptom questions on a mobile phone over 6 months. Readings were automatically transmitted wirelessly to the mobile phone and then to data servers. Instructions were sent to the patients' mobile phones and alerts to a cardiologist's mobile phone as required. The authors concluded that their findings provided evidence of improved quality of life through improved self-care and clinical management from a mobile phone-based telemonitoring system. The authors also mentioned that the use of the mobile phone-based system had high adherence and was feasible for patients, including the elderly and those with no experience with mobile phones[31].

A research in US revealed that population-based approaches could prevent up to 70 percent of deaths by targeting underlying risks such as tobacco, drug and alcohol abuse, diet and sedentary lifestyles, and environmental, occupational, and infectious risk factors[32]. The death causes in Turkey are primarily focused on cardiovascular diseases and cancer (68%), which can be prevented by population-based telemedicine efforts.

The Internet offers an effective way to prevent diseases in public domain which can be applied to Turkey. The opportunity for public health officials to collect data from private sources might be important in their surveillance efforts. School attendance records and sales of prescription drugs or nonprescription remedies could signal the outbreak of a disease in its early stages, before symptoms reach the level at which people visit a doctor.

In Turkey, we had a total of 19546 pharmacies in 1998 and this number was 22780 in 2010 and the customer population per pharmacy was 3318 and 3236 in 1998 and 2010 respectively, which is better than many European countries. (http://www.beo.org.tr) In our opinion some of the tasks can be handled easily by the pharmacies in Turkey, such as the evaluation of drugs sold and reporting of an unusual change in the sales for a special drug.

Health professional education

In professional education databases as the source of scientific knowledge are important. In the US, the National Library of Medicine (NLM) made its Medical Literature Analysis and Retrieval System (MEDLARS) available online in the early 1970s. So, online accessible databases have been available since then. In Medline, which is the name of the online database, there are 12292 journals and only 6 of the journals are from Turkey.

The most important journal selection criteria[33] include the orderly publication of the journal, the objectivity of the referees, the appropriateness of the format of the journal to international rules and the article quality. The journals in Turkey are generally fit to these criteria except content quality. This is a vicious circle caused because of the grading of journals. The journals that enter international indexes are graded more and for this reason qualified articles are generally preferred to be submitted to foreign journals. The native journals are not referred because they have not entered indexes. And if the native journals are to be referred, they cannot be reached because a database containing these journals and a retrieval system do not exist, which makes the acceptance of the native journals to the indexes more difficult.

Review

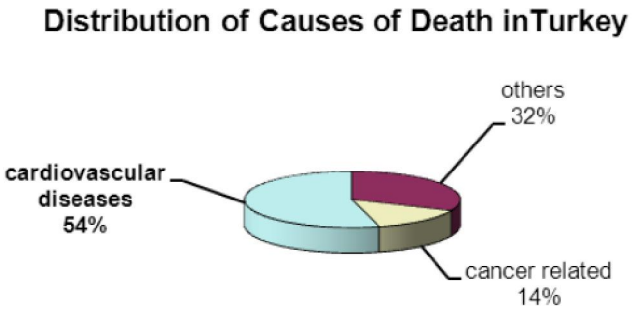

Figure 2 : Causes of death in Turkey.

Turkey lacks a database containing the native journals which have qualified articles which is essential to get out of this vicious circle. This database should also contain the articles that are of great scientific value but related to local problems, such as "Anemia in the Mediterranean region of Turkey". There was a study to reach such journals named as Turkish Medical Index. But there exists problems in reaching some of the articles, the links are unreachable[34]. A study is conducted by Medical Data Processing Association to form a database using XML[19].

Teleconferencing is one of the educational tools, but there are a few places in Turkey where the infrastructure is sufficient. As considered above, the bandwidth becomes a problem in teleconferencing.

OBSTACLES

Despite the initiatives taken in Turkey, no noteworthy progress has taken place since the introduction of the first telemedicine group project UMEDIA in 1997. Although the main reason for failure of UMEDIA is given as financial problems, underestimating the technical barriers and loss of leadership are other factors which led to the end of this national telemedicine effort. It was stated that, the targets were not distant in the technological aspect, which was not true at that time. Security, availability, quality of service are main barriers for the usage of the Internet as a communication medium in telemedicine, which still partially exist today. The other factor that led to the failure of UMEDIA, the loss of a strong leadership was important to accomplish UMEDIA, because telemedicine is a study at the junction of networking and medicine and requires a strong leadership to combine independent disciplines and motivate researches.

Today, there still exist technological, organizational, financial and legal obstacles, which have prevented widespread adoption of telemedicine for different disciplines in Turkey. For instance, no legal measures have been set for data protection and information security of the internet yet. In addition, initial investments for investigation of technological aspects introduce financial obstacles.

The attempts that have been performed up to now resulted in advances especially in tele-radiology and telepathology in Turkey. Although much has been done since 1997, telemedicine studies in Turkey are conducted separately by the academia, government and a civil organization. These independent and small scale studies shift the realization of telemedicine in Turkey to a further date. For success in telemedicine a collaboration of the government, universities, medical institutions and civil organizations is required.

RECOMMENDATIONS

Recommendation 1

Strong leadership is needed to conduct telemedicine studies. The project UMEDIA lacked motivation and the other researches are independent and unorganized. A leadership combining the governmental, academic and private sector units, and organizing the studies among them is essential!

Recommendation 2

Telemedicine, being a discipline in the junction of medicine and information technologies, needs working force having knowledge of both areas. Although several universities in Turkey have graduate programs on medical informatics, none of the universities has a telemedicine department at the undergraduate level. The formation of such departments is crucial. Medical students who are interested in computer science should be given opportunity to specialize in telemedicine by taking a technical education after their six year medical education, whereas engineering students should have graduate level education opportunity on telemedicine.

Recommendation 3

Government, industry, and academia should work together and with professional associations with expe-

rience in health and information technology to educate the broader health and health care communities about the ways the Internet can benefit them. The health staff in health care institutions should be trained to use computers and the Internet and made familiar with the advantages, so that a change in their jobs would be desired. Otherwise some social barriers would also form when trying to implement telemedicine.

Recommendation 4

The government should cooperate with networking and medical industries to realize telemedicine. Cooperation with professional associations with expertise in health issues and information technology from developed countries should be encouraged so as to share experiences in order to develop and promulgate guidelines for safe, effective use of the Internet in clinical settings.

Recommendation 5

Quality initiative associations must be formed and standards developed to rate and control health related Websites.

Recommendation 6

Technological barriers might be considered by detail and efficient ways to overcome them must be encouraged.

Recommendation 7

Health organizations in industry and academia should work to evaluate various health applications of the Internet in order to improve understanding of their effects, the business models that might support them, and impediments to their expansion.

Recommendation 8

Public and private health organizations should experiment with networks based on Internet protocols and should incorporate the Internet into their future plans for new networked applications and into their overall strategic planning.

Recommendation 9

Computer engineers and academic members should be encouraged to work on databases for journals, personnel health records; and also on the format and standards of health records.

CONCLUSIONS

Turkey has a great potential and need for telemedicine and many initiatives are performed in order to realize telemedicine since 1997. The first group project UMEDIA, which failed due to financial problems, is followed by the e-Health Project of the government. Moreover, considerable telemedicine research is conducted and graduate programs on medical informatics are formed in several universities. Also a civil organization conducts studies for medical indormatics and arranges a national conference on this subject.

The Internet can support a wide range of applications in consumer health, clinical care, health care financial and administrative transactions, public health, professional education in Turkey. However, there exist technological, organizational, financial and legal obstacles that prevent widespread adoption of telemedicine for different disciplines.

Technical advances are needed across many areas of information technology (not just networking) if the potential of the Internet is to be achieved in support of health applications. Home consultations and patient monitoring cannot be realized due to technical barriers, such as bandwidth, security and availability. Security and availability are critical technical needs for health applications of the Internet and are not adequately met by today's Internet. Also bandwidth requirements needed for remote consultations, medical image transfer, teleconferencing are not met in all cities and the network of Turkey is not enough to support many telemedicine applications. Ensuring widespread access to the Internet is essential to achieving its promise in health applications. The Internet usage in rural parts of Turkey and also in the east and in the south is not sufficient for a widespread adoption of telemedicine.

Moreover security and privacy issues introduced by internet and telemedicine should be set on legal bases. Afterwards interest in telemedicine studies should be promoted in the academia by establishing a 'telemedicine engineering' discipline that forms a technological workforce nationwide. On the medical side, medical training should be developed so as to capture informatics teaching. Additionally, existing health related Websites in Turkey should be accredited in terms of

Review

quality of the information in these sites since health is a sensitive subject that cannot tolerate any mistakes. Also the efficiency of e-mail communication between patients and care providers in those websites should be investigated. Finally and most importantly, a workforce on telemedicine should be formed in Turkey by a collaboration of the government, universities, medical institutions and civil organizations for the success of telemedicine in Turkey.

REFERENCES

[1] N.A.Brown; The telemedicine information exchange: An online resource. Comput.Biol.Med., **28(5)**, 509-18, Sep **(1998)**.

[2] Jim Reid; A telemedicine primer: Understanding the issues, Innovative medical communications publisher, 3435 SE 23rd Terrace, Topeka, Kansas 66605, 303 **(1996)**.

[3] R.Wootton, L.Bonnardot; In what circumstances is telemedicine appropriate in the developing world, JRSM Short Rep., **1(5)**, 37, Oct 1 **(2010)**.

[4] Canan Aydoðdu; Telemedicine in Turkey: Potential, initiatives and obstacles, The 9th international eHealth, telemedicine and health ICT Forum for education, networking and business, (Med-e-Tel 2011), Lüksemburg, 6-8, April **(2011)**.

[5] Efe Onguner; http://inet-tr.org.tr/ inetconf3/bildiriler/umedia.htm. Access date 20.11.2012, Umedia onur kodu; III.Turkey internet konference, METU, Ankara, 21-23 October **(1997)**.

[6] Tamer Çolakoglu, Mehmet Arbatli, Tamer Ilker; ATO & BTO, http://inet-tr.org.tr/ inetconf3/bildiriler/vademekum.htm. Access date 20.11.2012, Bir elektronik yayin ornegi: VADEMECUN- internet (Internet Ilaç Rehberi), III.Turkey internet konference, METU, Ankara, 21-23 October **(1997)**.

[7] Ömer Bayhan, Ibrahim Sogukpinar; http://ab.org.tr/ab01/prog/FTOmerBayhan.html. Access date 20.11.2012, Web tabanli tibbi görüntüleme ve hasta takip sistemi tasarými, Akdemik Bilisim, 01,1-2 Subat 2001, Ondokuz Mayis Universitesi, Samsun, **(2012)**.

[8] M.Kuntalp, O.Akar; A simple and low-cost internet-based teleconsultation system that could effectively solve the health care access problems in underserved areas of developing countries, Comput Methods Programs Biomed, **75(2)**, 117-26, Aug **(2004)**.

[9] A.Eren, A.Subasi, O.Coskun; A decision support system for telemedicine through the mobile telecommunications platform, J.Med.Syst., **32(1)**, 31-5, Feb **(2008)**.

[10] C.O.Sakar, O.Kursun; Telediagnosis of parkinson's disease using measurements of dysphonia, J.Med.Syst., **34(4)**, 591-9, Aug **(2010)**.

[11] E.Turk, E.Karagulle, C.Aydogan, H.Oguz, A.Tarim, H.Karakayali, M.Haberal; Use of telemedicine and telephone consultation in decision-making and follow-up of burn patients: Initial experience from two burn units, Burns., **37(3)**, 415-9 **(2011)**.

[12] Ayhan Istanbullu, Inan Güler; http://ab.org.tr/ab01/prog/TumBildiriler.html. Access date 20.11.2012, Saglik sektörü caliþanlarinin egitiminde biliþim teknolojilerinden yararlanma, Akdemik Bilisim'01,1-2 Subat 2001, Ondokuz Mayis Universitesi, Samsun, **(2012)**.

[13] Kemal Hakan, Tamer Çalikoglu, Hidayet Dogan; http://www.inet-tr.org.tr/inetconf7/bildiriler/103.pdf. Access date 20.11.2012, Ulusal tip dizini, Seventh Internet Conference in Turkey, **(2001)**.

[14] Kemal Gülkesen, Filiz Isleyen, Osman Saka; http://www.inet-tr.org.tr/inetconf7/bildiriler/108.pdf. Access date 20.11.2012, Türkiye de saglik alaninda sivil toplum orgütleri web'i nasil kullaniyor, Seventh Internet Conference in Turkey, **(2001)**.

[15] Murat Erdal, Sedef Saygili; http://www.inet-tr.org.tr/inetconf7/bildiriler/41.pdf. Access date 20.11.2012, Internet saglik sektöründe gizlilik ve etik standartlar, Seventh Internet Conference in Turkey, **(2001)**.

[16] O.Ongürü, B.Celasun; Intra-hospital use of a telepathology system, Pathol Oncol Res., **6(3)**, 197-201 **(2000)**.

[17] K.Bicakci, N.Baykal; EVEREST: An efficient method for verification of digital signatures in real-time teleradiology, Stud.Health Technol.Inform., **107(2)**, 1241-5 **(2004)**.

[18] M.O.Oztas, E.Calikoglu, K.Baz, A.Birol, M.Onder, T.Calikoglu, M.T.Kitapci; Reliability of web-based teledermatology consultations, J.Telemed.Telecare, **10(1)**, 25-8 **(2004)**.

[19] M.Baba, D.Seçkin, S.Kapdagli; A comparison of teledermatology using store-and-forward methodology alone, and in combination with web camera videoconferencing, J.Telemed Telecare, **11(7)**, 354-60 **(2005)**.

[20] O.Arican; E-dermatology: Emails about dermatological diseases on the Internet, J.Dermatol, **34(6)**, 375-80, Jun **(2007)**.

[21] E.Senel; History of teledermatology: a technique of the future in dermatology, Skinmed, **8(3)**, 167-70, May-Jun **(2010)**.

[22] O.Coskun, A.Eren, M.Eren; A computer based telemedicine protocol to predict acute coronary syndrome in patients with chest pain at home, Int.Heart J., **47(4)**, 491-500, Jul. **(2006)**.

[23] E.Sagbas, B.Akpinar, I.Sanisoglu, B.Caynak, M.Guden, U.Ozbek, Z.Bayramoglu, O.Bayindir; Robotics in cardiac surgery: the Istanbul experience, Int.J.Med.Robot, **2(2)**, 179-87, Jun. **(2006)**.

[24] TurkMIA: Turkish medical informatics association. http://www.imia-medinfo.org/new2/node/268. Access date 20.11.2012.

[25] Networking health: Prescriptions for the Internet, Committee on enhancing the internet for health applications: Technical requirements and implementation strategies, Computer science and telecommunications board, Commission on physical sciences, mathematics, and applications, National Research Council, National Academy Press, **(2000)**.

[26] John Oyston; Department of anesthesia, scarborough general hospital. Original paper: Anesthesiologists responses to an email request for advice from an unknown patient. http://www.jmir.org/2000/3/e16/ Access date 20.11.2012

[27] Canan Aydogdu (Pamuk); Smart home bogaziçi Unv., Master Thesis, **(2001)**.

[28] T.U.Onbay, A.Kantarci; Design and implementation of a distributed teleradiaography system: DIPACS. Computer methods and programs in biomedicine, **104**, 235-242 **(2011)**.

[29] McCormack, John; Group practices find their way to the internet, Health Data Management, **8(1)**, 46-53 **(2000)**.

[30] L.Xu, J.B.Jonas, T.T.Cui; Beijing eye public health care project. Ophthalmology, **119(6)**, 1167-74 **(2012)**.

[31] E.Seto, K.J.Leonard, J.A.Cafazzo; Mobile phone-based telemonitoring for heart failure management: A randomized controlled trial. J.Med.Internet Res., **14(1)**, e31 **(2012)**.

[32] J.M.McGinnis, W.H.Foege; Actual causes of death in the united states, Journal of the American Medical Association, **270**, 2207-2212 **(1993)**.

[33] Fact Sheet; Journal selection for index medicus/ MEDLINE. http://www.nlm.nih.gov/pubs/factsheets/jsel.html Access date 20.11.2012

[34] ULAKBIM Veri tabanlari: Tip veri tabani, http://uvt.ulakbim.gov.tr/tip Accessdate20.11.2012