e-health in the Eastern Mediterranean Region: a decade of challenges and achievements

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Introduction

The World Health Organization Eastern Mediterranean Region (EMR) has made huge progress in terms of use of information and communication technology (ICT) in the healthcare sector. Despite the late entry of ICT in health in the Region, there have been many impressive developments both as public health applications and in medical care. The article attempts to draw a picture of the current status of e-health applications in the Region with some specific examples of milestones and achievements made. The overall ICT situation and economic factors coupled with the health situation in the Region dictate the state-of-the-art of e-health.

Health situation and socioeconomic indicators in the Region

The EMR consists of 22 countries: 15 in Asia and 7 in Africa. A variety of official and local languages are used including Arabic, English, Farsi, French, Kurdish, Pashto, Somali and Urdu. The Region has some of the world's richest and the world's poorest countries in Africa and in the Gulf Region. The burden of disease differs among the countries as some suffer from a range of communicable diseases such as malaria, tuberculosis and poliomyelitis while others have started to suffer from chronic diseases such as obesity, diabetes and cardiovascular diseases. The Region has a huge disparity in level of development of national (health) information systems.

Difficult political environments persist in the Region, particularly for countries with complex emergencies such as Iraq, Palestine, Somalia and Sudan. Weak capacity for policy formulation and analysis, strategic planning, economic analysis of health systems and long-term scenarios for human resource development remain major challenges. Health care delivery systems in the Region have widely differing characteristics and performance. However, all countries in the Region face an overriding dilemma: how to meet rising demand with finite, and in some cases shrinking, resources. Most countries in the Region have "mixed" systems of health care, with a varying degree of mix of providers—public, private and government—although usually with 1 sector dominating.

One of the most crucial issues facing health systems in the EMR countries is the weakness in planning human resources development. The problems range from absolute shortage to under-employment, where national health systems are unable to absorb human resources, to geographi-

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cal and skills-related maldistribution. The role of governments in health financing is decreasing, and there is limited interest among donors to support health systems and service development projects.

The Region is at risk for epidemic-prone diseases because it is a crossroads for international trade, travel and tourism, and a centre for religious mass gatherings, and is continuously exposed to a changing expatriate workforce [1].

e-health is viewed against the above background in the Region. Use of ICT in health is an integral part of national health information systems. These systems represent the backbone of the national health system, being the glue that ties all the components together.

e-health (use of information technology and telecommunications in health) has 3 basic elements: ICT infrastructure, health and biomedical knowledge and people (users). The ICT infrastructure in EMR countries has witnessed rapid development and sustained improvement as has been demonstrated by the latest figures and statistics on governance and legal framework, connectivity and Internet penetration, personal computer availability for both home use and business applications, training and skills development and applications. The Region is characterized by a huge diversity in ICT readiness in the same way as it has diversity in health situation and other socioeconomic indicators.

Information technology and telecommunications in the Region: overview

A recent study covering the 6 Levant countries, Egypt, Iraq, Jordan, Lebanon, Palestine and Syria; the North African countries of Algeria, Libyan Arab Jamahiriya, Moroc-

co, Tunisia and Sudan; along with Yemen in the Arabian peninsula revealed that these 12 countries collectively had a lower personal computer penetration rate than the global average. The 6 Gulf Cooperation Council (GCC) states, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates, however, registered a higher number of PCs sold compared to the global norm [2].

Assessment and ranking of 127 countries on factors ranging from the cost of mobile phone calls and available Internet bandwidth to the quality of higher education indicated that Arab countries have risen significantly in the rankings as Egypt moved from rank 80 to 63 and Bahrain, Jordan and Qatar leapt 6, 4 and 11 places respectively. Oman and Saudi Arabia, new to the report, entered at positions 53 and 48 respectively [3]. Table 1 shows the ranking of EMR countries in the Networked Readiness Index.

The International Telecommunication Union (ITU) maintains the Information and Communication Technology Opportunity Index [4]. The main objective of the Index is to track the progress of developing countries and highlight their opportunity to become Information Societies which allows it to track the digital divide and to help developing countries particularly measure their progress (or shortcomings). Table 2 shows the 2001–2005 values and 2005 ranking. EMR countries that rank high in the index are more likely to introduce e-health applications. This has become evident from the number and types of e-health projects implemented in these countries and, more importantly, the approach that has been followed by many of them.

Internet penetration rates in the Region vary, ranging from a minimum of 0.1% in Iraq to 38.4% in the United Arab Emirates. According to the Internet World Stats, none of the EMR countries is among the top 38 countries that have a penetra-

Table 1 **Ranking of Eastern Mediterranean Region (EMR)countries in the Networked Readiness Index [*3*]**

EMR country	Rank in the EMR	Rank globally
United Arab Emirates	1	29
Qatar	2	32
Tunisia	3	35
Bahrain	4	45
Saudi Arabia	5	52
Kuwait	6	75
Oman	7	53
Egypt	8	63
Morocco	9	74
Pakistan	10	88
Libyan Arab Jamahiriya	11	105
Syrian Arab Republic	12	110

Table 2 **Information and communication technology opportunity index for the Eastern Mediterranean Region (EMR): 2001–2005 values and 2005 ranking [*4*]**

Country	Rank in EMR 2005	World rank 2005	Average annual growth rate (%) 2001–05
Qatar	1	39	79.39
United Arab Emirates	2	41	42.99
Bahrain	3	44	39.53
Kuwait	4	54	44.80
Lebanon	5	62	49.61
Saudi Arabia	6	75	45.19
Jordan	7	84	29.89
Oman	8	86	41.01
Tunisia	9	94	50.07
Islamic Republic of Iran	10	98	44.16
Palestine	11	99	35.66
Morocco	12	105	57.95
Egypt	13	107	51.89
Syrian Arab Republic	14	112	82.59
Libyan Arab Jamahiriya	15	122	46.47
Sudan	16	135	99.76
Pakistan	17	139	79.51
Djibouti	18	146	55.25
Somalia	19	158	91.40
Afghanistan	20	180	399.71
Yemen	NA	NA	97.67
Iraq	NA	NA	

NA = not available

tion over 50%, as of November 2007 [*5*]. The same classification shows that 3 EMR countries (Bahrain, Kuwait and the United Arab Emirates) are among the 65 "average Internet penetration countries", with a penetration of 15.2%–49.9%. The 158 "low Internet penetration countries" include all other EMR countries. Table 3 shows the latest available number of Internet users and penetration rates in the EMR countries. In fact 9 EMR countries have a penetration of less than 10%.

What is e-health?

e-health, or the use of information and communication technology in health, is defined as "the use, in the health sector, of digital data—transmitted, stored and retrieved electronically—for clinical, educational and administrative purposes, both at the lo-

cal site and at a distance" [*6*]. The Millennium Declaration acknowledges that ICT is an important tool to achieve the Millennium Development Goals; ICT can help alleviate poverty, improve the delivery of education

Table 3 **Number of Internet users, penetration rate and use growth in the countries of the Eastern Mediterranean Region [*5*]**

Country	Internet users 2007	Penetration (%)
United Arab Emirates	1 708 000	38.4
Kuwait	816 700	32.6
Qatar	289 900	32.0
Islamic Republic of Iran	18 000 000	27.5
Lebanon	950 000	24.2
Bahrain	157 000	22.2
Morocco	7 300 000	21.3
Saudi Arabia	4 700 000	17.0
Tunisia	1 722 000	16.6
Jordan	796 900	13.2
Egypt	8 620 000	10.5
Palestine (West Bank)	266 000	10.5
Oman	319 200	10.0
Syrian Arab Republic	1 500 000	7.8
Pakistan	12 000 000	7.3
Libyan Arab Jamahiriya	260 000	4.2
Sudan	1 500 000	3.7
Djibouti	11 000	2.2
Afghanistan	535 000	1.7
Yemen	270 000	1.2
Somalia	98 000	1.0
Iraq	36 000	0.1

and health care, make government services more accessible, and much more. Target 18 of Goal 8 calls upon countries to "in cooperation with the private sector, make available the benefits of new technologies, specifically information and communications" [*7*].

e-health in the Regional strategy

The World Health Organization (WHO) Regional Office for the Eastern Mediterranean developed a Regional strategy for knowledge management to support public health which was adopted by the 53rd session of the Eastern Mediterranean Regional Committee in 2006 [*8*]. The strategy covered strategic directions at Regional level, including: managing knowledge policies, strengthening publishing and dissemination, promoting electronic publishing, expanding multilingualism, enhancing networking and communication, and strategic directions at country level, including leveraging e-health: use of ICT in health, building capacity for needs assessment, planning and evaluation, strengthening national programmes for knowledge management, enhancing information and communication infrastructure in health care institutions, developing human resources, supporting knowledge translation, promoting knowledge generation and establishing knowledge hubs.

A strategic direction entitled *Leveraging e-health: use of ICT in health in the Eastern Mediterranean Region* covers all aspects of e-health and provides the rationale and areas of application for ICT in health. e-health represents a cornerstone of the Regional strategy as a major enabling factor for implementing strategic initiatives and objectives. The endorsement by Member States of the strategy represents their endorsement of e-health and commitment to its implementation.

Collaborative activities in the area of e-health will be implemented in all areas of work, with particular emphasis on the following:
• measuring progress and trend analysis
• use of statistics for quality improvement

- health networking and collaboration
- representation (geographic information systems, electronic design, animation and multimedia enable graphic representation of health concepts and geographical knowledge stored as raw data)
- decentralization
- health education and learning
- delivery of health services
- income generation and economic opportunities
- access to information and knowledge.

e-health challenges in the Region

The diversity and variation in the socioeconomic and cultural situation among countries of the Region has resulted in variation and multiplicity of constraints in e-health implementation [9]. The constraints range from lack of awareness of potential e-health benefits; shortage, and sometimes total lack, of funding by the government and other healthcare providers; privacy concerns and lack of legal framework; weakness of information infrastructure; complex systems coupled with lack of skilled personnel; and lack of data standards that permit exchange of health data in local languages.

The specific challenges in the Region include:

- challenges in health data management, including absence of policies for data collection, absence of unified coding systems; absence of standards; disparity in quality of systems and data collected; little analysis and possibly no use of data;
- challenges to computerization or data processing, including fragmented efforts to develop applications; duplication of computer systems, even in the same institution; disintegration of systems; huge quantities of data stored in computers;
- challenges related to value and role of e-health as part of national health system, including what ICT is and how it can improve health; status of ICT among national health priorities; absence of measurement of the impact of ICT health; many pilot projects in small settings; resistance to ICT in health by healthcare professionals; ICT tools are not for health by design; and the communication gap between ICT specialists and healthcare specialists limits ability to develop appropriate systems for e-health;
- lack of financial support and sustainability, including funding e-health as research projects; funding e-health as pilot projects rather than long term commitment; funding e-health projects from donor agencies rather than from national budgets; funding for a specific component of e-health applications in isolation from other elements; funding for parallel systems in different institutions to do the same thing (cut and paste type of strategy); and funding for vertical programmes in the absence of integrated solutions;
- poor public–private partnerships in e-health, including private sector healthcare institutions having their own plans; private ICT companies working with the private health sector; private sector not willing to invest in ICT applications on behalf or in collaboration with the public sector; funding in the public sector not guaranteed and not appealing to the private sector;
- poor quality of ICT infrastructure, including healthcare institutions not on the priority list for computerization;

national information infrastructure very weak; ICT services very expensive; ICT services under the monopoly of the government; private sector still weak (which reduces competition); Internet penetration very weak;

- lack of technically competent staff at all levels, including healthcare professionals not receiving ICT training as part of their undergraduate programmes; ICT professionals mainly hardware and software engineers with little orientation on medical applications; in-service training and continuous education missing in the area of health informatics; very few specialized health informatics programmes; and team formation [health and information technology (IT) specialists] weak;

- legal and policy issues, including ambiguous legal framework; poor data management; lack of data security; limited trans-border data flow; open space of information flow and dissemination leads to misinformation, unethical use, concealed bias, covert self-dealing, fraudulent practices and evasion of legitimate regulation;

- lack of vision and clear policy direction for access to information, ICT and e-health;

- lack of political commitment: short-sighted view of the long term value of e-health;

- cultural and multilingual challenges as many e-health systems were developed in languages other than those used in the Region; imported systems comply with cultural needs of countries that developed them rather than those importing them.

Participants of the inter-country meeting of health informatics focal points held in 2001 concluded that the health and medical informatics situation in the Region had some problems which required immediate intervention by top management in ministries of health [10]. Many positive initiatives had been taken by the countries of the Region, especially in terms of developing strategies and long-term plans, as well as applications in specific areas of health informatics. More specifically, the meeting drew the following conclusions:

- The mission of IT departments in ministries of health needs to be well defined.

- Electronic medical records are an essential cornerstone for supporting health care services.

- Use of telemedicine is growing in the Region.

- The move to electronic libraries, virtual libraries and health sciences databases is an essential element in health care provision.

The meeting produced a set of recommendations for Member States which since then have constituted the basis for e-health activities in EMR countries. They aimed at institutionalization of ICT support in ministries of health, building better infrastructure, investment in human resources, and expansion of the use of ICT to cover technical health areas.

Progress in e-health in the Region

Health on the Internet

In the 22 countries of the Region, all but 4 (Djibouti, Iraq, Libyan Arab Jamahiriya and Somalia) have established websites. These websites vary in quality, language (5 sites in English only, 5 in Arabic only, 6 in Arabic and English, 1 in French and 1 in Farsi) and comprehensiveness. Most of them are not built to function as e-health tools for health professionals and the public: they provide information on the Ministry's structure, ac-

tivities, departments, etc. but do not provide healthcare services or health and medical advice.

Health on the Internet is weak in the Region: in early 2006, a total of only 258 medical- and health-related websites were found through an Internet search. Currently there are 335 sites available, an increase of 38%. Of these, 51 were in Pakistan, 42 in Egypt, 56 in the Islamic Republic of Iran, 29 in Lebanon and 32 each in Bahrain, Jordan, Palestine and Saudi Arabia. The other 29 sites were distributed among the other countries. Health websites in the Region were maintained mainly by ministries of health, medical education institutions, research centres and hospitals in the private sector. Internet connections and web presence at health care institutions in the Region are still suffering from the digital divide.

e-learning

A number of countries in the Region have launched e-learning initiatives in the area of public health and medical education and health education. These range from presenting offline electronic information resources such as CD-ROMs to the more interactive web-based e-learning systems.

e-learning for healthcare professionals

In the Islamic Republic of Iran, e-learning was introduced in many medical universities with simple technologies such as computer networks, multimedia, search engines, electronic libraries, and distance learning. Among the most prominent universities that have adopted these technologies are the medical universities of Tehran, Shahid Beheshti, Mashhad, Esfahan, Tabriz, Shiraz, Ahwaz, and Kerman. They have built a network of digital libraries that provides access to students and faculty to the electronic resources in all these universities. Some of them utilize the Distance Learning Network

(DLN), and a national programme is being implemented to train academic staff; some courses have been taught in Tehran and Shahid Beheshti Universities as well [11].

In Pakistan, the Aga Khan University has been developing capacity to make e-learning a common feature of education in its School of Nursing and Medical College. It has more than 1500 computers for its 1000 students and 4000 employees. The university uses the Internet, intranet, extranets, satellite, broadcasts, videos and CD ROM technologies in teaching and learning [12].

In Morocco, the Institute National d'Administration de Santé (INAS) in Rabat, which is mandated for the development of human resources in health, has initiated an e-learning project for training of healthcare professionals. One of the major players in health education in Morocco, INAS reaches out to 45 000 health care workers at different levels (doctors, nurses, health care workers, trainers, etc.) with limited resources; e-learning was, therefore, considered a possible solution. INAS forged collaboration with the Institute of Tropical Medicine, Antwerp, the Netherlands aiming at developing human resources in health using the e-learning approach [13].

e-learning for health education and promotion

WHO drafted an e-Health Strategy which was submitted to the 115th session of its Executive Board on January 2005 (EB115/39). The e-health resolution (WHA58/28) is the outcome of the proposed e-health strategy to the 58th session of the World Health Assembly. "e-health for citizen's education and health promotion" or "Health Academy" is a WHO initiative to create a global health and technology alliance. It provides guidance in terms easily understood by people from all walks of life and all age groups,

taking into consideration individual cultural sensitivities. Information is prepared and then translated into the local language of the country in a culturally acceptable form.

A pilot phase of the Health Academy was completed and evaluated in Egypt and Jordan. It involved a total of 6785 students in the age range 12–17 years in 45 schools. The students' evaluation of the courses was most positive. It demonstrated that the Health Academy e-learning approach is an effective tool to learning and it can impact attitudes and behaviour [14].

The Health Academy is currently being expanded to other countries in the EMR and other regions. An expansion phase was completed in Jordan in 2007–08, during which the Academy was introduced in 72 schools in all parts of the country. The Academy was also introduced in Lebanon in 2007–8: 40 schools were covered: governmental 20, private 10 and the United Nations Relief and Works Agency for Palestine Refugees 10. The projects were managed by both the Ministry of Health and the Ministry of Education.

An introductory and planning workshop was organized in Saudi Arabia in 2007 for the GCC countries and Yemen. The workshop resulted in development of plans of action for the introduction of the Academy in these countries.

Telemedicine activities and applications

Interest in health informatics and telemedicine started in the Regional Office in the mid-1990s. Systematic effort was exerted to institutionalize health informatics and telematics (e-health). The Regional Committee in its 44th session in 1997 discussed a technical paper on "Health informatics and telemedicine" which reviewed progress and telemedicine activities in the Region at the time. The reported experience of EMR countries in telemedicine applications was modest and fragmented, and did not reflect the real situation. A resolution was passed in which Member States and the Regional Director of the EMR were requested to strengthen the use of ICT in health and introduce the necessary legal framework and infrastructure at both country and Regional level.

The Regional Office conducted a survey of telemedicine applications and services in the Region in 1999/2000 (16 countries out of 22 completed the questionnaire) [15]. The survey included questions on all aspects of telemedicine activities. The following are the main findings:

- The primary objectives of telemedicine in EMR countries are medical consultation and medical education (distance learning), which involve transmission of static black-and-white images, transmission of colour images, transmission of slow-scan video and transmission of video images plus voice.

- Telemedicine projects in EMR countries mainly comprise consultation between a doctor and another doctor or paramedic outside the country, transmission of images and consultation between a doctor and another doctor or paramedic inside the country.

- The participants in and operators of telemedicine programmes in the Region are ministries of health, hospitals or clinics and telecommunications authorities. The programmes are offered as public services; a number of them are still at the experimental stage.

- The vast majority of telemedicine programmes are funded by government subsidy. The private sector has not come forcefully into this area.

- Access to telemedicine services in EMR countries is mainly offered to those par-

ticipating in the telemedicine experiment or programme, or other medical practitioners, with very little access provided to those in remote and rural areas.

- The majority of the EMR countries provide training as part of the telemedicine programme. That training is mainly provided to doctors and health care workers.

- The telecommunications facilities that are used to provide telemedicine services in the region include satellite, wire-line telephone service and wireless radio.

- The vast majority of EMR countries do not have national policies or regulations for telemedicine services. Few countries have the intention to develop national policies covering telemedicine.

- The majority of telemedicine services in the EMR function under license either from the Ministry of Health or the Ministry Communications. A number of countries have no licensing schemes.

Health mapping and geographic information systems

Health mapping and utilization of geographic information systems in health have been considered key e-health applications as they represent a state of development and maturity in health information management. Health mapping requires robust health statistics and thematic databases combined with spatial databases for geographic entities and locations. The Regional Office developed a strategic plan for health mapping in 2003 which was used to guide and assist countries to implement health mapping activities. The Regional Committee [16] passed a resolution in October 2007 to support health mapping and institutionalize it EMR countries.

A review of published literature showed that a number of countries in the Region have used GIS for health mapping. The common element in all these studies is the strong link between geography (location) and the health problem being addressed. Presenting health data in a map, using GIS, was employed in these studies to help show the influence of geography on health.

A GIS-based analysis was conducted in the Islamic Republic of Iran to map the incidence of childhood cancer in districts of the Tehran metropolitan area and to explore possible clustering of cancer cases in the diverse environments of this area [17]. In a study of the Rift Valley fever outbreak in Yemen in 2000–2001, GIS technology enabled researchers to study the spatial distribution of outbreaks at the national and local levels [18].

In Egypt, health mapping techniques have been used for a number of different purposes. Several studies were conducted in which GIS functions were used to identify environmental indicators for villages at high risk of filarial transmission [19,20].

In Afghanistan, a study was conducted using GIS technology and population-weighted raster maps to assess mine education performance, coverage and costs [21]. In Saudi Arabia, GIS technology was used to produce catchment area and patient profile distribution and flow models to support local health planners in their health care decision-making [22].

A study in Lebanon integrated different data sources using GIS techniques to support decision-making in the humanitarian sector. In the humanitarian community, data integration for health mapping has served as a powerful coordination mechanism and led to the creation of UN-led Humanitarian Information Centres [23].

In Kuwait, a GIS application was used to model exposure to smoke from oil fires by integrating spatial and temporal records of smoke concentrations and population

movements. Exposure was then linked with reports of upper respiratory ailments [*24*].

Health informatics education in the Region

The importance of health (medical) informatics education was recognized by the Regional Office as it has the potential to change the status of use of ICT in health. It is believed that qualified health informatics professionals can make the move towards successful national e-health programmes. Health informatics support has been provided in many countries through healthcare professionals interested in ICT or by ICT professionals who found themselves working for ministries of health and healthcare institutions. The problem has been the lack of understanding of needs coupled with lack of skills in health informatics applications. The Regional Office made attempts to develop health informatics education programmes as part of medical education or as full-fledged programmes to graduate qualified professionals in this field. A model curriculum for health informatics was developed and shared with medical and health sciences colleges in the Region.

A number of countries have also recognized the need and took major steps to establish postgraduate programmes in health informatics, which holds the promise of producing a generation of health informatics professionals in the Region. A few examples are presented here.

Islamic Republic of Iran: health informatics MSc programme

The MSc in Health Informatics programme is a new 2-year programme and is being delivered in collaboration with Zahedan University of Medical Sciences.

The programme provides students the knowledge and skills that will help them maximize the use of information and ICT in the health care sector. It equips students with generic tools to enable them to respond to future developments in health care and in information technology while grounding these in the "real world" of current initiatives in information policy, technology and management.

Students study the programme in Chabahar, Islamic Republic of Iran via distance learning and also spend a semester at the University of Sheffield in the United Kingdom [*25*].

Saudi Arabia: health informatics MSc programme

The College of Public Health and Health Informatics was established in 2006 as part of the King Saud bin Abdulaziz University for Health Sciences. The college offers gradaute studies in health informatics, health systems and quality management, public health, and epdimology and mediacl statistics.

The need to establish a postgraduate programme on health informatics was based on recognition that hospitals and other healthcare institutions in Saudi Arabia had to modernize themselves through the utilization of information technology to improve services, reduce costs and improve efficiency. Lack of trained health informatics professionals was believed to hamper development in the healthcare sector [*26*].

The MSc programme started in September 2006 with a group of 25 students, with the intention of keeping the intake within this range. The mission of the programme is to advance the quality and efficiency of the Saudi Arabian healthcare system through improved information management, communication and the generation of new forms of knowledge.

Oman: postgraduate diploma in medical librarianship

The Regional Office recommended in one of its missions to Oman the establishment of

a medical librarianship training programme in collaboration with the Department of Library and Information Science at Sultan Qaboos University. The Ministry of Health and the university worked on the implementation of that recommendation and made an agreement to establish a postgraduate diploma programme in medical librarianship (N. Al-Shorbaji, unpublished report, 2002).

The first batch of students, comprising 12 science graduates, was enrolled in the programme in the academic year 2003/04. The 1-year programme offers courses on medical librarianship as a profession, classification, indexing and cataloguing using specialized systems, medical library services, health on the Internet and a research project [27].

Health informatics professional associations in the Region
Professional associations play a major role in networking and cooperation among e-health professionals. They set and raise the standards of professional practice in e-health, enhance the status of the profession, build capacity of human resources, represent the voice of the practitioners, organize conferences and meetings, publish specialized literature and more importantly build a sense of belonging among members. A common set of objectives among these associations includes:

- to provide healthcare professionals and policy makers with knowledge, skills on how to make best use of ICT in healthcare,
- to enhance communication and build communities of health informatics professionals,
- to promote medical/health informatics as a viable and respected profession,
- to encourage collaboration and sharing of experience at national, regional and international level,

- to foster enhanced collaboration and establish relationships with relevant organizations world wide,
- to further foster and enhance research, development, and the diffusion and dissemination of medical/health informatics,
- to establish codes of ethics and practice,
- to provide professional and independent advice to national authorities.

Examples of associations that are active in the Region are listed below.

Syrian Arab Republic
The Syrian Medical Informatics Association was founded as one of the scientific associations of the Syrian Medical Association (Syndicate) [28]. It aims to improve the status and the professioan of medical informatics to become part of medical practice.

Islamic Republic of Iran
The Iranian Medical Informatics Association is the premier professional association to advance and advocate the use of ICT at every level in the delivery of healthcare and medical services. It was established in 2005 as a result of recognition of the role of ICT in health and the need to network and collaborate at national and global levels. The mission of the association is to facilitate continuous quality improvement in health through advocating and advancing the use of advanced ICT throughout the country [29].

Lebanon
The Lebanese Medical Informatics Association is a non-profit, nongovernmental organization based on the voluntary work of health professionals and computer scientists with a special interest in medical informatics. The purpose of the association is to promote the use of the telecommunications and information technology in

medicine or, perhaps more accurately, in the health sector. This technology is viewed as a means to improve the services offered by the healthcare delivery system, decrease their cost and reduce loss of time in service delivery [30].

Saudi Arabia
The Saudi Association for Health Information was established to work under the direct supervision of King Saud University for Health Sciences to practice public activities, develop theoretical and applicable knowledge, and provide scientific and applicable studies and consultation, private and public. It aims to act as an umbrella for practitioners in healthcare to better utilize the applications of health informatics in therapeutics, research and e-learning [31].

Pakistan
The Telemedicine Association of Pakistan was established to oversee the campaign and future projects of telemedicine in Pakistan [32]. The association has contributed to training programmes, initiation of projects and fostering international collaboration.

Arab region
The Arab Telemedicine Society was founded under the umbrella of the Arab Medical Union in October 1999 after the recommendations of the First International Telemedicine Symposium for the Arab World, Africa and Europe held in Tunis in 1998. Founding members were representatives of 6 Arab countries (Algeria, Egypt, Jordan, Kuwait, Morocco and Tunisia).

The role and purposes of the society are:

- to promote the creation of national associations in the Arab World and scientific exchange between them;
- to support cooperation between Arab nongovernmental organizations, and dialogue and cooperation between governmental and non governmental institutions;
- to bring together e-health users: scientists, researchers, sponsors, manufacturers and distributors;
- to support activities relating to the establishment of appropriate legal outline conditions for telemedicine applications [33].

Eastern Mediterranean Region
The Middle East Association of Healthcare Informatics (MEAHI) is a geographic chapter of the International Medical Informatics Association. The association was established in response to the need for education and awareness of medical/health informatics as a key to continuous quality improvement in the health industry in this Region. For several years, there had been a growing recognition that a professional body specializing in biomedical/healthcare informatics was needed, however, it was necessary to wait for the emergence of greater awareness in the Middle East medical/healthcare professional community before MEAHI could be established. MEAHI includes in its membership health informatics associations and educational institutions and individuals in the Region [34]. It is a chapter of the International Medical Informatics Association, and complies with the aims and objectives of that association.

Research and publication in e-health in the Region

Research and publishing in a scientific field is a sign of its development and progress. The e-health field has not been well researched and published in the Region due to the novelty of the subject, lack of long term and established experience, lack of expertise and lack of funding to document experience and conduct research.

A search on e-health was run in the Index Medicus for the Eastern Mediterranean, which is the largest database of health and biomedical literature in the Region [*35*]. In addition to the standard Medical Subject Heading (MeSH) term "information management" a number of search strategies were used to search the database, including health (or medical) and informatics, (computers; health and information and management; health or medical records; hospital and information and systems; health and Internet; and medical librarianship. The result was a total of 71 articles and research papers of which only 1 paper used the term e-health in its title and abstract. The papers covered a range of topics such as medical informatics (19 articles), medical records (16 articles), hospital information systems, searching the Internet and use of computers in health. Journals from Pakistan (33) and Saudi Arabia (19) produced the highest number of articles.

It is worth noting, however, that the majority of research in ICT in health is disseminated through medical conferences that organize special sessions on e-health, or through the specialized conferences organized in the Region on the use of ICT in health. It is estimated that during the past 10 years over 250 research papers have been presented to conferences in the Region on the topic of e-health and its variations. The most prominent and regular conferences have been:

- Regional Conference on e-health, which is organized every other year by the Regional Office; the 5th in the series was convened in June 2006;
- Regional Conference on Virtual Health Sciences Library; the 5th in the series was convened in November 2007;
- Regional Conference on Medical Journals Publishing, which is organized by

the Regional Office; the 3rd in the series was convened in January 2006;
- Middle East Information Technology in Healthcare Forum; the 4th in the series was convened in January 2008;
- Annual Meeting of Specialized Medical Centres, Alexandria, Egypt (special session on e-health);
- Syrian National e-Health Conference, November 2005;
- Euro-Mediterranean Medical Informatics and Telemedicine Conference; the last conference was convened in March 2008;
- Saudi e-health Conference, the last conference was convened in March 2008;
- joint EMR, ITU conferences on computer applications in health; the last was convened in November 2007;
- Kuwait Public Health Conference, April 2008 (special session on e-health);
- Middle East Medical Congress (special session on e-health);
- Medicine in the Information Technology Era (Tanta, Egypt), 2002.

Access to health information
Regional partnerships: networks and communities

The Regional Office has been working with EMR countries to develop the Virtual Health sciences Library (VHSL) which is a collaborative effort for networking and resources-sharing. The main objective is to facilitate and enhance access to health information in the Region [*36,37*]. The active participation of countries is the Region has substantially contributed to the success of this effort. A number of initiatives have been implemented with the full participation of EMR countries. These include:

- Union List of Medical Journals in the Region. The List includes complete list-

ing of holdings of 6280 journal titles in 222 libraries from 18 countries in the Region. The List is supported by an electronic document delivery service that countries run on their own.

- Regional Medical Journals Consortium, which is a collaborative effort among countries providing the facility to access the online version of all journals by any institution that has a subscription to any number of journals within the Consortium. The Consortium includes 950 journal titles, accessible to 87 institutions in the Region.

- Index Medicus for the Eastern Mediterranean, which includes indexing and abstracting of 420 journals published in 19 countries of the Region. The Index is published on the Internet and is backed up by an electronic document delivery service. The contribution of EMR countries to the Index is considered an example of partnership among countries for better registration, monitoring and access to health research.

- Directories of medical colleges, medical libraries, editors, research institutions and collaborating centres. These directories are used as a basis for networking and collaboration among the countries of the Region. The contribution of countries towards the update and maintenance of these directories signifies their commitment to information and knowledge sharing. Three EMR countries (Afghanistan, Djibouti and Somalia) have not yet contributed to the database due to a total absence of medical journal publishing.

Networks and communities of practice have been built and maintained through the full collaboration of professionals in the Region. These include the Virtual Health Sciences Library, the Eastern Mediterranean Association of Medical Editors, Health Informatics, the Eastern Mediterranean Approach to Non-Communicable Diseases Network and Arabization of Health Sciences Network.

Global partnerships: HINARI implementation in the EMR countries

The Health InterNetwork Access to Research Initiative (HINARI) provides free or very low cost online access to the major journals in biomedical and related social sciences to local, not-for-profit institutions in developing countries. HINARI was developed in the framework of the Health InterNetwork, introduced by the United Nations Secretary-General at the UN Millennium Summit in the year 2000.

HINARI was launched in January 2002, with some 1500 journals from 6 major publishers, following the principles in a Statement of Intent signed in July 2001. Twenty-two additional publishers joined in May 2002, bringing the total number of journals to over 2000. Since that time, the number of participating publishers and of journals and other full-text resources has grown continuously. Today more than 70 publishers are offering their content in HINARI, and others will soon be joining the programme. An evaluation is in progress which will determine the long term future of HINARI. The publishers and other partners have made a commitment to sustain the initiative until 2015 [*37*]. Eleven countries in the EMR have benefited from the initiative. To date 198 institutions (Afghanistan 17, Djibouti 4, Iraq 50, Palestine 13, Somalia 7, Sudan 42 and Yemen 27) have registered in HINARI as part of Phase 1, which makes them eligible for access free of charge, and Phase 2 (Jordan 13, Morocco 14, Syrian Arab Republic 6 and Tunisia 5), which allows for access at very low cost. The

WHO Regional Office provided training sessions in the 11 countries, bringing the total number of trainees to over 1000; this was in addition to the local training provided by national institutions.

Conclusion

e-health has made substantial progress in the Region. An inventory of projects and activities would not be practical here, but the indicators to this progress are evident from the examples and the specific national activities that have been covered. This progress can be better calibrated when legal frameworks are introduced, national e-health policies are developed, more human resources are trained, regular funding is committed and long term plans are made.

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