Report

WHO EMRO's approach for supporting e-health in the Eastern Mediterranean Region

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نهج المكتب الإقليمي لمنظمة الصحة العالمية لشرق المتوسط في دعم الصحة الإلكترونية في الإقليم

نجيب الشربجي

الخلاصة: « الصحة الإلكترونية » مصطلح عام يقصد به استخدام تكنولوجيا وتطبيقات الحاسوب والاتصالات في مجال الصحة والرعاية الطبية. وتعرض هذه الورقة البحثية الإطارَ العام للأسلوب الديناميكي والمتنوِّع لمنظمة الصحة العالمية في دعم الصحة الإلكترونية في إقليم شرق المتوسط. وهو يشتمل على: رسم السياسات؛ وتنمية الموارد البشرية؛ والتخطيط والرصد والتقييم؛ والمشابكة والاتصال؛ وتطوير البِنْية التحتية؛ وتقديم الخدمات الاستشارية؛ والنشر الإلكتروني؛ وتطوير النُظُم؛ والتعلُّم الإلكتروني؛ والتطبيب عن بُعْد؛ وتقديم الخدمات المكتبية على الخط المباشر؛ ودعم مبادرة الشبكة الدولية للصحة لتيسير الوصول إلى نتائج البحوث الصحية HINARI. كما تستعرض هذه الورقة البحثية بعض العقبات التي تقف أمام تطوير نُظُم الصحة الإلكترونية في الإقليم.

ABSTRACT "E-health" is a generic term covering the use of computer and communication applications and technologies in health and medical care. This paper outlines WHO's dynamic and diversified approach for supporting e-health by the Regional Office of the Eastern Mediterranean. This includes: policy-setting; human resources development; planning, monitoring and evaluation; networking and communication; infrastructure development; consulting services; electronic publishing; systems development; e-learning; telemedicine; and online library services and support to HINARI. It also reviews some of the impediments towards development of e-health in the Region.

Approche du Bureau régional OMS de la Méditerranée orientale pour promouvoir la cybersanté dans la Région de la Méditerranée orientale
RÉSUMÉ « Cybersanté » est un terme générique couvrant l'utilisation d'applications et de technologies informatiques et de communications dans le domaine de la santé et des soins médicaux. Le présent article décrit l'approche dynamique et diversifiée de l'OMS pour promouvoir la cybersanté adoptée au Bureau régional de la Méditerranée orientale. Cette approche comprend : l'établissement de politiques, le développement des ressources humaines, la planification, le suivi et l'évaluation, l'établissement de réseaux et la communication, le développement des infrastructures, les services de consultation, la publication électronique, le développement des systèmes, le cyberapprentissage, la télémédecine, ainsi que les services de bibliothèque en ligne et le soutien à l'initiative HINARI. Il examine également certains des obstacles qui entravent le développement de la cybersanté dans la Région.

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Introduction

The goal of information management in health care is to obtain, manage and utilize information to improve the performance of health care and medical services, governance and management and support processes. Delivering health care to the population is a complex endeavour that is highly dependent on information about the individual patients, the techniques of care, the care provided, the outcome of the care, as well as the performance of the health care provider. Like other resources—human, material and financial—information is a resource that must be managed effectively by health care managers and leaders if they are to plan, coordinate and integrate services.

The basic assumption in this paper is that information technology has no value unless the information component is the prime target. Information technology is a tool to help the management of information. Health information management has become one of the essential elements of all national health care systems. The growing interest in the subject and the increase in allocation of funds for its development have led to its institutionalization and recognition by senior management and health workers. The growth of health information management systems is based on a number of assumptions [1]:

- health care will increasingly be an information-driven service;
- information is a major resource which is crucial to the health of individual patients, the population in general and the success of the organization;
- health information systems should be viewed on a continuum, beginning with patient-specific data (clinical), moving to aggregated data (performance, utilization), to knowledge-based data (planning and decision support), to comparative, community data (policy development);
- the quality of data and its transformation into information are fundamental to the efficiency and effectiveness of all information systems. Emphasis should therefore be placed on information that has value in decision-making, evaluation, planning and policy development.

Technology will increasingly be integrated and assimilated into the working life of all health managers and health professionals. Therefore, the purpose of this paper will be to discuss the ways in which information and communication technology (ICT) can contribute to the improvement of health care. In other words: what is e-health?

The Regional Office for the Eastern Mediterranean (EMRO) of the World Health Organization (WHO) established its health informatics and telematics programmes over 10 years ago. It has been providing support to its member states through the full integration of health information management, informatics and telecommunication services. At Headquarters level, WHO has moved one step forward by creating the Department of Knowledge Management and Sharing. This department has a unit called E-Health which is supported by a number of other departments at Headquarters. In EMRO, one department coordinates this support through the Unit of Health Information Management and Telecommunication. This paper reviews EMRO's approach to supporting e-health in the Region.

Definitions

A simple definition of medical informatics is: "computer applications in medical care".

The *Journal of Medical Internet Research* has defined e-health as "an emerging

field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally and worldwide by using information and communication technology" [2].

EMRO's definition of e-health is "the use, in the health sector, of digital data—transmitted, stored and retrieved electronically—for clinical, educational and administrative purposes, both at the local site and at a distance" [3]. In a paper presented to the WHO Executive Board in January 2005, e-health was described as "the use of information and communication technologies locally and at a distance" [4]. As adopted by EMRO, e-health covers all aspects of health: both public health and medical care; both information technology and telecommunication; both remote and local access to information.

E-health as part of the health care professional's work: implications for the curriculum

The argument that health care informatics should be a central feature of the health/medical undergraduate curriculum rests on the intimate relationship of information management to the 5 essential roles envisaged for future health care professionals. For each of these roles the health care informatics learning needs could be stated as learning objectives. These roles are as follows ("informatics" is data processing using computers while "telematics" refers to data communication using telecommunications technology):

1. ICT learning needs for "the lifelong learner role"

To fulfil this role the graduate should be able to demonstrate knowledge of information resources and tools available to support lifelong learning. The knowledge component includes the awareness of these resources, their content and the information needs they can address. The skills that are needed for this role include the ability to retrieve information as well as filter and evaluate it. The required attitudes will include developing appropriate information habits.

2. ICT learning needs for "the clinician role"

To fulfil this role the graduate should be able to use appropriate and available ICT to acquire and analyse patient information leading to proper clinical decision-making. The range of informatics and telematics skills which are required for this role include the ability to store and retrieve patient information, the analysis of such information, including laboratory information, and using any supportive facilities. The necessary attitudes which relate to this role include attention to the confidentiality of patient information and its security in the electronic medium.

3. ICT learning needs for "the educator/communicator role"

Medical and health practitioners need effective education/communication skills in the context of relating to students, peers, patients and the public at large. This role will be facilitated by skills enabling utilization of the ICT and its potential for making effective communication messages and presentations. It also includes the ability

to access and utilize relevant information resources in the Internet, on CD-ROM or in any other electronic format.

4. ICT learning needs for "the manager role"

To fulfil this role the graduate should be able to collect and analyse information about service clients, the work done and the system functions that, when put together, comprise the ingredients of a management information system. The relevant informatics and telematics skills for this role include the ability to use information technology for collection, storage, retrieval and analysis of service information. The learning may include training in specific software packages used for the management of resources, supplies, personnel and surveillance information.

5. ICT learning needs for "the researcher role"

Throughout their career, health/medical graduates will be involved in the consumption of research products and in many instances conducting their own research. Research includes traditional biomedical research in the laboratory, clinical research and population-based and health system research. The relevant informatics and telematics skills needed for this role include the knowledge of literature sources and how to access them, the use of computers in data collection and analysis and how to disseminate the results.

Areas of application of medical informatics

Medical informatics can be applied in a number of areas of health care:

Management

Support to management activities in health care ranges from the management of an activity (e.g. an immunization or an awareness campaign), to the management of a national programme (e.g. disease control), to the management of a health care institution (e.g. a hospital or a laboratory) or the management of the health services of an entire nation.

"Management" refers to the cyclical process of problem analysis, planning, programming, budgeting, implementation and monitoring, evaluation and re-planning. Thus, it includes, but is not restricted to, logistics, administrative and financial management. For example, whereas it includes the support to the monitoring of expenditure against approved budgets, it must also support the managerial necessity of linking resources (financial, human) to the various aspects of the health services and programmes.

Whereas there are numerous examples of informatics and telematics support to specific areas of management (e.g. logistics, administrative and financial), there are no fully developed systems supporting the broad role of management as defined above.

Hospital management information systems

A hospital management information system (HMIS) provided key information across the continuum of health care for hospitals: in inpatient facilities, outpatient clinics and extended care facilities. An integrated HMIS provides patient billing, patient scheduling and tracking, and electronic medical records that include personal data, laboratory and diagnostic data and all clini-

cal data (treatment, medication). The HMIS integrates hospital services with outpatient care, payment services and public programmes. Different solutions have emerged based on standardized solutions or according to specific needs.

Epidemiological surveillance

Disease surveillance involves the collection of ongoing routine data to examine the extent of disease, to follow trends and to detect changes in disease occurrence. Epidemiological surveillance is essentially the study of the patterns of distribution and the trends of diseases and related health care measures, by geographical areas, age groups, communities, etc., so as to establish priorities and optimize health care measures through monitoring and evaluation. This requires the collection and analysis of large amounts of data, from and about the locations where diseases and other health problems occur and from where patients present themselves, typically in urban and rural health centres and hospitals.

Although informatics and telematics support to health statistics was one of the earliest applications of computing in developing countries, it is also an area that requires the most improvement. Arguably, traditional routine data collection practices could be replaced by more cost-effective computer-supported sampling techniques. The accuracy and cost of manual recording of data about admission, discharge and transfer of patients in hospitals (and the equivalent stages in health centres) could be improved by relatively simple computer support, since such statistics can be computer-extracted from the application. Furthermore, better utilization of satellite-based remote sensing data could provide the essential intelligence sought for surveillance of certain problems such as waterborne vectors and diseases.

Developments in informatics and telematics prompt the need for a major rethink of the traditional methods employed for disease surveillance, early warning and sentinel systems, especially for communicable diseases.

Electronic health records

There has always been a desire for well-structured and accessible patient data, and developments in computer science now make it possible to develop a comprehensive electronic health record for patients. The electronic health record has a number of advantages, including:

- *Simultaneous access from multiple locations.* Consultants, physicians and nurses located in separate buildings, in other cities or even in other countries can simultaneously share access to the patient record for a consistent view of the problem.
- *Support for data exchange and sharing of care.* Two hospitals will easily be able to share the content of a medical record electronically without the need to move files between locations. Parts of a record can be copied to other locations according to needs and access rights.
- *Legibility of records.* As the data is machine-coded or typewritten, there is no room for mistakes based on misinterpretation of data.
- *Variety of presentations.* As data is electronically stored in a structured manner, it can be presented in different formats.
- *Completeness of the record.* As the data elements are well-defined, they can be tagged in such a way that the operator has to enter the data before moving to a new data field. This ensures that the record is complete.
- *Support for decision-making.* A complete and accurate medical record will

allow the physician to make decisions based on the data available in the record. The ability to link data elements and generate new information based on inferences can help in decision-making in clinical trials and medical care.

- *Support for other data analysis*. Medical research, epidemiological surveillance and disease trend analysis is not patient-based. The need here is to generate information based on extraction of data from multiple sets of records to analyse relationships, e.g. between geographic location and a certain disease or disease and age group, etc.

The above advantages can be even greater as the storage capabilities of new computer systems make it possible to create a multimedia medical record, including X-ray images, charts, sound recordings, diagrams and pathology reports. These not only have clinical value but are also invaluable for education purposes.

Although computers have the potential to improve legibility, accessibility and structure of records, they also pose heavy demands on data collection. In order for the electronic medical record to accomplish its clinical, legal, and administrative requirements, an information infrastructure must be in place to support the various data capture, storage, processing, communication, security and presentation functions.

Another success factor in the electronic health record is the application of standards, specifically those of Health Level Seven (HL7). HL7 is one of several accredited standards developing organizations operating in the health care arena and its mission is to "to provide standards for the exchange, management and integration of data that support clinical patient care and the management, delivery and evaluation of health care services. Specifically, to create flexible, cost effective approaches, standards, guidelines, methodologies, and related services for interoperability between healthcare information systems" [5].

Access to literature and information services

Many libraries in developing countries are victims of the economic and currency problems of their countries. University and medical libraries have had to dramatically reduce their acquisitions of journals and publications of foreign medical societies. The use of CD-ROMs that list the holdings of foreign libraries largely alleviates the problem of searching for information, but there is still the problem of acquisition of scientific literature. The gravity of the situation motivated the international scientific community to collaborate to seek affordable means of linking scientists in developing countries to international networks to access the available information and literature services. The health sector is a major beneficiary of this collaboration.

Health and biomedical literature is presented in a number of electronic media that facilitate access to this literature by the health care community. These include:

- *Health and biomedical information on CD-ROM*. The most cost-effective electronic publishing medium of health literature has been the CD-ROM. By this means, MEDLINE and many other bibliographic databases have been able to reach even the most remote health care units in most countries.
- *Electronic journals*. For many medical professionals, online or CD-ROM abstracts are inadequate compared with the full text of research papers. In response to this need, many publishers of medical journals have either moved to electronic publishing or have published their

journals in both printed and electronic formats. Many of these journals are available free of charge on the Internet or on CD-ROM.

- *The Internet*. Many health care organizations and publishers have started to use the Internet as a vehicle to publish their products on the Internet. These include textbooks, manuals, video clips, articles, frequently asked questions, drug information, etc. A major issue, however, is still the quality of biomedical information on the Internet.

- *Electronic mail systems and discussion and newsgroups*. E-mail was the driving force behind advancements in telecommunication links, to directly link individuals and institutions of similar professional interests or engaged in joint activities and projects. The same links that enable e-mail also enable the establishment of electronic bulletin boards, discussion groups and electronic conferencing. E-mail text messages are the least costly computer application because messages are primarily stored and forwarded without any time-consuming processing. The past 5 years have witnessed an exponential growth in e-mail within and between developing countries and internationally, particularly over the Internet and over simpler networks bridging onto the Internet. Experience has shown that the installation of networking and e-mail facilities in one site vigorously triggers the enthusiasm for more national and international links, even via simple radio links or semi-reliable local telephone lines. E-mail services are only one aspect of the full range of multi-media services on the Internet.

Specific examples of Internet use by the health and medical community include: medical training and continuous education, medical information access, patient care and support, remote diagnosis and consulting, emergency/epidemic support, tele-working for the disabled, preventive care education and preventive health, and electronic publishing of the full texts of health and biomedical literature.

Knowledge-based services

An application of informatics that is relatively recent but will expand with the spread of telematics support is the access to and use of knowledge-based systems—also known as expert systems and decision support systems. Given a patient's coordinates and symptoms, for example, the system can provide diagnostic support, suggest additional tests or propose a treatment. Starting in the mid-1970s, a growing number of knowledge-based systems have been developed in the health sciences. Such systems often include a combination of literature-based data (from journals articles and textbooks) and opinion-based data (e.g. guided by experts and derived from well-documented patient cases).

Appropriate knowledge-based information is acquired, assembled and transmitted to users as required. Knowledge-based information management consists of systems, resources and services to:

- help health care professionals acquire and maintain the knowledge and skills they need to care for patients;
- support clinical and management decision-making;
- support performance improvement;
- satisfy research-related needs; and
- educate patients and families.

Large knowledge-based systems under active development have the potential for becoming national and international repositories of medical knowledge. The work

of the National Library of Medicine in developing the Unified Medical Language System (UMLS) is an example. UMLS develops and distributes multi-purpose, electronic "knowledge sources" and associated lexical programmes. Systems developers can use the UMLS products to enhance their applications—in systems that are focused on patient data, digital libraries, web and bibliographic retrieval, natural language processing and decision support. The aim is that researchers will "find UMLS products useful in investigating knowledge representation and retrieval questions" [6].

Expert or decision-support systems (the former name for knowledge-based systems) have some shortcomings, as a clinician cannot convey his or her complete understanding of a patient case to a computer programme. The computer programme in most cases is not capable of assimilating all data input to it. The training requirements for the system and the operators are extensive and demanding. This training or lack of it will influence the clinical decisions made by the physician.

Knowledge-based systems are in use on an experimental basis in many developing countries, including some that have been developed by institutions and groups in the countries themselves. A few main issues, which are not unique to developing countries, remain to be resolved. For example, the assurance that the content of the knowledge base has been vetted by a recognized authority (who and how); the validity of the knowledge base when it is transported from one setting to another; and the lack of legislation concerning the respective responsibilities of the developers, users and intended beneficiaries of such systems. Nevertheless, knowledge-based systems can be valuable sources of expertise and knowledge, especially as they double up as educational and training tools. These are particularly useful to physicians and other health workers in remote locations, depending on the availability and types of telecommunications services.

Geographic information systems

A geographic information system (GIS) is an organized collection of computer hardware and software, geographic and tabular data, and personnel and knowledge designed to capture, store, manipulate, update, analyse and display spatial data. GIS has become an essential part of health information systems as it provides a visual presentation of statistical data with a clear link to geographic locations. As a system, GIS comprise 5 major parts: hardware, software, data, procedures and people, and the content are the spatial database and the attributes. The benefits of GIS include linking spatial and attribute data; cartographic displays; customization of applications; data entry, data processing and data integration; database management; visual database analysis; and visual reporting on screen or in print.

Telemedicine

Telemedicine is the "use of information technology to deliver medical services and information from one location to another" [7]. It is "medicine at distance". It uses electronic signals to transfer medical data (i.e. high-resolution photographs, radiological images, sounds, patients' records and videoconferencing) from one site to another. It has been defined as "the practice of medical care using interactive audio, visual and data communications; this includes medical care delivery, consultation, diagnosis and treatment, as well as education and the transfer of medical data" [8]. The term "education" covers both the education of the patient and the continuing education of the health care staff. To provide telemedicine services, 4 essential components

are required: medical knowledge in digital format, people (providers and recipients), data processing equipment and telecommunication facilities.

Telemedicine has become one of the most familiar applications of medical informatics and has spawned a number of specific services (tele-pathology, tele-radiology, tele-dermatology, tele-nursing, tele-pharmacy, etc). It makes full use of the computing and telecommunications features of this technology. A number of serious issues impact on telemedicine, however—some technological, others managerial and legal.

EMRO's support for e-health

Based on its strategic vision and full understanding of the value and role of ICT in health, EMRO has introduced a number of initiatives and implemented a number of activities in support of e-health in the Region. Examples of these are outlined below.

Awareness-raising, policy-setting and working with decision-makers

Addressing decision-makers and leaders of the health care sector and medical education has been a priority for EMRO. The Regional Committee was approached twice through technical papers on health and medical informatics [5,9], with the aim of familiarizing ministers of health in understanding the e-health issues and helping them in defining priorities. A number of conclusions and recommendations were made after extensive discussions in these Regional Committees. EMRO participated in high level meetings and medical conferences to introduce e-health issues to health care managers, professionals and practitioners. EMRO developed and adopted

the "E-health code of ethics" which sets a number of guiding principles for health on the Internet [10].

Human resources development

Education and training of 3 categories of human resources (health care professionals, e-health operators and the public) were provided in the following formats:

- *Professional conferences, meetings and seminars*. EMRO has conducted a series of conferences on health over the last few years, the last of which was in the Islamic Republic of Iran and was dedicated to electronic health records [11].

- *National training courses*. Training events were organized in most of the member states to introduce different facets of e-health. These have included GIS, health statistics databases, electronic health records and Internet searching.

- *Fellowships and internships*. Training opportunities were provided to a number of people to undergo training in specific areas of e-health. These sessions were provided at EMRO or one of the specialized institutions in the Region or beyond.

- *Field visits and studies*. Opportunities were given to a number of people to visit institutions in the Region where one or more e-health applications are running. This has provided a hands-on experience for these professionals to understand the issues as they are on the ground.

- *Development of training materials.*

- *Development of model medical informatics curriculum.*

- *Collaboration with medical colleges to introduce medical informatics education.*

Planning, monitoring and evaluation

EMRO has assisted member states to plan and evaluate e-health projects. External funding was provided for a number of projects in the Region through donors and extra-budgetary resources. To allow for the best utilization of funds, EMRO was requested on a number of occasions to assist in planning future projects or evaluating ongoing projects. Setting criteria for evaluation and standards for quality control in collaboration with member states have resulted in high quality ICT products and services in the health care sector in the Region. A directory of projects has been established, allowing countries to enlist their activities and resources.

Networking and communication

In a sector that is information-intensive, networking and communication are critical for success. EMRO has provided a platform for a number of initiatives to support networking and communication among professionals working in the area of e-health and "communities of practice". These have included:

- EMR networks, such as: Health Sciences Libraries; Health Care Informatics; Editors of Medical Journals; Translators of Medical Literature; Food Safety and Nutrition; Non-Communicable Diseases [*9,12–15*].
- Listservs and discussion groups, such as: Health Sciences Libraries; Health Care Informatics; Editors of Medical Journals; Translators of Medical Literature; Food Safety and Nutrition; Non-Communicable Diseases [*16*].
- Communities of practice. Sharing of information on e-health projects and activities constitutes an important way of learning from experience and sharing resources.

Infrastructure development

EMRO has been assisting countries to build the ICT infrastructure necessary to launch e-health services. This has included:

- support to establish Internet connections for health institutions;
- support to establish Internet presence (websites for ministries of health);
- training on Internet technology; and
- financial support to build local area networks and provision of data processing and telecommunication equipment.

Consulting and advisory services

Support has been provided to a number of countries to assess their needs, evaluate technical options and develop plans for e-health projects. A number of alternative solutions were proposed, based on EMRO's evaluation and technical advice.

Electronic publishing

EMRO has adopted a policy of open access to its health information resources. This access can only be supported through electronic publishing using the available means, including:

- EMRO website [*17*]. The website was established in 1997 and has grown to include pages on all health topics in addition to health profiles of countries, health policies and information services. The website is available in both Arabic and English. The search engine *Google* has been used to index and search the site.
- Full text of books and journals. All issues of the *Eastern Mediterranean Health Journal* have been published on the Internet, allowing free access to all its contents [*18*]. A number of EMRO publications have also been published on the Internet [*19*].

- CD-ROM publishing and distribution. A CD-ROM version of EMRO publications has been produced and distributed to health care professionals and institutions.
- Hosting of medical library sites on the EMRO website.
- Digital "Institutional Memory" project.
- Databank of technical papers and *PowerPoint* presentations.
- Collaboration in the Epidemiology Supercourse (a library of PowerPoint lectures funded by the National Library of Medicine and available free on the Internet to support global health).

Development and maintenance of systems

EMRO has assisted countries in the development and maintenance of a number of computer applications for health information management including:

- health statistics and surveillance system: *Regional Health Statistics Database* (a database to promote electronic collection, management and exchange of statistical data and to reach compatibility and uniformity of definition of health indicators);
- geographic information system: *HealthMapper* (a surveillance and mapping application developed by WHO) [20];
- database management system for bibliographic data: the *Union Catalogue of Medical Journals and Library Database* (a database published on the EMRO Internet site with input from 175 libraries in 4 countries of the Region) [21];
- drug production quality control software;
- management information system: the *Regional Activity Management System* (a programme management component that provides information on planning, programming, implementation, monitoring and evaluation of EMRO activities);
- language processing: the *Unified Medical Dictionary* (an Arabic/English medical dictionary, originally compiled in the late 1960s and early 1970s in response to a recommendation of the Arab Medical Union) [22]; and
- directory systems: conferences, libraries, institutions, mailing lists.

EMRO Virtual Health Sciences Library

Development of the EMRO Virtual Health Sciences Library, an on-line library service, has allowed for a substantial increase in knowledge management activities and information sharing among member states [23]. Among the activities that were implemented are:

- *Union Catalogue of Health Sciences Journals* in the Region;
- inter-library and document delivery services;
- portal of EMR health sciences journals;
- regional databases;
- directories of: collaborating centres; medical education institutions; health sciences libraries; WHO depository and reference libraries; and medical conferences.

E-learning and WHO's Health Academy

The Health Academy is a WHO initiative developed since 2000 to harness modern technology to provide knowledge and know-how to the people of the world in the area of health and disease prevention [24]. The Health Academy uses e-learning techniques to deliver validated health informa-

tion for people of all ages and occupations, in a language that is easily understood. It not only increases knowledge but influences attitudes and behaviour. E-learning in the context of the Health Academy is a one-on-one interactive experience between the programme viewed on computer and the learner. It is now being extended into many areas in many disciplines. A pilot project has just been completed in 2 EMR countries, Egypt and Jordan, where 20 schools were involved. The support to the Health Academy project includes:

- development of training materials in appropriate languages and their adaptation to the local situation;
- preparation of materials in interactive mode for e-learning;
- planning the project in collaboration with the ministry of health, ministry of education and ministry of information technology;
- assess the e-readiness and needs at schools;
- selection of schools to participate in the project;
- awareness campaigns for schoolteachers and headteachers;
- training of mentors;
- pre-testing of participating students;
- deployment of materials either on CD-ROM on through the Internet;
- evaluation and post-testing.

Telemedicine

Support to telemedicine projects in EMR has been provided in different ways and methods combining needs assessment, planning, training, provision of equipment and software, collaboration and networking. Examples of these are:

- needs assessment in the Islamic Republic of Iran, Sudan, Libyan Arab Jamahiriya and Egypt;
- provision of equipment in Yemen;
- training in the Libyan Arab Jamahiriya, Egypt, Yemen and Islamic Republic of Iran;
- collaboration with Saudi Arabia (designation of a WHO Collaborating Centre);
- development of an e-health portal [3]; and
- development of a directory of telemedicine projects in the Region.

EMRO launched the largest ever survey on "Use of Internet and e-mail by physicians in selected countries of the Region". The survey was conducted in 7 countries and revealed important results on attitudes to and extent of use of the Internet and e-mail by physicians. A multilingual site (in Arabic, English, Farsi and French) has been launched on the Internet for extend the survey to other physicians in the Region [25].

Support to HINARI

The Health Information Network Access to Research Initiative (HINARI) is a collaborative effort between WHO and the private sector to provide access to medical literature free of charge or at a reduced rate [26]. Over 35 publishers of medical journals have agreed to provide access to their journals to countries that have a gross national product (GNP) less than US $1000 and to charge US $1000 per annum per institution in countries with GNP less than US $3000.

Ten countries in EMR have made use of this initiative: Afghanistan, Djibouti, Iraq, Jordan, Morocco, Palestine, Tunisia, Somalia, Sudan, Syrian Arab Republic and

Yemen. The Regional Office provides support in the following ways:

• support registration and enrolling in HINARI in Yemen, Sudan, Iraq, Jordan, Morocco;

• provision of national training in Iraq, Jordan, Morocco, Syrian Arab Republic, Yemen and Sudan;

• provision of Internet access in many institutions in countries eligible for HINARI; and

• translation of training materials and promotion of HINARI.

Geographic information systems

The Regional Office has been supporting GIS activities in the Region in a number of ways, including:

• development of a regional policy and plan for GIS implementation;

• capacity-building at EMRO and member states;

• building of the digital maps collection based on aerial images, mapping and global positioning and digitization;

• training of national staff. A series of national training courses were conducted for staff from most of the countries of EMR to use the *HealthMapper* software and to collect data;

• capacity-building at country level including hardware and software;

• software development and localization including updating the *HealthMapper* package, development of Arabic and Farsi versions and development of training materials.

Barriers to developing medical informatics in the EMR

EMRO has been assessing the situation in its member states and has conducted surveys about the level of use and impediments to implementation of e-health [*27*]. A number of issues have emerged, some institutional, others personal:

• *Lack of awareness.* Many of the health care institutions in the Region have not addressed the issue of ICT at a strategic level due to the fact that they do not fully appreciate the impact made by ICT on medical education and health/medical practice, nor do they appreciate the gravity of lagging behind in this field. When such awareness is present, the response is usually limited to attempts to introduce computer literacy among staff or students and seeking the use of the technology by senior staff for managerial or data analysis purposes.

• *Lack of vision.* Medical informatics and telematics is a multidisciplinary professional practice. It requires knowledge of both ICT and health sciences. Most health care leaders are health care professionals who have little knowledge in ICT. This has lead to a lack of comprehensive and long-term planning for e-health applications. The response to needs for computerization is usually temporary and short-term in nature. Solving the current data processing problems has blinded many managers from thinking about long-term or strategic solutions.

• *Financial constraints.* Development and maintenance of a proper ICT infrastructure is expensive and the cost is beyond the budget of many institutions in the Region, particularly when technology is sought for large-scale institutional use. The economic situation and financial constraints in the health care sector has left many health care units and medical education institutions without proper funding to cater for their basic needs, let alone computerization. Dependence on external resources or funding from do-

nors has become the rule rather than the exception in the introduction of e-health in the Region.

- *Limited medical informatics expertise.* None of the countries in the Region offers any type of medical informatics education and training. Very few professionals have been lucky enough to receive any training abroad. As this area of expertise is still lacking in the Region, with little awareness of its value, health care institutions will continue to suffer. Medical informatics has to run in parallel with medical education. Before too long, the delivery of health care services will depend completely on ICT.

- *Poor communications infrastructure.* Many countries of the Region lack a basic ICT infrastructure. A lack of computerization policies, national information policies, telecommunications facilities,

information culture or qualified personnel have inhibited the adoption of ICTs in the health care sector.

- *Absence of legal, legislative, ethical, and constitutional frameworks.* Most of the countries of the Region have not introduced laws and regulations to regulate information technology in general and health informatics in particular. The legal frameworks are needed to regulate electronic data interchange, access to patients' files, electronic publishing, coding systems, confidentiality and privacy.

The Regional Office recognizes the serious constraints that hinder the full utilization of the power of e-health in the Region. For e-health to become an integral part of health care services there has to be awareness, education, finance, a legal framework and international support and collaboration.

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