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EASTERN MEDITERRANEAN

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TECHNICAL PAPER

HEALTH INFORMATICS AND TELEMATICS
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1. **INTRODUCTION**

This is the first paper on the subject of health informatics and telemedicine to be presented to the WHO Regional Committee for the Eastern Mediterranean. Hence, it will address the general definition and framework of health informatics and telematics and offer an in-depth analysis of telemedicine: its definition, applications, potential benefits, constraints and issues for consideration. In January 1997, two papers on the subject were presented to the 99th session of the WHO Executive Board (EB99/30 and EB99/INF.DOC/9). The development of national health information systems in the Region was discussed at the Thirty-eighth session of the Regional Committee in 1991.

Health informatics in general and telemedicine in particular are viewed in this paper as elements of the wider frame of the national health information system (NHIS), which encompasses among other things the application of computers and telecommunications in health care. Proper introduction of these as part of the NHIS will allow for:

- exchange of information and data between medical professionals, scientists and experts nationally and internationally;
- distant consultations by real time examination of diagnostic pictures; and
- interactive management of patients' medical records.

The specific applications and the areas in which computers can be used will be briefly mentioned to put health informatics and telemedicine in their context as part of a national health information system. Terminology that has been used in the literature on the subject includes health informatics, medical informatics, biomedical informatics, telematics, telehealth, telecare and telemedicine. For the sake of uniformity and for the purpose of this paper we will use medical informatics, telematics and telemedicine fully recognizing that telemedicine is only one area of health informatics and telematics.

2. **INFORMATICS AND TELEMATICS IN HEALTH**

2.1 **Definition**

The provision of health care requires, and generates, a wide range of data and information, which needs to be collected, processed, distributed and used. One way to view the scope of the uses of informatics and telematics in health is through an understanding of the types of health data and information involved, which may be categorized into six groups:

- management information: information for the day-to-day management needs and for planning, programming, budgeting, monitoring;
- clinical information: data and information to support clinical functions such as diagnosis and treatment; this includes imaging;
- surveillance and epidemiological information: the patterns and trends of diseases and related health care measures;
- literature: documentation, reports, formal publications and “grey” literature published in printed or electronic format (CD-ROM or over the Internet);
• knowledge: the information readily usable to support a technical task, such as the
diagnosis of a medical problem, the conduct of a laboratory test or proposed treatment;
and
• personal and community health-related information directed at the public.

The sources of these types of data and information are within and outside the health
care infrastructure and are located at varying distances from the users. Moreover, users
generally require (and generate) a mixture of these types of information depending on
circumstances. Thus, the collection, flow, processing and distribution of health-related data
and information are key factors in the efficacy, efficiency and economy of the operations and
development of the health care services.

Health informatics has been defined as “an umbrella term used to encompass the
rapidly evolving discipline of using computing, networking and communications—
methodology and technology—to support the health-related fields, such as medicine,
nursing, pharmacy and dentistry” [1,2]. This definition covers a very large domain and
includes clinical and administrative messaging, reference retrieval, operation and
management of health services, patient information, health education and promotion,
epidemiological surveillance, health status monitoring, clinical decision support, image and
signal analysis, modelling and telemedicine.

2.2 Electronic messaging and cooperation

Electronic mail (e-mail) was the main initial driving purpose of telecommunication
links and is extensively used to 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 creation of electronic bulletin boards, discussion groups and even conferencing.

The past few years have witnessed an exponential growth in the use of e-mail in and
between developing countries and internationally, particularly over the Internet and over
technologically simpler networks riding on the Internet. This growth has included most of
the countries of the Region where the telecommunications infrastructure is widespread and
reliable. E-mail is now used in at least 21 Eastern Mediterranean Region (EMR) countries
and it is anticipated that full Internet connection will be operational in most of these
countries within the next two to three years.

Experience has shown that the installation of a networking and an e-mail facility in
one site vigorously triggers enthusiasm for more national and international links, even via
simple relatively cheap radio links or semi-reliable local telephone lines.

E-mail services are not to be confused with, and are only one aspect of, the full
range of multimedia services on the Internet. The Internet is mainly a communication
protocol and can be used by different equipment, networks and technological environments.
It can be used for e-mail, file transfer, web browsing, discussion groups and many other
information services. Specific examples of Internet use by the health and medical community include:

- **Medical training and continuous education.** Examples: Hong Kong Medical Association Continuous Medical Education site (www.hkma.co.hk); Massachusetts Medical Society site (www.massmed.org); Online Course on Medical Bacteriology (www.qmw.ac.uk);
- **Medical information access.** Examples: MEDLINE (www.nlm.gov); Physicians Home Page (php.silverplatter.com);
- **Patient care and support.** Examples: Interactive Patient (medicus.marshall.edu); The Interactive Patient (http://152.163.202.22);
- **Remote diagnosis and consulting.** Examples: The Virtual Medical Center (www.sci.lib.uci.edu); Your Medical Information Online Source (www.interactive.com); Health Seek (www.healthseek.com);
- **Emergency/epidemic support.** Examples: National Center for Emergency Informatics (ncemi.org); Emergency: a Guide to the Emergency Services of the World (www.cett.citri.edu.aq);
- **Teleworking for the disabled.** Example: Teleworking and Disabled People (www.doc.mmu.qc.uk);
- **Preventative care education.** Example: Preventive Care Guidelines for Adults (kaiseronline.org); Preventive Health Services (www.wbboy.com); and
- **Electronic publishing of full texts of health and biomedical literature.** Examples: British medical journal (www.bma.org.uk); Lancet (www.lancet@elsevier.co.uk); and Eastern Mediterranean health journal (www.who.sci.eg).

2.3 Management

Management ranges from the running of an activity, such as an immunization or an awareness campaign to the management of a national programme (e.g. disease control), the management of a health care institution (e.g. a hospital or a laboratory) or the management of the entire national health services.

“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 and administrative and financial management. Whereas there are numerous examples of informatics and telematics support to logistics and administrative and financial management, there are no fully developed systems supporting management as broadly defined above. To support the efforts made by various ministries of health in the Region, the Regional Office for the Eastern Mediterranean (EMRO) has supported initiatives in the Islamic Republic of Iran, Jordan, Kuwait, Morocco and the Syrian Arab Republic, and to establish computer-based medical records and electronic document management systems. Establishment of health statistical databases, as part of national health information systems, has been supported in almost all Member States. This was done through development of national health statistics databases, training on the use of the computerized version of the *International classification of diseases and related health problems*, 10th revision, (ICD-10) and computer-based data collection methods.
2.4 Epidemiological surveillance

Epidemiological surveillance is essentially the study of the patterns of distribution and trends of diseases and health care measures by geographical area, age group, community, etc. so as to establish priorities and optimize health care measures through monitoring and evaluation. This requires the collection and analysis of varied and relatively 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.

Informatics and telematics support to health statistics and epidemiology are perhaps the earliest and thus more popular applications of computing in developing countries. It is also an application area that calls for the most improvement. Arguably, certain traditional routine data collection techniques could be replaced by more economic computer-supported sampling techniques. Also, relatively simple computer support to the patient admissions, discharge and transfer function in a hospital and the equivalent in a health centre could improve on the accuracy, time and cost of manually maintaining statistical forms or eliminate it altogether, since such statistics could be automatically extracted from the computer application. Furthermore, better use of satellite-based remote sensing data, could provide essential intelligence sought for surveillance.

The Regional Office, in collaboration with ministries of health in the Region, has established well defined computer-based epidemiological surveillance methods. National immunization programmes have been equipped with the necessary hardware and software to facilitate regular data collection, management and reporting. The most recent development in this respect is the transfer of epidemiological data from Kuwait and Lebanon to the EMRO central computer through the Internet. These data will be made available to all EMR countries through the EMRO Web site. This model will be applied to other EMR countries gradually.

2.5 Access to literature and information services

Many libraries in developing countries, including those of the Eastern Mediterranean Region, are prime victims of poor economies and hard currency problems. Many university and medical libraries have had to dramatically reduce their acquisitions of journals and publications of foreign medical societies. The uses of CD-ROMs on which foreign libraries' holdings are listed largely alleviates the search problem (but the acquisition problem remains).

2.6 Knowledge-based services

An application area that is, relatively speaking, recent but will usefully expand with the spread of telematics support, is the access to and uses of knowledge-based systems, also known as expert systems and decision support systems. These are systems that provide expert advice on medicoscientific issues. For example, given a patient's location and symptoms, it could provide diagnostic support, suggest additional tests or propose a treatment.
A few 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 developing countries themselves. However, there are a few main issues, which are not unique to developing countries, that remain to be resolved, such as quality control of the system by a recognized authority, its validity in different settings and the lack of legislation concerning the developers, users and intended beneficiaries.

2.7 Technological facilities

The minimum equipment required for national and/or international connectivity are a computer; a device to bridge between the computing and telephone systems (known as a modem); communications software; and a telecommunications medium. Depending on the type of data and the speed and volume of processing, the computing facility ranges in sophistication and cost. Data, which include images, particularly dynamic or video images, demand powerful computing facilities. But, for applications such as e-mail of text messages, statistics, finance and administration, a modest computing facility (costing today approximately US$ 2000) would suffice for single user access.

The telecommunications medium is the most critical for many institutions in most developing countries, as it is often the main hurdle to development of data-sharing networks. Public data networks (PDNs) are networks, developed and operated by telecommunications authorities or service-providers, to cater for data communications. The health sector in most Asian, Eastern Mediterranean and south American countries already has access to and has begun to use PDNs. An increasing number of African countries have PDNs already operational in the main cities. An example of a national health care application that is growing with the growth of the national PDN is the National Cancer Register of Egypt. This uses EgyptNet—the PDN of Egypt—to link the National Cancer Institute, Cairo, to all the regional cancer institutions that have computing facilities and access to an EgyptNet node.

Apart from public or dedicated telephone lines, the health sector in many developing countries is also using radio frequency links over short distances (in Afghanistan, Somalia and Sudan) and low earth orbit and geostationary satellites. The use of satellite services, particularly the location and installation of a satellite earth station, requires the cooperation, and often the authorization, of the national telecommunications authorities.

3. TELEMEDICINE

3.1 Definition

There is no globally accepted definition of telemedicine. It has been simply defined as the “use of information technology to deliver medical services and information from one location to another” [3]. 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 [4]. One definition of telemedicine frequently used is that it is 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” [1]. The term “education”
covers both the education of the patient and the "continuing education" of the health care staff. Many other definitions have been offered with a common element in all of them, which is the use of telematics to deliver medical and health care services to patients wherever they are.

3.2 Telemedicine—why?

The health sector in nearly all countries faces two demands that appear to be contradictory: first, to provide equitable access to quality health care services and, second, to reduce, or at least control, the increasing costs of health care services. It is believed that telemedicine could contribute towards meeting these demands by optimizing the uses of existing resources (such as experts and equipment) by availing and sharing such resources via telecommunication links. Telemedicine can be useful for situations in which physical barriers prevent the ready transfer of information between patients and health care providers and the availability of information is vital to proper medical management [5].

According to a study made by the International Telecommunication Union (ITU) in 1996, titled *Telemedicine and developing countries* [6], telemedicine and telehealth have the potential for offering developing countries the following qualitative improvements:

- distance consultations, diagnosis and treatment by medical specialists practising in a national, regional or international hospital centre for referrals;
- availability of quality health care in remote areas of the country, by deployment of mobile telecentres travelling from one village to another or creation of local community centres which meet the joint requirements of several villages;
- improvement in the qualifications of national specialists and health technicians by opening up international medical databases;
- overall improvement of service by centralization of resources (specialists, hardware and software packages); and
- effectiveness and efficiency in management of action related to reduction of waiting times for consultations, and introduction of medical information systems.

The same study concluded that telemedicine and telehealth could reduce health costs in developing countries, potentially in these ways.

1. For the patient:
   - cutting down on journeys to major health centres for specialist consultations;
   - reduction of length of stay, and therefore cost of hospitalization, since the patient can be treated and checked up on at a distance.

2. For providers of health services:
   - reduction in operating costs through centralization and optimization of resources (expertise, laboratories, equipment, etc.);
   - reduction in costs of training and updating, improvement of specialists' qualifications through distance teaching and access to medical databases.
Despite the high potential of usefulness of telemedicine, a study concluded that in the absence of empirical current data regarding accuracy, reliability, utility and user satisfaction, the high level of expectations must be viewed with some caution. The ITU study [5] also warned that—despite all the benefits—telemedicine must be introduced into the overall health infrastructure in a balanced way so that it is not at the expense of higher priorities, such as clean water, nutrition and sanitation. Countries should not be enamoured of high technology to the extent that they introduce such services to sectors or areas where other needs should be met first.

3.2.1 How does telemedicine work in practice?

Telemedicine could enable:

- a general practitioner located in a rural setting, to seek and obtain a second or an expert opinion from colleagues located in a national speciality hospital or anywhere else in the world;
- a health worker, such as a remotely located nurse, to obtain the technical guidance of a physician to attend to a patient;
- a physician to look after a patient who is remotely located, for example at home in an inaccessible area or in another country; and
- the sharing of pooled equipment that is centrally located; such equipment can often not be afforded by smaller health care institutions.

3.3 The requisites of telemedicine

The main features of a telemedicine system that would enable the examples in the previous section to be realized are shown, simplified, in Figure 1. This model applies to telemedicine links over any distances, within a nation or between nations. The most important are the professionals at both ends, that is the requesters for and the providers of services. At each end, they need a telemedicine infrastructure, which rests on a telecommunications infrastructure.

What makes the difference and thus decides the extent of the medical care to be supported this way, are the power and the speed of the telemedicine peripheral equipment and the telecommunications lines. In order for a telemedicine system to be clinically useful, it must have several features, including programmability, high performance, flexibility and upgradability. It must also provide programmable handling and compression of audio and video and other images to support applications ranging from typical video teleconferencing to diagnostic-quality consultations.
The telemedicine infrastructure is the means by which medical data and any subsequent remote medical analysis are exchanged between the requester and the provider of the telemedicine service. That is, it comprises the communications software and the communications medium between the two locations. The telecommunications service would also depend on the telemedicine services to be supported, which could require narrow or broadband, standard or high-speed telecommunications. For example, for a physician seeking the support of a radiologist to interpret a radiological image, the telemedicine infrastructure should include the ability, at both ends, to scan, compress and transmit an image, to have it accurately reproduced at the radiologist's end and to transmit the interpretation and comments expressed either on the image or as a separate report or both. The telemedicine infrastructure could be simple or complex, reasonable or costly, depending on the types of telemedicine services to be provided. For example, telepathology requires special cameras to digitize slides and telepsychiatry requires two-way—that is interactive—video conferencing.

3.4 Cost of telemedicine

Cost–benefit analysis of telemedicine should always be undertaken before embarking on national telemedicine projects. The cost of telemedicine needs to be considered in relation to how it contributes to improving the health of the population by preventing
disease, treating illness, and ameliorating pain and suffering, and how it compares with alternative systems [3]. The cost involved in a telemedicine project consists of [6]:

1. Capital expenditures

   These may include:
   - cost of telecommunications equipment specifically used for telemedicine (or a proportion, if the equipment is also used for other purposes)
   - cost of land vehicles, boats, or planes for mobile units (unless already available)
   - cost of necessary hardware, software, interfaces and peripherals
   - cost of special diagnostic apparatus or modifications to existing stock
   - import duties, one-time licence fees and similar
   - costs of modifications to remote clinics, if necessary.

2. Operating expenses

   These may include:
   - telecommunications expenses;
   - maintenance of computers and other specialized telemedicine apparatus
   - vehicle running maintenance and expenses
   - cost of telemedicine specialists and operators (when performing also nontelemedicine duties, only the relevant portion should be counted)
   - administrative costs
   - insurance costs
   - training and skill maintenance costs.

3. Indirect costs

   These may include:
   - impact of competition for available funds in times of scarcity
   - balance of payment impact if funds need to be obtained externally.

3.5 Factors to be considered to ensure successful telemedicine projects

3.5.1 Definition of goals, aims and objectives of the project

A clear statement of what the project will achieve compared with what can be achieved through other means should be made. Telemedicine projects that do not have well defined objectives and that are driven by technology or personal interest are more likely to fail. Telemedicine needs have to be clearly defined. A market analysis approach may be applied here. Different degrees of telemedicine applications can satisfy different needs. Assessment of needs to identify which technology is most appropriate should be done at early stage of project planning.
3.5.2 Cost–benefit analysis

Telemedicine applications involve agents from various sectors at the national, regional and global levels. The costs of each one of these agents' services offered differs in its scale and in the way it is calculated. Among the most prominent agents in a country are the ministry of health, in charge of the health and well-being of the community; the telecommunications authority, which takes care of information/data carriers; the legal authorities; the private sector, including the telemedicine equipment manufacturers and suppliers; the service providers; private hospitals; and clinics. There is a need to justify expenditures on telemedicine, expected benefits or revenues possibly generated. Since technology is heavily involved in telemedicine, its ever-changing nature has to be taken into consideration. Cost–benefit analysis, which might be valid today may not be so in a few months time. The cost of everything involved has to be properly calculated and assessed to compare all the available options.

3.5.3 Integration of telemedicine services in the overall health infrastructure

Telemedicine services must function seamlessly within the overall health system to ensure that a certain degree of balance is achieved. The national health information system and the national health services should incorporate telemedicine as an integral part, rather than as an auxiliary service added piecemeal to the other components.

3.5.4 Telemedicine projects should start on a small scale with room to grow

A pilot project at the beginning to gain experience before full-scale implementation will lead to more successful projects. A gradual step-by-step approach allows all parties involved to get acquainted with the new technology and concepts and adapt them better.

3.5.5 Advice from other more experienced individuals and institutions

Advice should be sought at all stages of project implementation. Consulting services, WHO, the ITU, mature telemedicine projects and individuals with experience should be consulted at various stages of implementation as required.

3.5.6 Ongoing evaluation of the project

Each project should be evaluated through continuous data collection, observation and comparison of achievements with objectives. This will keep the project on track and guarantee systematic feedback and evaluation. Telemedicine technology changes rapidly, which entails keeping up-to-date with new technologies to integrate appropriately with existing ones.

3.5.7 Policies for licensing, reimbursement, compensation, liability, confidentiality and responsibility for the patient

Clear policies should be developed and agreed upon before embarking on telemedicine services. Questions such as the following should be considered.

- What licensing requirements should there be to allow a physician from one country to remotely diagnose a patient in a second country?
• Who will be responsible for the consequences of wrong diagnosis: the doctor sitting near the patient or the remote doctor in another country?
• What is the basis for reimbursement? Local rates or rates used in another country? Is the cost of telecommunications involved? How would health insurance schemes react to that?
• Whose responsibility is confidentiality and data security? Who will be held responsible for leakage of medical records transmitted over international telecommunication lines?

The lesson that has been imported from experience in the United States of America and some European countries shows that there is no agreed-upon set of standards and policies. Different places apply different practices. All that has not stopped interstate or intercountry consultations.

3.5.8 Adherence to technology standards

Telemedicine uses advanced technology, which involves computers, sound, video and image processing, and telecommunications. Each one of these has its own standards, which have to be combined to get the best results. Many systems are described as “proprietary”, which means they are unable to communicate with equipment from outside their own system. This kind of equipment should be avoided in favour of open standards. The choice of telemedicine technology should always be based on how the need can be met by the lowest cost and most accessible technology that complies with the standards.

3.5.9 Human resources elements

Three interrelated facets of human resources are connected to the success or failure of telemedicine projects:

Management and administrative personnel involved in the project. These should be fully aware and briefed on the project background, rationale, expected result, and their input and contribution to its success. They have to be fully involved if telemedicine is to be integrated into the health services in general.

Physicians, radiologists and all other health and medical personnel. Full briefing, training and education should be provided to all those involved with the project. They should fully realize that telemedicine is not a new branch of medicine that they have to learn, rather it is a new way of delivery of medical and health care to the patient. The acceptance and commitment of the health personnel to telemedicine are crucial to its success.

Patients and telemedicine users. Acceptance of telemedicine by patients has been reported as higher and more encouraging than by physicians. Patients receiving telemedicine services must believe that it can be useful to them. Cooperation from patients can help successful implementation of telemedicine projects.

3.6 Telemedicine issues and trends

There is, it seems, worldwide enthusiasm for telemedicine, and valuable experience is being reported from many institutions in a number of countries. Even though few "data" are cited, the "experiences" reported to date are indicative of issues and trends highlighted
by a number of reports, the most comprehensive of which is the ITU study [7]. That report identified 10 potential problems with telemedicine:

1. Like many people, some physicians may resist the use of new technology that they may not understand. This may be especially so in rural areas since physicians working there are often not very young;
2. There are few insurance providers who will cover risks associated with telemedicine consultations;
3. Rural consultations are not frequent and it may be difficult to run cost-effective systems;
4. Some states in the USA require that if a physician is to practise in that state, he/she must be the owner of a licence granted by that particular state. In other words, physicians may find it difficult to provide a telemedicine service outside their own state in places requiring a local licence to practise;
5. Confidential medical data regarding patients must be protected from unauthorized access (encryption and password security may help);
6. To be successful, telemedicine service providers must focus on the needs of the medical profession and the patient, and not force-fit existing technology on these services. Customer focus must not be replaced by product focus;
7. Some telemedicine systems and services require that users have compatible hardware at both ends of the communications link, which reduces interoperability and the benefits of access to different sources of telemedicine expertise. Similarly, the absence of standards in some aspects of telemedicine can also deter the cost-effective implementation of new telemedicine services;
8. Financing is often complex since telemedicine applications often involve different partners in a single venture (e.g. telecom operators and hospitals);
9. Telemedicine may not seem cost-effective since it often enhances service rather than perform a process more efficiently. This may multiply demand for a previously inaccessible service, thereby increasing costs;
10. Systems management and organizational problems may defeat the successful implementation of technologies or services or intentions which all otherwise may be good.

Mandil in his study of requirements of COPINE (a proposed satellite-based cooperative information network linking professionals in Africa and Europe) health sector users [1] identified the following issues in addition to the above:

1. There is a widely expressed need for an international consensus on a “minimum data set” for reporting and describing telemedicine experiences;
2. There is an extremely high level of acceptance by patients but less by physicians (possibly for reasons suggested above);
3. Telemedicine services lead to cost savings due to low transport costs and less work time lost;
4. There remains the potential problem that telemedicine’s effect could increase the cost of care since, historically, “high tech” in medicine has led to cost increases;

5. In certain developed countries, there is growing concern that telemedicine will draw revenues away from rural and remote centres to the specialist centres;

6. There is a need for a set of principles for an equitable and controllable payment system for telemedicine services;

7. Ethical and legal questions remain to be resolved, such as those concerning the respective responsibilities of the requesters and providers of such services.

Decades of known problems caused by differing national telecommunications regulations and standards (e.g. television and digital clinical images) still beg for improvement, as do the issues of telecommunication pricing, based on distance. An improvement already announced by some telecommunications service providers, is that pricing will be based on bandwidth-on-demand.

The COPINE study cited above, showed that telemedicine could grow to be a significant domain of international cooperation. Several experts and institutions in North America and Europe have indicated their willingness to contribute certain hours per week of their time to provide free telemedicine consultations. It is expected that similar offers could be obtained from experts and centres of excellence in other parts of the world. WHO could promote the establishment of “pools” and schedules of teleconsultation “providers” and facilitate access to their services by those who need it.

Finally, international cooperation in telemedicine also constitutes a challenge to the industry to avoid proprietary, bundled products (which were the initial offerings on the market) and draw from the lessons of the computing industry by offering independent components enabling the development of open, scalable, interoperable and affordable solutions.

3.7 Telemedicine in the countries of the Eastern Mediterranean Region

There has been very little experience reported of telemedicine in the Eastern Mediterranean Region and what there is fragmented and does not reflect the real situation. Through searching the available sources, it was possible to record the following:

Egypt. Health Care International, Scotland, a provider of health services internationally, has established links with and receives referrals from health care providers in Middle East countries including Egypt [7].

Jordan. The Global Telemedicine report in 1994 reported that Mayo Clinic, Rochester, Minnesota, provides services for the Amman Diagnostic Clinic in Jordan. Private hospitals have been reported as have bought and installed telemedicine equipment [8].

Saudi Arabia and the United Arab Emirates. Eight teleradiology demonstrations were performed between a hospital in Massachusetts and two sites in Abu Dhabi, United Arab Emirates, and Riyadh, Saudi Arabia, in 1994 at the invitation of the respective ministries of health. Thirty radiological studies were digitized, compressed and transmitted to Cambridge, Massachusetts, where they were interpreted on diagnostics workstations by a
team of specialist radiologists. Videoconferencing was also possible between the three sites [9]. Other hospitals in Saudi Arabia have telemedicine connections with hospitals in Glasgow, Scotland [7]. Yale Telemicine Center in the US has initiated a number of telemedicine programmes which include providing consultations in real time for physicians in Saudi Arabia [10]. Saudi Arabia has reportedly installed two telemedicine systems in Riyadh and Jeddah and proposals have been made to link these to 18 hospitals in the country [10]. The same report also noted that the United Arab Emirates is considering installation of telemedicine equipment similar to that installed in Saudi Arabia.

_Tunisia_. The Institute for Research in Information and Telecommunications Systems initiated three interrelated telemedicine projects in Tunisia in 1993. The aim of these projects was to provide a new environment for doctors to enable them to use the latest technologies in their activities. These projects are the Multimedia Telemedicine Network, the Medical Decision Support Systems Project and the Multimedia Information Systems Project [12]. No experience on performance or output of these projects has been reported.

_West Bank and Gaza_. Two hospitals are reported to have installed telemedicine equipment [11].

_Other EMR countries_. Bahrain, Egypt, Kuwait, Lebanon, Oman and Qatar are reported to have been considering installation of telemedicine equipment [11].

A serious need exists for a field survey of telemedicine services and applications in the EMR countries. This survey could be conducted through a fruitful collaboration between the Regional Office and the ministries of health and the private sector in these countries.

4. MEDICAL INFORMATICS SUPPORT TO THE EASTERN MEDITERRANEAN REGION MEMBER STATES

Support to Member States has taken a number of forms at different times during the past few years. This support has been implemented either in collaboration with specific programmes at headquarters or, in most cases, with unilateral action by the Regional Office. This section highlights examples of activities carried out to support Member States.

4.1 Consultancy services

Support was provided in the forms of consultancy services through the Regional Office to Jordan, Kuwait, the Libyan Arab Jamahiriya and Oman on:

- establishment of their respective user requirements
- setting of priorities
- the transformation of priority requirements into technical specifications
- the choice of competitively offered solutions, including computing, networking and communications support to various aspects of the national health information system.

Consultancy services have been provided to enhance networking infrastructure and to develop national health databases in Egypt, the Islamic Republic of Iran and the Syrian Arab Republic.
4.2 National conferences, seminars and workshops

WHO has organized international hands-on training seminars aimed specifically at familiarizing midlevel managers in the national health care services with the state-of-the-art and the potential of health informatics and telematics. Participants from Afghanistan, Cyprus, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Kuwait, Libyan Arab Jamahiriya, Oman, Pakistan, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia and Republic of Yemen have attended these seminars and workshops. National seminars and workshops have been conducted in five countries (Egypt, Islamic Republic of Iran, Kuwait, Pakistan and Syrian Arab Republic) and four more are planned before the end of the year in Jordan, Qatar, Saudi Arabia and Sudan to train national vaccination programme officers on the computer-based system for data collection and surveillance. These workshops were the basis for establishment of national programmes for vaccine and immunization in EMR countries. Three regional workshops were held in 1995, 1996 and 1997 with participants from all EMR countries to introduce the computer software and ensure the training of trainers. Regional training workshops were held to introduce computer package for food and nutritional analysis. After the two-week training course, the software has been distributed to Member States upon request.

4.3 Development of software for use by Member States

Support has been extended to Member States to develop software packages in support of their national health information systems. EMRO staff developed the Information for action software, which is used in vaccine and immunization programmes. Support was extended to Jordan to develop its national database on child health and maternity. Support to the Islamic Republic of Iran, Morocco and the Syrian Arab Republic was extended in the form of hardware and software support to develop medical records systems.

4.4 Hardware support

Standard and specially designed applications in Member States are supported by the Regional Office. Hardware constitutes a major part of the informatics and telematics infrastructure in health care. Hardware support is extended to all Member States without exception and according to their expressed needs.

4.5 Internet connections

Member States are being encouraged and supported to establish Internet connections at the ministry of health. Support has been extended to the Ministry of Health in Jordan to be connected to Internet. A comprehensive national Internet/Intranet infrastructure is being developed at the Ministry of Health and Medical Education in the Islamic Republic of Iran. A satellite station and connection are supported in Sudan. This connection will be expanded to cover a number of institutions. The aim is to link all medical colleges and hospitals in one infrastructure to facilitate communications and data transfer. Twelve WHO offices in Member States have established e-mail or Internet connections, which are put at the service of the Member State concerned.
4.6 Access to health and biomedical literature

The Regional Office over the past few years has taken major steps towards enabling Member States to access health and biomedical information through a number of initiatives, mainly:

- support to link to international databases and networks;
- provision of CD-ROM databases to institutions and libraries in all Member States;
- publishing of databases on CD-ROM and on the Internet;
- development of computer-based information systems in Member States.

5. INTERNATIONAL ROLE ON INFORMATICS AND TELEMATICS

5.1 Information society and development

The G-7 Summit of 1995 deliberated on the potential of modem information technology for international cooperation and development; it was decided to hold a conference on “information society and development” in May 1996 in South Africa. The conference was attended by decision-makers from many developing countries and G-7 countries. WHO contributed to this conference, where a strong bid was made to link the many existing national, regional and global initiatives for informatics and telematics. Among the nine themes discussed some had a direct bearing on health; “Theme 1” included telemedicine, interactive health networks, epidemiological surveillance and telecommunication services in rural and remote areas, and “Theme 3” included human resources development and “distance learning”.

An African regional telecommunication development conference was also held in May 1996, in Abidjan, Côte d’Ivoire. It adopted a resolution on telemedicine in Africa, essentially drawing attention to its potential value and the requirements for operation. The WHO Regional Office for Europe contributes to the G-7 regional health database project known as Glophein-west, part of a network of decentralized national databases. It includes data on communicable diseases and vital statistics. A Glophein-east project is planned, to extend the network to other Member States in the Region.

5.2 Evaluation of software for health applications

An international conference on technical innovations and the applications of informatics in the health sector (held in November 1987 in Italy) drew attention to the rapid growth of software and the need for objective evaluation before new software is actually used in support of medical and health care. In 1989, the Director-General of WHO approved a study on the feasibility of setting up an international centre for health applications software evaluation (CHASE), which would ensure liaison with national centres for the same purpose (Italy provided funds for the feasibility study and offered sites for the centre in Italy).

Such software applied to the provision of health and medical care (including clinical care) and the education and training of health and medical personnel. WHO consolidated the findings and conclusions of the various studies and consultations’ concerning the establishment of CHASE, reviewed alternatives for involvement in its management and
operation and summarized the arrangements for the sites offered by the Italian authorities, to whom the final report was sent in April 1994. They have verbally endorsed the report and expressed their commitment to financing the establishment and first five years of operation of CHASE; written confirmation is awaited. In the meantime, many inquiries have been received from the institutions involved in the feasibility study, and others. An institution in Singapore and another in the United States of America have offered to host CHASE.

The increasing availability of knowledge-based systems and applications, without clear indications as to the reliability of sources, is a matter of concern. Many of those involved turn to WHO for guidance. Even without CHASE, WHO might consider proposing minimum rules and standards to be applied before such a knowledge-based system is made available on the Internet.

5.3 Health cards

Several types of “health card” are available, distinguished according to the technology they use: embossed plastic, bar code, magnetic strip, chip, optical and “hyper” or combination. The latest “chip” and “optical” technology gives a strong impetus to the debate on data confidentiality, security, updating, costs and other questions. WHO has directed scientific discussions, based on practical experience, about the evolution of technology and has canvassed a cross-section of views from the health care services using or considering using the cards, as well as from those who believe that much more research and development are necessary. An international conference on the state of the art was held in 1993 in France, chaired by WHO and starting a biennial series; the 1995 conference was held in Germany. There was general consensus on the need to regulate the use of such cards according to three broad categories:

1. identification and authentication of a patient or a health professional (mainly administrative data);
2. records of patients in special groups such as diabetics, dialysis and transplant patients (minimum essential information concerning the case history and treatment); and
3. complete medical records (full patient record on card). Doubts about the latter grow as networking develops, particularly concerning security of data.

By far the greatest practical experience in this field is in Germany, where over 80 million cards of the first category are in use, primarily for patient authentication and health insurance purposes.

5.4 The Internet

Noncommercial e-mail services were first provided by Bitnet, starting in 1983, and were restricted to the academic and research communities. They were also provided by the Internet to all categories of users, including governmental and commercial institutions. The Internet was conceived as an international cooperative, a “network of networks”. It is reckoned to have about four million nodes, with between 30 to 40 million users, in nearly 110 countries, and its use is increasing by about 12% to 15% per month. Its services include discussion groups, bulletin boards and newsletters for nearly 6000 interest groups, and it provides access to tens of thousands of databases in a variety of forms, such as “gophers”
and world-wide web (WWW) sites. It is estimated that 15% to 25% of the information on the Internet relates to health.

Recent requests from WHO’s Member States have concerned connection to the Internet, and help has been given to countries within the limitations of the types of networking and telecommunication services available to them. Similar requests are expected from other Member States. Relatively few developing countries (only 12 countries in the Eastern Mediterranean Region) can benefit from the full range of Internet services. The majority have off-line connections, so that they cannot benefit from the WWW, only from the e-mail and off-line information services. This creates a “have” and “have-not” situation considering the wealth of Internet on-line services.

The year 1992 was an important milestone in the history of the Internet, in that its commercial traffic first exceeded noncommercial traffic. Participants in the Africa Telecom 94 forum expressed the hope that the inevitable trend would not be allowed to jeopardize or limit Internet use by the noncommercial scientific community, including the developing countries.

The Internet is by far the largest source of expertise on knowledge-based systems, and the point made elsewhere about the validity of the knowledge should be heeded. Outside WHO, it is by far the largest medium for exchange of information on health issues. WHO might consider convening or sponsoring a major international conference seeking consensus on ways and means to improve and safeguard the quality of health and health-related information on the Internet.

5.5 International Telecommunication Union

The series of Telecom conferences organized by the International Telecommunication Union are by far the most important and the largest on international telecommunications, combining scientific discussions and commercial exhibitions. One is held each year in rotation between Africa, the Americas, Asia and Geneva (Global Telecom). In recent years, the Telecom organizers have decided to highlight the applications of communications in different sectors. WHO made presentations on telematics support to health care, including telemedicine at Africa Telecom 94, at Global Telecom 95 and at Americas Telecom 96. It has been invited to do the same at Asia Telecom 97, Interactive Telecom 97 and Africa Telecom 98.

5.6 Collaborating centres on health informatics

Collaboration with institutions in different parts of the world in informatics and telematics in health is indispensable. Five institutions are designated WHO collaborating centres on health informatics. A centre in Singapore carried out a comparative study on the uses of hand-held data collectors in health surveys. One centre in the United States of America prepared training material and conducted training courses for health care decision-makers in Latin America, and another carried out extensive studies on “telemedicine” applications and workstations. One in Japan developed the software for “dental passports” and carried out field studies. Negotiations are proceeding for the designation of six more centres.
5.7 Nongovernmental organizations

A number of nongovernmental organizations are concerned with medical informatics and information processing in general. Cooperation is excellent, particularly with the International Medical Informatics Association (IMIA). WHO contributed to the evolution of IMIA from a nongovernmental organization for medical informatics researchers in Europe and North America to a more international body dealing with several applications of informatics in the health sector. WHO cosponsored and actively participated in the formulation of the scientific programme of IMIA's three-yearly Medinfo conferences and collaborated in some of its technical working groups. It also collaborates with the International Federation for Information Processing (IFIP), the parent organization of IMIA, in two main areas: the technological aspects of data confidentiality and security, and networking.

5.8 Standards

The adoption of common standards is essential for the cost-effective exchange of information between individuals, groups and systems. Despite improvements in recent years, the lack of such standards remains an impediment to technical progress and to extensive national and international collaboration in health informatics. The problem has political, commercial and technical causes of five main kinds, starting with the more acute sources of disagreement:

- differing concepts of "health informatics and telematics" and components such as "nursing informatics";
- differing ideas on meaning, affecting terminology, coding schemes and codes;
- differing approaches, e.g. to safeguarding the security and confidentiality of patients' medical data;
- differing "syntax", e.g. in the format of messages to be exchanged; and
- differing communications protocols.

The differences are being tackled on many fronts by international and regional standards organizations and in consultations between professional groups and the computing industry—with a few slow but sure improvements. It is often asked why WHO's contributions in this field do not go beyond the International classification of diseases and certain aspects of health-related terminology. It is emphasized again and again that WHO, in collaboration with Member States, should give priority to the development of informatics standards and "minimum data sets" (in PAHO these are referred to as a "minimum set of functionality and data elements needed by health services and providers").

5.9 Legislation

The health professions in virtually every country are regulated by laws and regulations intended to safeguard the interests and concern of those receiving health care as well as the providers; much of the existing legislation is geared to the hospital setting. The WHO guidelines for regulatory changes in certain areas do not refer to "informatics". It has been suggested that the legal requirement for keeping manual records in professional practice is a major impediment to progress in health informatics. Measures to remove such obstacles should be accelerated.
5.10 Liaison with industry

The support of industry is sought and sometimes obtained for noncommercial purposes such as education and training and technical demonstrations; the Intel Corporation supported a brief study and demonstration of the uses of “desktop” video-conferencing for telemedicine in South Africa—a demonstration, which was repeated at the opening of Global Telecom 95. Several companies are supporting a plan to issue a CD-ROM on their work with WHO, tentatively titled Health care in the cyber age, for WHO’s 50th anniversary. The Pan American Health Organization (PAHO) has established a “partnership contract” with IBM (Latin America Healthcare Solutions) to develop joint research in five areas. Contacts are being made with AT&T for a similar arrangement.

The role of industry is fundamental in determining needs and solutions in what is referred to as “the market” for the general tools for “informatics and telematics”. Beyond this there are clear indications that the industry should be influenced by leading organizations in differing sectors concerning desirable features, levels of sophistication and price range. A concerted effort must be made to arrive at a clearly defined arrangement with industry at the global and national levels to ensure the availability of appropriate and cost-effective tools.

6. CONCLUSION

From the preceding discussions it is clear that the availability of health information through an efficient national health information system is of utmost importance, not only for the establishment of reliable statistics and epidemiological surveillance but also for efficient planning and management as well as up to date delivery of health services, preventive, promotive and clinical.

Several studies in developing countries have shown that the inadequacy of communications infrastructure and services in many developing countries is increasingly recognized as a major impediment to development. At the same time, the world is witnessing a rapid development in communications technology with extensive application in various fields including health. Health informatics and telemedicine in particular can have a major impact on the methods, quality, efficiency, access and economy with which health care services are provided and managed. The sharing of health care knowledge and expertise is improved; health information is more efficiently collected, processed and disseminated; health literature is accessed and searched; health education and training materials are prepared and actual education and training are delivered; research is conducted and coordinated; and contacts and dialogue are established and maintained between individuals or institutions.

It is important therefore that Member States develop comprehensive national plans on health informatics and telemedicine. The plan should be based on clear analysis of country situation and actual needs. National expertise in this area, and in particular in areas of communications technology evaluation, selection, adaptation, cost-effective use and development, should be developed.
In the meantime the Regional Office should develop the expertise required to support Member States in these activities.

At global level WHO is uniquely equipped to fill the glaring need for an international, technical and independent forum for promoting the uses of available and proven informatics and telematics tools in health and for critically influencing the development of new, appropriate and cost-effective tools. Hopefully, this role will be supported by national and international professional societies and by the informatics industry.

7. **RECOMMENDATIONS**

1. The Member States with support from EMRO should conduct a comprehensive situation analysis of the present application and use of health informatics and telematics in Member States and identify national needs.

2. The Member States with support from EMRO should develop national plans for the development and use of health informatics and telemedicine.

3. The Regional Office in collaboration with Member States should develop appropriate mechanisms for collaboration at regional and subregional levels. These mechanisms should make better use of the resources available at the centres of excellence and WHO collaborative centres in the Region.

4. The Regional Office in collaboration with Member States should set up a study group to investigate the applicability of telemedicine in Member States of the Eastern Mediterranean Region on the basis of case studies and comparative analysis;

5. The Regional Office should lead an educational and informational campaign to introduce appropriate telemedicine applications in the Eastern Mediterranean Region.
REFERENCES


