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6. TELEHEALTH: WHAT IS IT? WILL IT PROPEL CROSS-BORDER TRADE IN HEALTH SERVICES?

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Telecommunications is a key to the globalization process and to the sustenance of its outcome. This chapter is concerned with the role that telecommunications play in the evolving impact of globalization on the health sector, and the resulting current trends and issues. In particular, it is concerned with the uses of telecommunications in health, or TeleHealth, with particular emphasis on TeleMedicine and how these are beginning to be practised in differing countries This chapter also stresses that TeleHealth and TeleMedicine could eventually constitute a main sector of international cooperation and trade, subject to certain impediments being overcome.

Throughout this chapter, the terms TeleHealth and TeleMedicine are written as such, consistent with the author's past publications on the subject[1], to emphasise the author's belief that, in the near future and for some countries within a matter of five years, the wide and sophisticated uses of telecommunications in health will be routine, so much that the prefix "Tele" could and would be dropped to re-stress the basic objective of Health and Medicine.

I THE IMPACT OF GLOBALIZATION

Globalization has been recognised as a "process" by which persons, concepts, images, ideas, values, capital and traded goods diffuse across national boundaries, thus steadily increasing global socioeconomic and political interdependence and integration[2]. Whereas this has been most evident in trade,

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[1] S. H. Mandil, Telematics support to health care in Africa. Invited Plenary Address to International Conference of the International Telecommunications Union, AFRICA TELECOM 94, Cairo, April 1994.

[2] A. Hurrell, and N. Woods, Globalization and Inequality. *MILLENNIUM: Journal of International Studies*, Vol. 24, No. 3, 1995.

industry and economics, it is also true in socioeconomic sectors such as health and the environment.

The importance of respecting "national boundaries", also known as the sovereignty of independent states, is a key factor in the peace and stability that contribute to the growth and sustenance of global trade and economic interdependence. But, this principle of sovereignty does not mingle well with the environmental and health challenges facing our world, which call for international (and some add even intra-national) actions. For environmental and health issues, the demarcation lines between national and international policies and actions are "blurred", and certainly not clear cut. International environmental and health challenges and policies should influence and be influenced by national challenges and policies.

It should be stressed here that we cite "challenges and policies" and not only "policies", by which we also mean that the burden of resources for some national challenges must be recognized and supported internationally. These challenges include control of infectious diseases and epidemics, preservation of the regional and global environment, trafficking of harmful substances and drugs, research into new and re-emerging diseases, provision of affordable diagnostics and treatment, and cost-effective education and training of the necessary human resources. Much of the resource burdens of these health challenges are either tackled inadequately or not at all at the international level, with few notable exceptions for which WHO is responsible and financed.

The advent of almost globally accessible, cost-effective telecommunications services, within and between nations, offers a significant opportunity to face and alleviate much of these challenges. In addition to spreading awareness and understanding of global interdependence on environmental and health issues, and of the importance of an equitable sharing of the benefits of international trade, telecommunications tools and services could be used to improve the equity of access to quality health care, the extent and quality of education and training of human resources, the cost-effective surveillance of diseases and services, and technological developments for affordable diagnosis and treatment, especially those needed by the poorest countries.

II HEALTH: INFORMATION-INTENSIVE

The term "health informatics was defined[3] 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". This section of the chapter is concerned with how information-intensive is the health sector, what are the main types of health information and how these were traditionally supported and are to be supported in the dawning cyber age.

What information? And for what purposes?

The provision of health care requires, and generates, a wide variety of data and information, which need to be collected, processed, distributed and used. One way to view the scope of the uses of the methodology and technology of computing, networking and communications in health, is through an understanding of the principle functions, and the types of data and information in the health sector. There are basically five main types:

- **management** information, that is information for the day-to-day management needs and for planning, programming, budgeting, monitoring and evaluation of, for example, an immunization campaign, a health care institution (e.g. a hospital, a health centre, a laboratory), the health services in a geographic area (e.g. a province, a district, a city, a community, or the whole nation)
- **clinical** information, that is data and information to carry out, and which is generated by, clinical functions such as diagnosis and treatment; this includes static and dynamic images
- **surveillance and epidemiological** information, that is information on the patterns and trends of diseases and related health care measures and services
- **literature,** that is notes, reports, formal publications and "grey" literature
- **knowledge**, that is the information on the actual know-how needed to carry out a medical or technical task, such as how to diagnose a specific medical problem, how to conduct a related laboratory test and how to treat an ailment.

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. In practice, users require and generate a mix of these types of information at differing stages of their respective functions. For example, a physician may consult a "knowledge" base, whilst examining a patient and would enter relevant "clinical" data into the patients record, which may be used by the "management" system for billing purposes. Also, the clinical data would eventually be stripped of its "personal and private" items and passed on to contribute parts of the health

[3] S. H. Mandil, From EDP in Health to Health Informatics. Proceedings of MEDINFO 92. Amsterdam, North-Holland Publishers, 1992. pp. xxxii to xxxviii.

"surveillance" information. Thus, the collection, flow, processing and distribution of health, and health-related, data and information are key to the efficacy, efficiency and economy of the operations and development of the health care services.

Information support: traditional and cyber age

Health care encounters and transactions are multifaceted. They occur, for example, between a patient and a physician; between two physicians; between a patient or a physician and an expert consultant or a health institution (e.g. a laboratory, a pharmacy or a rehabilitation centre). And, such encounters may occur in one's own community, in another part of the country or in another country. All such encounters require data and information prior to the actual start of the encounter, and generate it during the encounter or soon thereafter. Such "data and information" could be in differing volumes, at differing times and in differing forms such as voice, numbers, text, graphics and static or dynamic images, and are often a judicious mix of all these.

The sources and repositories of such data and information could spread over differing locations and would take differing forms, for example, complete patients records; hand-written prescriptions; reports by a physician, a consultant or a laboratory; and responses from a library, a surveillance system or a drug interaction information service.

Traditionally, all such encounters were face to face, and the spoken and written word were the main modes of communication and of medical record-keeping, whilst transport was mainly by road, rail or air, using public and private services. On the inception and popularization of the telephone, it became a key liaison tool in the health care services, first for the spoken word and decades later for the facsimile transmission of the written word. As the telephone services network grew, it became the communication network of the health professionals and institutions, nationally and internationally.

The uses of technology in the clinical/medical aspects of the health care services steadily grew and included sensing and measuring equipment, laboratory services, static and dynamic imaging. With the growth of the use of such technologies and of the variety and sophistication of these, it was inevitable that many of such "technological" services became separated from the mainstream health-care institutions - separated in distance and more significantly in management. So, the communications between such technology-based services and the mainstream health-care services became an important consideration in the efficacy and economy of the health sector.

The popular use of computer-assisted communications by the health sector started some fifteen years ago with simple electronic messaging (E-mail**)**, carrying purely alpha-numeric messages and reports. Just as voice communications was the main motive for the installation of telephones in physicians' cabinets and health care institutions, E-mail was the main initial justification for the installation of modern telecommunication links. And, as E-mail services grew, so did the demands on their performance and geographic

coverage: more locations at more speed and with more bandwidth to cater for the growing "attachments" to the E-mail messages. The past five years have witnessed an exponential growth in the uses of E-mail in the health sector, within and between countries including most developing countries, particularly over the Internet. This is covered, in section IV of this chapter, with the discussion of health information infrastructures, or health "info-structures". In many of the industrially developed countries, E-mail is taking over those functions that do not really require face-to-face encounters, such as preparing and sending prescriptions and reports, fixing appointments and scheduling services, and referring patients. Where the performance of telecommunications services permit, it is also used for transmitting medical images and related expert readings, either written or oral.

At a higher level of sophistication of the use of computer-assisted telecommunications the actual examination and care of a remotely located patient - TeleMedicine. TeleMedicine is an important and growing field and is expected to change many of the traditional approaches in health care (see section III).

Another area, that is, relatively speaking, not recent but will usefully expand with the spread of telematics support, is the access to and uses of knowledge-based systems. These systems, which are also known as expert systems and decision-support systems, provide expert advice and guidance on medico-scientific issues and procedures. For example, given a patient's coordinates and symptoms, they could provide diagnostic support, suggest additional tests or propose a treatment. There are numerous examples of knowledge-based systems developed by and for developing countries[4] [5] [6] [7].

Literature services are important to health care. Apart from their obvious educational values, they are vital for information on new procedures, clinical trials, evidence-based considerations, and so on. Telematics is a significant improvement over traditional means of searching for and acquiring such literature. It enables the individual personally to carry out the search, with ease, speed of access and, more significantly, with a much higher level of completeness - more depth and breadth of searches - because of the impressive and still growing international electronic interlinkages between many of the literature services. Many libraries in the poorest of the developing countries are

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[4] S. H. Mandil, et al., *Health Informatics in Africa (HELINA 93).* Excerpta Medica series. Amsterdam, Elsevier, 1993.

[5] V. Wuwangse, K. Yusof, *Experiences in the Development of a Medical Expert System*. Proceedings of MEDINFO 89. Amsterdam, Elsevier, 1989. pp 244-247.

[6] H. F. Marin, et. al., *An expert system prototype for perinatal care*. Proceedings of MEDINFO 92. Amsterdam, Elsevier, 1992. p. 1602.

[7] F. S. Boyom, T. D. Esae, *Expert systems as a useful tool for tropical diseases diagnosis: the case of Malaria.* Proceedings of HELINA 93. Amsterdam, Elsevier, 1993. p. 140.

prime victims of economic and financial problems. Many such university and medical libraries have had dramatically to reduce their acquisitions of journals and publications of foreign medical societies. The uses of CD-ROMs, whereby foreign libraries holdings are listed, largely alleviate the search problem, but the acquisition problem remains. Telematics is addressing such problems in at least two ways. First, professionals and institutions in many developing countries are able to directly query the wealth of international health literature services. Most have only offline links; and "full connectivity" to all developing countries is a major challenge that is being addressed[8]. Second, where the facilities do not permit sophisticated online searches, interim bilateral arrangements are beginning to be put in place whereby the relevant queries are passed to a colleague or an institution in a more fortunate setting to place such a query and respond to the original requester. Some of these arrangements are even automated via friendly gateways (se section V below).

Epidemiological surveillance is essentially the study of the patterns of distribution and trends of diseases and related health care measures, by geographical areas, age groups, communities, etc., so as to establish relevant priorities and to optimize health care measures through monitoring and evaluation. Surveillance requires the collection and analysis of varied and relatively large amounts of data, from and about the locations where diseases and related health problems occur and from where patients present themselves, typically in urban and rural health centres and general and specialist hospitals. Traditionally, the raw data are extracted from completed forms and reports, prepared according to long-established procedures of reporting by the smaller units (e.g. health centres), through interim units (e.g. a provincial general hospital), to a central facility (e.g. a ministry of health or a medical research council) responsible for analysing and storing such data and issuing relevant periodic surveillance reports. These arrangements and related facilities have long been recognized as slow, inaccurate, and incomplete, and present major problems of logistics of transmission, processing and storage. Often, the reporting of serious infectious diseases and epidemics follow a totally different reporting system.

Telematics is making it possible to introduce major improvements to the traditional methods of surveillance. Improvements stem from support to the decentralization of responsibilities and tasks. Where relatively simple affordable desktop computers are used to record patients visits and other encounters (e.g. vaccinations) at the community and health-centre level, it has also been possible to embed controls to vet the accuracy of the data, and economically and selectively to extract relevant data for transmission to interim or central facilities for surveillance purposes. Informatics and telematics support to health statistics and epidemiology is perhaps the earliest and thus more popular application of computing in developing countries. It is also an area that calls for the most

[8]ADB, ITU, InfoDEV, UN/ESA, and WB: *Global Connectivity for Africa: Issues and Options*. United Nations Conference, Addis Ababa, June 1998.

improvement. Certain traditional, routine data collection practices 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 eliminate or improve on the inaccuracy, time and cost of manually maintaining statistical forms. Furthermore, better or more utilization of satellite-based remote sensing data could provide the essential intelligence sought for surveillance of certain problems, such as water-borne vectors and diseases. The developments in, and growing availability and uses of, computing, networking and telecommunications in most countries, stress the need for a major rethinking of the traditional methods employed for surveillance, early warning and sentinel systems, especially on communicable diseases.

In summary, families of applications of computing, networking and communications are making a major impact on the methods, quality, efficiency and economy with which health care services are provided and managed; health care knowledge and expertise are shared; health information is collected, processed and disseminated; health literature is accessed and searched; health education and training material is 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. The necessary health information infrastructures, or health info-structures, are taking shape in a number of countries.

III TELEHEALTH AND TELEMEDICINE

Definitions

We are encouraged and pleased to note that the following definition for TeleMedicine, which we have formulated and adopted over five years ago for our own work in this field, has been accepted and used in various international fora on the subject[9]: *TeleMedicine is the practice of medical care using audio, visual and data communications; this includes medical care delivery, consultation, diagnosis, treatment, education and the transfer of medical data.* The term "education" covers both the education of the patient and the "continuing education" of the health care staff. TeleHealth is broader than TeleMedicine in that it also encompasses the uses of computer-assisted telecommunications to support functions other than the clinical aspects of health care, and which were discussed above: management, surveillance, literature and access to knowledge.

The rationale for TeleHealth and TeleMedicine

Nearly all countries have been and are involved in one form or another of a reform of their respective health sectors. The common rationale for such a reform is how to meet the problems and challenges of having less resources available to the health sector than needed to meet the expectations of the population and demands for quality health care services. That is, the costs of health care have been increasing to such an extent that governments, which have borne the major burden of funding health care services and schemes, are unable to meet the requirements and demands of their populations. Consequently, in the industrially developed countries, this resulted in a significant reduction in the health insurance coverage by governments. In the developing countries, particularly the poorest where the health care services have been mainly "free", this resulted in a significant decline in the extent and quality of the health care services.

The health sector, in nearly all countries, is facing 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. One of the initial measures that may be taken to alleviate the above is to optimize the uses of existing resources - professional staff, health care institutions, expensive equipment, etc. It is thus no exaggeration to state that all 'health sector reform' plans or programmes, known to the author, include a significant dose of "informatics and telematics support". Telecommunications is viewed as one of the means that could support such optimization.

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[9] ITU/BDT Study Group Annex 4: TeleMedicine Questionnaire for the Report on: *TeleMedicine in Developing Countries*, Document 2/155, June 1997.

How does TeleMedicine practically contribute to improving the quality and coverage of health care services in a cost-effective manner? This could be exemplified by the following four scenarios. First, TeleMedicine could enable a general practitioner who, for example, could be located in a rural setting, to seek and obtain a second or an expert opinion from colleagues located, for example, in a national speciality hospital or anywhere else in the world. Second, TeleMedicine could enable a health worker, such as a remotely located nurse, to obtain the technical guidance of a physician to attend to a patient. Third, TeleMedicine could enable a physician to look after a patient who is remotely located, for example, at home or in another country. Fourth, TeleMedicine could enable the shared use of pooled equipment that is centrally located, often not affordable to smaller health care institutions.

Relationship to TeleEducation

It has to be remarked here that the technological facilities and protocols needed for TeleMedicine are predominantly the same as those for TeleEducation and training in health care. For example, in TeleMedicine we might have a video conferencing session of an expert advising or consulting for a general physician on a specific case with the aid of static or dynamic medical images. The same facilities would support a lecturer at one end delivering a lecture or a training session, with the aid of images, to any number of 'students' at the other end sharing a single workstation or each with her/own workstation and scattered over a campus, a city, a nation or the world.

Our experience when working with and supporting countries[10] [11] has shown that, invariably, the users requirements for TeleMedicine services and facilities include a significant portion of TeleEducation, particularly "continuing medical education", which is a compulsory requirement for re-licensure of medical practice in some countries.

The requisites of TeleMedicine

What are the main requisites of a TeleMedicine service that would support the scenarios cited above? A simplified model comprises provider and requester, each with their TeleMedicine infrastructure, linked through their telecom infrastructure. 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 and the providers of, for example, a medical consultation. At each end, they need a TeleMedicine infrastructure, resting on a telecommunications infrastructure. What makes the

[10] S. H. Mandil, TeleMedicine in Health Care in Kuwait. Unpublished document WHO/AOI/95.13, October 1995.

[11] S. H. Mandil, Telemedicine in South Africa: Current Status and the Way Forward. Unpublished document WHO/AOI/97, December, 1997.

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.

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. For example, for a physician seeking the support of a radiologist to interpret a radiological image, the TeleMedicine infrastructure could comprise the facility, at both ends, to scan, compress and transmit the image, to have it accurately reproduced at the radiologist's end, and to transmit his/her interpretation and comments expressed either on the image, 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 the slides, and TelePsychiatry requires two-way, that is interactive, video conferencing.

The Telecommunications infrastructure comprises the means to actually carry the content of the two-way communications 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.

An evolving, formidable momentum

This section cites a number of examples, from both developed and developing countries, to show what functions in the health sector, and particularly in medical care, are beginning to be supported with the uses of telematics.

There are hundreds of sites around the world that are either studying and experimenting with TeleHealth, particularly TeleMedicine, and relatively fewer that have started a regular operational service. In selecting examples to cite here, we have three aims in mind. First, to demonstrate the international scale of such efforts. Second, we seek to exemplify the variety of the types of experiences. Third, we seek to stress the nontechnical issues that are critical to eventually go beyond experimentation; issues such as policy, strategy standards and legislation.

The sum total of the TeleHealth and TeleMedicine activities around the world, exemplified by the experiences cited below, on a few examples from the industrially developed countries and in on a few examples from the developing countries, stress that a formidable momentum is building up that will and should positively influence health care within countries. It could change key aspects of cooperation thereon between countries.

Industrially developed countries

The TeleMedicine experience in the **United States of America** is the most extensive, in the numbers of TeleMedicine sites, the variety of the TeleMedicine projects and operational services, the uses of telecommunications and peripheral medical equipment, and innovations thereon. Indeed, most of the earliest TeleMedicine activities that inspired and triggered the current spread of this new methodology and technology for medical care of the individual, started in Northern America. As these have been reported extensively in numerous periodic and other publications[12] [13], they are not repeated here.

In **Canada**, the TeleMedicine experience is extensive and includes one of the earliest experiences of international TeleMedicine links[14]. Recently, Canada has successfully rallied the public, private, health and telematics sectors to agree on concrete steps to develop a national health info-structure[15], to take advantage of the linking of the provincial and other fibre-optic networks in the country into, effectively, one coast-to-coast national network.

The **United Kingdom** experience with TeleMedicine is of great value to the rest of the world because of its relationship to the national health services, which have been copied or adapted by many other countries. By definition, the NHS implies a national synchrony and compatibility in such major developments as TeleMedicine. For example, the NHS experience with "collective buying" of telecommunications capacity is cited in section V below. One TeleMedicine application that we choose to cite here is one that combines TeleMedicine with primary health care. In the Mid-Lothian region of Scotland[16], an expectant mother's periodic check-up could be carried out from the nearest health centre, where the relevant sonographic images are prepared, but examined at a distance, through video conferencing, by a specialist who may be anywhere in the region or the country. This cuts down the costs and inconvenience of travelling to where the specialist may be, and leads to speedy dealing with any suspected abnormalities.

Northern **Norway** is a part of the world where there is one of the broadest ranges of TeleMedicine applications that are routinely used in day-to-day health care[17], and the same facilities are neatly used for continuous medical education courses through TeleEducation. A national policy on TeleMedicine makes such

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[12] R. L. Bashur, et. al., *Telemedicine: Theory and Practice*. Springfield, Illinois, Charles C. Thomas Publishers, 1995.

[13] American TeleMedicine Association, 901 15th Street NW, Washington DC, USA.

[14] *Project SHARE*, Intelsat Corporation, Washington DC, USA, 1985/1987.

[15] Health Canada, National Conference on Health Info-structure, Edmonton, Canada, February 1998.

[16] Health Care Telematics Centre, Royal Infirmary, Edinburgh, Scotland, 1996/1997.

[17] S. Peterson, *TeleMedicine in Norway, Today and in the future*, 3rd International Conference on the Medical Aspects of TeleMedicine; Kobe, Japan, 1997.

services directly covered by health insurance. Furthermore, they have an active programme of international cooperation. One of the lesser known international TeleMedicine cooperation is that between the medical community of Tromso University Hospital and the North Western region of Russia - Archongelsk, and through the latter with the cities of Koltes and Velsk. These TeleMedicine links are used for TeleConsultations on a range of health and medical issues, and for TeleEduction. The benefits are also said to be mutual; for example, expertise in Diphtheria in North West Russia could be helpful to Northern Norway, where it is lacking.

France is another country with a declared national policy on the uses of TeleMedicine. According to such a policy, all regional and national operational experiences, as well as studies, in TeleMedicine are routinely recorded, updated and made nationally accessible so as to promote cooperation through the interlinkages of networks. This is coordinated by a national committee in which government, professional societies, the industry and academia, are represented, and which also cooperates for links between major TeleMedicine centres in Europe, including those involved in the health projects of the G-7 Global Information Society Initiative[18]. The TeleMedicine links are also extended to Indian and Pacific ocean islands and to some North African and Latin American countries.

The challenges of health care in **Australia** are compounded by the geographic size and population spread. The potential of telecommunications to meeting these challenges has been appreciated decades ago and started with the "radio doctor", by which remote oral consultations were conducted over radio frequency links. Today, modern communications are gradually taking over. For example, every rural hospital in Western Australia has a satellite station initially used mainly for continuous medical education, but more recently used by general practitioners in remote and rural areas for TeleConsultations with their city-based colleagues and specialists, aided with video conferencing.

The uses of TeleMedicine in **Japan** have also grown considerably in the past five years, particularly between major hospitals and the health services in rural and remote areas and islands, for remote diagnosis and treatment. Japan has also developed TeleMedicine cooperation with a few developing countries in the Asia-Pacific region, primarily over satellite links. These link a few of the expert university hospitals in Japan with several health care sites in Cambodia, Fiji, Papua New Guinea and Thailand.

Developing countries

The experience in developing countries as a whole does not compare in volume with that in the industrially developed countries primarily because of the lack of the telecommunications infrastructure to support TeleMedicine services.

[18] G-7 Information Society, G-7 Pilot Project Progress Report, 1997.

Nevertheless, the experience to date is quite significant and does set examples of the cost-effectiveness of TeleMedicine in certain settings.

First and foremost, it is important to stress that we do not argue that TeleMedicine services are more important or more effective than tackling the basic causes of poor health: poverty, lack of clean water, basic nutrition and sanitation. These call for a significantly larger scale of political will and resources. If these resources are available, then tackling the basic causes of poor health is the undisputed priority.

The argument here, which is demonstrated again and again by experiments and examples in a number of countries, is that TeleMedicine is a means by which the uses and value of existing, or relatively smaller additional resources, could be optimized. For example, the present five Ethiopian expert radiologists who travel to different parts of the country to cover the basic essential services, could multiply their output three or fourfold if the radiological images 'travel' to them via telecommunications. Another example, the cost of two doctors attending a few weeks' course abroad could be used to transmit the course via telecommunications to the benefit of ten's of other doctors.

The TeleMedicine experience in developing countries may be grouped into these four main categories: paper consultancies or studies; studies or experiments which included actual practical demonstrations; practical studies or experiments over a significant period of time; operational services.

The examples given below of these four categories are neither exhaustive nor exclusive; there are other examples in countries not cited here. The examples below are chosen in order to illustrate the variety and the spread of TeleMedicine experiences in developing countries to date.

In the first category - paper consultancies or studies - a study in and for **Bhutan** confirms that TeleMedicine links could significantly improve the support on diagnosis and proposed treatment, given to general practitioners and non-medical staff in remote smaller hospitals and primary health care centres, by colleagues in the main and referral hospitals. The study proposed that the telecommunications requirements of the health sector, at the remote site, could be usefully combined with those of other sectors and provided in a local TeleCentre equipped with shareable equipment and services. A study in **Sri Lanka** was conducted by the telecommunications operator, Ceycom, examining and aggregating the requirements of various sector including health. Its findings on the potential cost-effectiveness of telecommunications services at the local level compare to that in Bhutan.

In the second category - studies or experiments which included actual practical demonstrations - a study in the **Dominican Republic** included a demonstration of temporary TeleMedicine links between two sites in the country and two sites in Venezuela and Canada, to demonstrate the technical feasibility of remote national and international support to health care delivery and of obtaining second opinion. The TeleMedicine links included interactive video conferencing capabilities which enabled the transmission of medical images for remote diagnosis and proposed treatment. In **South Africa**, an ongoing study by the Department of Health will include pilot sites equipped with the necessary

TeleMedicine links for TeleRadiology, TelePathology and TeleOpthalmology. These will be partly based on the experience of a successful brief experiment in 1995 linking a general hospital in Tintswalo, Northern province, with the university hospital in Johannesburg, Gauteng province, for radiological readings and interpretation, and consultative advice to general practitioners.

There are several examples in the third category - practical studies or experiments over a significant period of time. With the support of the telecommunications operator, **Argentina** established a practical experiment with TeleMedicine link between Hospital de Clinicas and Universidad de Cordoba, enabling full video conferencing and image transmission and storage. **Malaysia**, backed up by a solid national policy on information technology in general and a specific Act of Parliament on TeleMedicine adopted in 1997, designated five major hospitals to act as TeleMedicine centres to provide teleservices on pathology, radiology, oncology, nephrology and psychiatry to rural and district hospitals. The latter have begun to be gradually equipped with the hardware and software to prepare and send diagnostic data and images. Already starting in 1995, the **Federated States of Micronesia** set up satellite-based demonstration projects mainly to establish how best to avoid off-island referral of patients and to facilitate continuous medical education. Whilst improved and standardized procedures are being established, these TeleMedicine links are being extended to other islands also using satellite links. In **Mozambique**, a variety of telecommunication links are used for an experimental TeleRadiology link between a major hospital in Maputo and another in Beira. Dial-up telephone, digital microwave and (Intelsat) satellite links are being used. As a part of the national health strategy to improve the access by remote and rural areas to quality health care, **Thailand** is experimenting with TeleMedicine as a cost-effective means for major hospitals to support remote health care sites. With some WHO funding, and satellite links from the ASEAN Pacific Telecommunity, a major hospital in Rajvithi is already linked to 12 remote sites, with video conferencing capabilities, enabling TeleRadiology, TeleCardiology, TelePathology and related TeleEducation. The same facilities are used to standardize the content of medical data bases and access to these. The Institut Pasteur in **Tunis** has established an experimental TeleMedicine link with the Hôpital Antoine, Nice, for TeleRadiology and TelePathology with emphasis on cancerology. It is also being extended to link with a comparable Italian institution.

In the fourth category - operational services - the King Hussein Medical Centre and Ammon Surgical Hospital in **Jordan** have (Intelsat) satellite links to Mayo Clinic in the United States, for second opinions on the diagnosis and proposed treatment of certain cases, and for TeleEducation. The example from **Malta** is on individual care using TeleMedicine links. Using specially developed, simple communication devices placed in the homes of the elderly who are living alone, any emergency or need for support is immediately detected over an Alert system, which is also set to transmit specific critical readings (heart beat, blood pressure, etc.) and to display the individual's basic personal health record, to an emergency control station that would act quickly, as appropriate.

The same telecommunications infrastructure is being expanded into a full national HealthNet over which hospitals and local health centres would cooperate, for example on sharing patients records. In **Mexico**, a satellite-based TeleMedicine link enables the specialists in the major 20 November Hospital in Mexico City to support the general practitioners in 10 general and rural hospitals in the Chiapas region, primarily with TeleRadiology, TelePathology and TeleConsultations. One of the few examples of international commercial TeleMedicine links is that between the King Faisal Specialist Hospital & Research Centre, **Saudi Arabia,** and several top American university hospitals led by the Massachusetts General Hospital, Boston, and a commercial enterprise[19]. This satellite-based link is used for routine diagnosis and for second opinion. Routine diagnostic data and images are sent via simple store and forward technology, and emergencies are further supported with video conferencing. The experience of **Singapore** is rather extensive because the support to the health sector is part of the massive national IT2000 Initiative, which also covers the support to administrative functions such as billing and payments. A national broadband network is used for support to TeleMedicine by enabling the sending, receiving and viewing of medical static and dynamic images, as well as conferencing. International links for second opinions and education are also supported, such as that between the Singapore General Hospital and Stanford University hospital. In **Taiwan**, experimental TeleMedicine links enable support to general practitioners in the islands of Penghu and Kinmen, to be provided by experts in the National Taiwan University hospital.

IV HEALTH INFO-STRUCTURES

The policy and strategy papers of WHO of the 1970s and early 1980s concerning national health information systems stress that the needs were for: *health information systems that would provide the right information, to the right person, in the right place, at the right time and in the right format*.[20]
Note that the emphasis was on the system seeking and providing the information. The appropriate adaptation of the above, to our emerging cyber age, would differ in a number of ways. For example, it is not only "systems", but a whole health information infrastructure. This does not seek and provide the potential user, but the users access and decide what information is necessary for them, when is it needed and in what format it is to be provided. Thus, in the emerging cyber age, it could stated that the need is for: *health info-structures*

[19] R. Richardson, Global TeleMedicine Practical Applications: Linking Saudi Arabia to USA. *Technology & Informatics,* Vol 23; Sosa-Iudicisso et al (Eds.), *Health, Information Society and Developing Countries*. Netherlands, IOS Press, 1995.

[20] WHO/ISS, Towards Principles for National Health Information Systems. Unpublished document WHO/ISD/78/13, 1978.

comprising of systems that contain validated and evidence-based information, accessible by the right and authorized person or institution, from wherever this may be, whenever this may be required, and in any format chosen at the moment of access.

A health info-structure may be defined as the infrastructure that supports health information and comprise of these four main entities: people and institutions; content: primarily information and knowledge; usage: its management and governance (protocols, standards, etc.); and technological support: computing, networking and telecommunications.

The above may be further clarified and explained with the aid of a simple model. Basically, information flows when a user, a service or a resource communicates with another user, service or resource, to fulfil a specific task or function using a certain tool(s) over a certain communications medium. For example, a general practitioner transmitting an X-ray image to a specialist radiologist to interpret, a surgery professor delivering a lecture, and a demonstration on a specific surgical intervention. Many of the needs of specific uses are in fact common and thus shareable; for example sending and receiving messages and reports, video conferencing, listening to a lecture, accessing the Internet, accessing a telecommunications or a telephone line, etc. These common needs can aggregated and catered for by one physical infrastructure over which there may be any number of logical structures. The common physical infrastructure and its services are then governed by rules of authorization, access, usage and accounting.

The past five years have witnessed an explosive start to the "informatization" of the support to health care. This is true for the industrially developed countries and developing countries, though to a much lesser extent in the poorest of the developing countries. This growth has included many developing countries in Asia, the Eastern Mediterranean and South America, where the communications infrastructure is widespread and reliable.

The infrastructure increasingly includes the Internet, either through direct connections or, as in some of the poorest developing countries, over networks of a simpler technology and a cheaper infrastructure that bridge onto the Internet. For example, E-mail services via the Internet have been introduced and used in parts of the health sector of at least 38 of Africa's 49 countries, and it is expected that reliable E-mail coverage will include the health sector of at least some parts of every African country within the next couple of years.

The Internet services include discussion groups, bulletin boards and newsletters for nearly 6,000 common interests groups, and has tens of thousands of data bases hosted on its nodes in a variety of forms, such as "gophers" and world-wide web (WWW) sites. More significantly, it is estimated that 15% to 25% of the content of the Internet deal with health or health-related topics.

At present, relatively few developing countries (only 12 countries in continental Africa) have full connectivity to the Internet, that is they can benefit from its full range of services. The majority have only offline connections to the Internet, that is they can use the E-mail services and can benefit from offline information services, but they cannot benefit from the online services such as the

WWW services. This is already a "haves" and "have nots" situation, because the current wealth and growth of the Internet are the online services.

The Internet is by far the largest source of knowledge-based systems, but the validity of the knowledge contained therein and its relevance to differing circumstances, should be examined. Second only to WHO, the Internet is one of the largest media for health issues.

The 'telecommunications medium' is the most critical for many institutions in most developing countries, and it is often the main hurdle and limiting factor to full global connectivity. 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 began to use PDNs. An increasing number of African countries have PDNs already operational in the main cities. The bandwidth supported over such networks determines the extent of its uses. Multimedia requires a broad bandwidth.

Radio-frequency links over short distances, and low earth orbit (LEO) or geostationary satellite earthstations, are being used by the health sector in many developing countries. The infrastructure and operational costs of geostationary satellites are relatively expensive to be acquired and regularly used by health institutions in developing countries, particularly Africa. In comparison, LEOs are much cheaper to install and require cheaper earth stations, but their access and use are limited to a certain span of time (typically 15 to 30 minutes) per day depending on the location on earth. This limitation also makes them unsuitable for online links.

At present, this technology is used in the health sector of about 20 African, four Asian and five other countries[21] [22]. These are used for E-mail and for access to health information services, mostly via gateways to the Internet. This success is also attributed to two important factors. First, the availability of a relatively cheap batch-oriented technology that could be used where better alternatives are either not available or not affordable. Second, the people-to-people collaboration of friendly professional groups in Australia, France, South Africa and the United Kingdom, who provide batch-technology users in developing countries with gateways to global networks such as the Internet.

The LEO-based services are functioning satisfactorily and have provided much appreciated support to users who have no means of telecommunications other than the conventional telephone, FAX and telex services with all they entail in terms of high costs and limitations or inadequacy for literature services. The end-users, quite rightly, are demanding and working for more and better services.

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[21] WHO/ISS, *Towards Principles for National Health Information Systems*, paper WHO/ISD/78/13, 1978.

[22] *VITA-Sat*, VITA, 1600 Wilson Blvd, Arlington, VA 22209, USA.

Other relevant developments to watch for that could increase the telecommunications infrastructure and boost its uses in the health sector in developing countries, including the poorest countries in Africa, are AT&T Africa ONE, Motorola's IRIDIUM and WorldSpace AfriaStar, AsiaStar and CaribStar. Africa ONE is a high-speed, broadband, fibre-optic ring around Africa with strategically situated hubs for any African country to link onto and thus to the international telecommunications networks. IRIDIUM is a communications network based on a galaxy of 66 LEOs that draws the advantages of the relatively cheap costs of LEOs, whilst providing the anytime access of geostationary satellites. WorldSpace is placing three geostationary satellites (with AfriStar due for launch in September 1998) over the three developing countries regions of the world, primarily dedicated to digital audio broadcasting and has offered free-of-charge use of three times three of its channels for health programmes by or through WHO.

In summary, the global and regional telecommunications facilities are evolving such that, if the commercial terms are affordable and if there is the political will to boost the health sector, there are clear indications that national health info-structures can be developed to serve primarily national purposes and to link to, share and participate in a global health infrastructure. The boost to international cooperation on global health issues and to the possibilities of international collaboration in health care, for example through TeleMedicine, will be significant. But there are certain impediments that need to be overcome to make that possible, and these are discussed in section VI.

V INTERNATIONAL TRADE

We briefly discussed above how the uses of telecommunications in health, particularly TeleMedicine, are viewed as one of the ways of improving the equity of access to better quality health care services within a country, and international cooperation thereon. This is so because, from a strictly technological point of view, it permits "tele-expertise", that is it permits a professional task or service to be delivered from a remote location.

The same notion of "tele-expertise" is viewed as the basis of the bulk of potential cross-border trade in TeleHealth particularly TeleMedicine. How? The following paragraphs provide some answers related to: services, such as hospital services, operations and management; technical expertise for the establishment and introduction of TeleMedicine services; education; and other areas.

Medical and health-care services

This is by far the main arena of current activity of national and cross-border trade in TeleMedicine, by both the private and the public health sectors. Up to 1995, this has been viewed as entirely within the industrially developed countries or between one such country and a developing country.

However, the past two to three years witnessed the start of such trade within and between a few developing countries. Most of such trade in TeleMedicine is embedded in other modes of cross-border trade in health care services. Some is trade in purely TeleMedicine services. Whatever form it takes, the key justification for such trade is the search for a more advantageous price/quality ratio.

The growth in the uses of TeleMedicine is closely tied to the promotion of cross-border trade in health care services because TeleMedicine improves the quality of the health care environment and its reputation. This is demonstrated by these two examples. A Singapore health organization which owns several quality hospitals there, is entering into joint ventures with partner organizations or hospitals in India, Indonesia, Malaysia, Sri Lanka and United Kingdom. Its plans include TeleMedicine links between its health care institutions as the means of developing an integrated network providing high quality, cost-competitive health care services. Another example is that of Jordan, which has a declared policy and strategy to attract foreign patients particularly from the neighbouring Arab countries. As one of the many measures and provisions for this goal, Jordan has established TeleMedicine links with other centres of medical care excellence, starting with the three Mayo Clinics in the United States.

There are also some purely commercial TeleMedicine services providers. One of the pioneers is WorldCare, a company previously known as WellCare, which is providing TeleMedicine services to some of the Arab Gulf countries from the Massachusetts General Hospital and through the hospital from other university hospitals in the United States[23]. This venture started with the intention that TeleRadiology would be its primary service, but experience showed that case management was an equally key service. Interestingly, the WorldCare experience shows that the drop in some of the number of certain TeleConsultations is attributed to the medical staff, at the recipient end of the TeleMedicine link, having become sufficiently experienced and knowledgeable to deal with certain cases themselves, demonstrating the inherent educational and training content of TeleMedicine consultations.

Cross-border trade in TeleMedicine also banks on factors other than the improved quality of services and its competitive pricing. There are competitive advantages due to linguistic and cultural factors which greatly influence the emotions of a patient and his/her family, and the offering of unique modes of treatment, such as the example of traditional Chinese medicine.

Technical expertise in TeleMedicine

Given that telecommunications in health, and particularly TeleMedicine, can be valuable and are thus desirable to establish in certain health-care settings,

[23] See footnote 19.

a demand is building up for technical services for the conception, specifications, acquisition and installation of TeleMedicine services.

Thus, some countries are beginning to convert their TeleMedicine technical expertise into an export earning. This may be comparable to the United Kingdom NHS establishing, some 10 years ago, an overseas enterprise to market and export health services provided by the public sector of the United Kingdom.

For example, an Australia TeleMedicine export programme was set up by a consortium of the University of South Wales, Sky TV, NEC Australia and SEACOM Australia. Its first major assignment is to establish the satellite-based China TeleMedicine Network to include over 1,000 Chinese hospitals, to support TeleConsultations, the exchange of medical patient records and laboratory tests, and TeleEducation. The same network is to be accessed by Australian health professionals interested in Chinese medicine and techniques. It is interesting to note that the satellite network is being funded primarily by pharmaceutical and medical equipment companies advertising over the network.

Education and training

As remarked in section III above, the technological infrastructure facilities and protocols need for TeleMedicine are basically the same as those for TeleEducation and training in health care. Thus, the great majority of existing TeleMedicine links double up to support TeleEducation too. Indeed, some TeleMedicine links were basically justified because of the added value of TeleEducation. A totally different, but relevant extra, is that students and trainees prefer to do their studies in their own countries so as to avoid the problems of licensure and re-certification of qualifications.

A growing volume of a wide variety of educational and training courses are beginning to be available via direct TeleMedicine links, and many are also transmitted via the Internet.

The subjects and content of such courses range from the specialized to the general, addressing differing levels of professional groups such as general practitioners, dentists and nurses. Many courses are accompanied by images and demonstrations that may require still images reception or video reception capabilities. Another characteristic is that courses may be delivered in a one-way mode, that is broadcast, or in an interactive mode, that is, the recipients have the ability to interface with the deliverer of the course, for example, for repeats, clarifications or further discussion.

These are courses that are free-of-charge and broadcast to whoever is able to receive, and others that are transmitted at a fee, to locations that have previously enrolled for these. Some of these courses were originally marketed on interactive discs, such as CD-ROMs and Videodiscs. The TeleEducation approach is a significant improvement over the discs in that its content is up to date, and includes realistic post-course questions and answers, and can be recorded for future reference. But its infrastructure and telecommunications costs can be significantly more.

Nevertheless, it is expected that cross-border trade in TeleEducation of medical topics, and in particular on specialized topics, will be a widespread reality much sooner than cross-border trade in TeleMedicine because of the time it will take to resolve certain governance impediments discussed below.

Other areas

There are other areas which are related to health care services and in which some form of cross-border trade has started and which could grow. Two differing examples may be cited, one administrative and the other scientific.

"Managed care" is a generic term referring to systems which integrate the funding and the delivery of health care through contracts with selected physicians and hospitals, linked with health insurance companies to provide health care to enrolled participants for a predetermined annual premium[24]. Managed care is a direct outcome of the recognition, discussed in section III above, of the impossibility to expect governments to continue fully funding quality health care for all its population. Differing forms of managed care have become popular in many of the industrially developed countries, and are making in-roads in other parts of the world, notably Latin America.

Managed care, and all other forms of health insurance, demand professional human support to process relevant claims. Cross-border trade in services relating to the processing and computing of insurance claims has been increasing. With the gradual introduction of health insurance in a large number of countries where it has not existed before, and with the growth of variations in health insurance schemes embedded in managed care, it is expected that this type of cross-border trade will increase.

Another area of cross-border trade is software development. Contracts for software development and maintenance with companies in countries with a large number of a highly qualified programming force, such Brazil, Egypt, India, Mexico, Pakistan and the Philippines, have been drawn up and successfully delivered for nearly fifteen years now. Although the bulk of such contracts were with other computing, networking and telecommunications companies in Europe, Japan and the United States, there were also contracts with clients such as hospitals, educational institutions and even United Nations organizations. The numbers, complexity and volumes of software developments and maintenance contracts have been steadily increasing, and can be expected to become a major sector of cross-border trade between all sorts of countries and institutions, and a source of foreign earnings for some developing countries.

[24] J. K. Ingelhart, Health Policy Report: Physicians and the Growth of Managed Care, *The New England Journal of Medicine*, Volume 331, No. 17, October 1994.

VI ISSUES AND TRENDS

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It has become widely appreciated, especially in development fora, that the poorest countries' recourse to the informatics and telematics technology is not a luxury. It is they who need it the most so as to bridge the development gaps which they would not be able to do with their existing or conventional technologies[25].

There is almost a worldwide enthusiasm for TeleHealth and TeleMedicine, with a sense that a new paradigm in health care is gradually shaping up. Valuable experiences are gradually being reported from many institutions in developing and developed countries. Published reports cite relatively little "data", but the experience to date is indicative and is the basis of the issues and trends highlighted below. Such experience includes WHO direct support to and collaboration with countries for the evaluation of requirements and the acquisition of facilities for, and pilot practical experiments with, TeleMedicine services in a country and between two countries.

TeleHealth and particularly TeleMedicine experiences are relatively new, and an international consensus is needed on a "minimum data set" for reporting and describing these. A few proposals have been adopted and related rosters of TeleMedicine projects are accessible on the Internet.

Impact on health care services

TeleMedicine services make it possible to extend all sorts of professional, including specialists, services and the access and uses of equipment to locations where there are none, such as remote and rural areas. This contributes to raising the levels of diagnostic services, related tests including imaging, and proposed treatments. Thus, TeleMedicine can contribute to the equity of access by all the population to quality health care services.

Aided with TeleMedicine links, much less time would be spent on having to transport patients, diagnostic samples, laboratory test results, etc., thus increasing the productivity of the daily work of a health professional or specialist, and the productivity of the health care services at large.

On the other hand, in some parts of the industrially developed countries, there is growing concern that TeleMedicine links would channel revenues to the specialist centres, away from rural/remote centres. This points to the need for an equitable, controllable payment system for TeleMedicine services.

Impact on the human resources for health

One of the most direct and readily measurable benefits of a TeleMedicine link is that it also enables continuous medical education, and other forms of

[25] S.- H. Mandil, Health Informatics and TeleMedicine. Unpublished document WHO/AOI/96.15. December 1996.

education and training. Indeed, this aspect is sometimes put as strongly as the TeleMedicine services itself.

Indications are also emerging that the installation and operation of a TeleMedicine link in remote and rural areas, or in a hardship area, leads to longer periods of retention of medical and professional staff there, and possibly to reduced migration abroad. This is because, where TeleEducation links are available, they are not isolated in a professional sense: professional support is accessible, and they can keep up to date with their subjects of expertise.

Impact on financial resources for health

A long-established argument is that "high tech" in medical care mostly leads to cost increases. This has also been said about TeleMedicine. But, it would be a mistake to compare a TeleMedicine facility with the installation of, say, a magnetic resonance imaging facility because of their respective differences in scope and overall impact on the health services.

A fully fledged TeleMedicine service that would support most forms of medical services (radiology, pathology, ophthalmology, dermatology, psychiatry, case management, etc.), including the capture, transmission and storage of the relevant medical data and images, can be quite expensive. This is mainly due to the costs of the differing digitized peripheral medical equipment required for each of these services, in addition to other equipment commonly needed by all the services. In practice, a TeleMedicine service is usually launched to support one form of service (e.g. TeleRadiology) and gradually enhanced to other services. Its startup costs have to be considered as any key managerial decision: how essential and what are the benefits and effectiveness over a period of time?

One of the measurable impacts of TeleMedicine services is the reduction in unnecessary referrals. Some projects report a 65% to 70% reduction which amounts to a direct cost saving due to low transport costs and less work time lost.

Another example of savings stems from the uses of TeleMedicine links for TeleEducation, that is the receipt of general and specialist courses, discussed in section III above. This would reduce the costs of education and training abroad, and would enable more nationals than those who are able to travel abroad, to benefit from the courses received.

Technical considerations

The adoption of common standards is a must for cost-effective exchange of any information and is clearly a must between individuals and institutions with TeleMedicine links. The problems of standards, as is the case for health telematics as whole, stem from political, commercial and technical differences. These lead to differences that range from the acute (differing concepts, semantics and approaches) that is difficult to resolve, to the small that can be resolved (differing syntax and communications protocols). Many standards

issues are being addressed on many fronts - by international and regional standards organizations, and in consultations between professional associations and the telematics industry - with a few, slow but sure improvements.

A growth industry is booming around TeleMedicine, especially for the development of digitized peripheral medical devices and their interfaces to the computing and telecommunications environment. In absence of a complete specification of the necessary standards for such peripheral devices, some speedy developments have placed in the market some ad hoc, non-standard devices and their interfaces. Despite progress in recent years, the lack of standards in peripheral medical equipment remains a technical and a cost problem.

By comparison, telecommunications standards are less of a problem thanks to the invisible muscle of the Internet, whose TCP/IP standard has imposed itself as the de facto standard even for private, global networks, known as Intranets.

A major component of a TeleMedicine service is the capture, transmission and storage of images, ranging from black-and-white still images to full colour dynamic images. Key factor is the quality and resolution of captured and tele-sent images. The past couple of years have witnessed the development of desktop video conferencing capabilities that are relatively cheap (complete kit for about US$ 800) for images of a quality acceptable to many but not all medical requirements. Higher resolution images would require much more costly facilities.

The tariffs and costs of the telecommunication services are also an important consideration. Images, and particularly high resolution images, require a lot of computing space and efficient telecommunication services. Traditionally, the pricing for such services was based on distance. An improvement that is already announced by some telecommunication service providers is that pricing would be based on bandwidth-on-demand. The availability of the relevant services and its pricing, should be obtained and carefully studied before embarking on TeleMedicine links nationally and internationally.

Health insurance considerations

One of the early impediments to TeleMedicine is that, in most countries, these services are not refundable by the health insurance schemes. Gradually, some countries such as Norway which adopted TeleMedicine as an integral part of its health care services, applied the fee-for-service schema to the TeleMedicine services. In the United States, this has just begun in a couple of states.

However, health insurance coverage is not portable between countries, and therefore does not apply for services rendered via TeleMedicine links. Some progress has been achieved by some groups of countries. For example, there is a European Union (EU) agreement that the health insurance coverage for an EU citizen should be according to the rules of the country where the EU citizen resides. Also, the MERCOSUR countries agreed, between them, to a

tarjeta MERCOSUR, whereby patients receive the same services from the corresponding health cooperative to which a citizen is enrolled. These could apply to TeleMedicine.

Administrative considerations

Some of the time-wasting and costly chores in the health care services relate to data and information from, about and for the individual patient. Where these are computer-supported, the administrative chores are less than for manual records. But the issues and considerations of privacy and confidentiality predominate (see below).

When services are provided over TeleMedicine links, the steps to update the relevant patient record is a convenient by-product of the TeleMedicine transaction. Equally convenient and efficient are the chores of scheduling and rescheduling patients visits, laboratory tests, etc. Thus, the infrastructure for TeleMedicine could partly alleviate the financial costs and delays of some administrative chores.

Ethical-legal considerations

Nearly all aspects of the health professions, in virtually every country, are regulated by a system of laws and regulations intended to safeguard the interests and concerns of the health care consumers and to protect the profession and its individual practitioners. A substantial proportion of the existing legislation is geared to the hospital setting. For example, “the law” requirement for keeping a manual record of professional practice is clearly a contradiction to the potential cost-effectiveness of paperless, that is electronically recorded, health care practices. The legislation gaps or obstacles that hinder the progress in reaping the benefits of informatics and telematics in health, including TeleMedicine services, need to be addressed soon - at the national and international levels. Even the internationally acknowledged WHO guidelines to bring about regulatory changes, in certain areas, do not explicitly refer to informatics or telematics.

TeleMedicine introduces a departure from a health care practice that is as old as time: the face-to-face encounter between the healer and the sick. Technically, there may be no difference between the tele-encounter and the face-to-face encounter, but psychological aspects aside, some ethical and legal questions remain. For example, those concerning the respective responsibilities of the managers, users and intended beneficiaries, and in particular of the provider and recipient of the TeleMedicine services. Clarity about these questions is a must if TeleMedicine is to confidently move from experimentation to practice. Legislation is being discussed and drafted in a number of countries; and can take long before it is formally adopted.

Two other related issues are also hindering progress with TeleMedicine services and cross-border trade. First, the problems of licensure for cross-border medical practice and sometimes for practice in a difference region, province or

state of the same country. It is a fact that TeleMedicine is presently, routinely and effectively practised from the United States to Saudi Arabia[26] and other Arab Gulf countries, but any such practice in the reverse direction is considered a felony.

Second, the TeleMedicine services that are between one-to-many or many-to-many sites often require the a "gatekeeper" to direct, monitor and control the links involved and to ensure that each request for a service is properly responded to within pre-set response times. This situation arises in most of the TeleMedicine links between hospitals and other health care institutions, also between countries. This gives rise to the laws and rules governing commercial presence in another country. There is great variance between countries on the laws concerning foreign ownership of health care institutions, especially hospitals. These directly affect cross-border trade in TeleMedicine services.

Finally, whereas the developments in the computing, networking and telecommunications technologies appear to have achieved secure encryption of data, secure networks and secure interim network nodes, a great deal needs to be invested in informing and assuring the public of the measures available and imposed. This aspect is not only detrimental to cross-border trade in TeleMedicine, but to most uses of telecommunications in the health care of the individual.

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A new paradigm in health care is beginning to shape up in differing parts of the world, in which the individual will play a major role in his/her health care and well being, and in which new forms of health insurance will gradually replace "free" care, and in which globalization and telecommunications will be major factors. The present trade in TeleHealth, particularly TeleMedicine, will significantly increase at the national level of most countries including developing countries. The relatively smaller doses of cross-border trade in TeleMedicine are poised to take off when the governance-related issues cited and briefly discussed above begin to be resolved.

[26] See footnote 19.