QUESTION 14/2
Fostering the application of telecommunication in health care

ITU-D STUDY GROUP 2 2nd STUDY PERIOD (1998-2002)

Final Report

Telecommunication Development Bureau (BDT)
International Telecommunication Union

THE STUDY GROUPS OF THE ITU-D

The ITU-D Study Groups were set up in accordance with Resolution 2 of World Telecommunication Development Conference (WTDC) held in Buenos Aires, Argentina, in 1994. For the period 1998-2002, Study Group 1 is entrusted with the study of eleven Questions in the field of telecommunication development strategies and policies. Study Group 2 is entrusted with the study of seven Questions in the field of development and management of telecommunication services and networks. For this period, in order to respond as quickly as possible to the concerns of developing countries, instead of being approved during the WTDC, the output of each Question is published as and when it is ready.

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Fostering the application of telecommunication in health care: Identifying and documenting success factors for implementing telemedecine

FINAL REPORT

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FOREWORD

There is a growing interest for telemedicine in developing countries which we, in BDT, have a duty to encourage and promote. Telemedicine has become a matter of strategic importance in the work of ITU-D thanks to the first World Telecommunication Development Conference (WTDC-94), which instructed our sector to *study the impact of telecommunications in health-care and other social services*.

We have been implementing pilot projects in line with Recommendation 9 of the second World Telecommunication Development Conference (WTDC-98), which recommended not only to study but to demonstrate the potential benefit of telemedicine to developing countries taking into account their environmental and local conditions. It was clear from this conference that we need to bridge the gap between the telecommunication and the health-care communities at all levels. The ability of telemedicine to facilitate health-care irrespective of distance and availability of personnel on the site, makes it attractive to developing countries.

We expect the pilot projects to serve as "test beds" or case studies for other developing countries interested in using telecommunications to extend health-care to remote and rural areas where most of their population lives. Several projects have been completed and more have been planned. You will read about them in this document.

How do we select pilot projects? On the grounds that they use existing telecommunication networks. That they involve one or more countries in different parts of the world. That they involve a mix of players such as telecommunication operators and/or local service providers, local medical services, health-care professionals, equipment suppliers, as well as international collaborators, including satellite operators and telemedicine institutes. It is important that pilot projects mirror the multidisciplinary approach required for the deployment of telemedicine. Besides, there must be someone from the local community where the pilot project is to be implemented. This person acts as the local project leader ensuring that all players remain committed and that they work together for the success of the project.

How are pilot projects funded? In the majority of cases, the budget comes from contributions made by project partners who include, as a rule, the local telecommunication operator. BDT's own contribution for each project is relatively small and comes at the moment from the TELECOM Surplus Programme. The funds for this Programme are mainly used to launch the activities and to attract other partners.

I do believe that telemedicine could improve the access to health-care in developing countries. Many lives may be improved or even saved if access to medical knowledge is facilitated through the concept of telemedicine.

Hamadoun I. Touré
Director
Telecommunication Development Bureau
International Telecommunication Union

PART 1

HOW CAN DEVELOPING COUNTRIES BENEFIT FROM TELEMEDICINE?

Introduction

Telemedicine is not a new concept. The telephone line was used from the very beginning for different kinds of medical consultations. There are several definitions of telemedicine. Let us take a recent one: *Telemedicine is the investigation, monitoring and management of patients and the education of patients and medical staff, which allow easy access to expert advice and patient information, no matter where the patient or relevant information is located.*

Telemedicine projects were widely undertaken in the late 60s and 70s, although – without exception – they were unsuccessful. The reasons for their downfall were many and varied but centred upon the costs of acquiring and operating the technology, poor image quality, and administrative and staff-training issues. More recently, activity in telemedicine has widely begun again and has been expanded. Today, the telemedicine applications are based on a variety of networks, ranging from the ordinary telephone network to specialized data and video communication networks.

The emergence of telemedicine as a recognized technique for health-care delivery in the developed countries has been accelerated by the continual decline of the cost of telecommunications and computing. However, despite the existence of a wide range of telemedicine research projects in various countries, there is little real evidence so far that telemedicine is cost-effective. On the other hand, there is good evidence for certain other benefits, in particular for the ability of telemedicine to deliver specialist medical expertise to regions and places which lack doctors. For this reason, telemedicine may be a useful technique in developing countries. Because there is very little practical experience in the use of telemedicine in developing countries, it might seem premature to consider the cost effectiveness of projects as the initial benefit for developing countries will not be a financial one.

Developing countries face various problems in the provision of medical service and health-care, including funds, expertise, resources, shortage of doctors and other health-care professionals. Roads and transportation are inadequate and make it difficult to provide health-care in remote and rural areas; problems in properly transporting patients are often encountered. A large number of villages and rural areas do not have the basic medical and health facilities, and the population in these areas have no access to medical advice, even in emergency cases. Rural patients have to be transported into city hospitals at great cost.

For countries with limited medical expertise and resources, telecommunications can provide a solution to some of these problems. They enable medical expertise to be accessed by under-served locations using telecommunications. The widespread use of telemedicine services could allow universal health access. Telemedicine offers solutions for emergency medical assistance, long-distance consultation, administration and logistics, supervision and quality assurance, and education and training for health-care professionals and providers. Telemedicine can help counter tropical diseases and meet the particular requirements of various medical specialities.

In the developed countries, there has also been an explosively growing interest in telemedicine and telehealth as a means to ease the pressure of health-care on national budgets. It may well be that some – certainly not all – of the technologies and experiences of the developed countries could be of help to developing countries in their desire to provide, especially, primary health-care. Telemedicine and telehealth should also be of interest to telecom operators since they generate additional traffic over existing networks and offer the opportunity to extend limited networks. The telecom and health "industries" can achieve synergies.

Decisions of the WTDC-94, AF-RTDC-96, AR-RTDC-96 and WTDC-98

The World Telecommunication Development Conference, which was convened by the BDT/ITU in Buenos Aires in March 1994, recommended that the BDT study the potential of telemedicine to meet some of the needs of developing countries. In particular, the conference approved a Question (number 6) on telemedicine which was assigned to Study Group 2 of the ITU Development Sector, as well as Recommendation No. 1 on Application of Telecommunications to Health and Other Social Services. The Conference noted that *the widespread use of telemedicine services could allow universal health access and consequently facilitate the solution of the principal health problems connected with infectious diseases, paediatrics, cardiology etc., particularly in areas where medical structures are inadequate or non-existing.* It is apparent from the work of the Rapporteurs' Group that telemedicine has considerable potential for developing countries. It also clear that there is limited telemedicine experience in developing countries so far and that useful models are needed. Telemedicine needs to be implemented carefully and managed well. The impact of telemedicine on health-care structures can be significant. In this respect, telemedicine can be seen as a tool to reorganize or to build up new health-care structures. It also raises concerns about liability, confidentiality, competition and other policy and regulatory issues.

The African Regional Telecommunication Development Conference (May 1996) considered the presentation from ITU-D Study Group 2, Question 6/2 on *Telemedicine and Developing Countries*. The Conference approved Resolution 7: *Telemedicine in Africa*. A telemedicine demonstration took place during the Conference in which doctors from Abidjan were consulting with medical specialists in Milan (Italy) and Toulouse (France) via a satellite using an Inmarsat B mobile earth-station. The doctors were able to see live images of each other and – at the same time – discuss cardiographic and dermatological images and photographs of serious wounds. "The interest in telemedicine may be growing rapidly in Europe and America, but we in Africa have very little experience of it. This is something new for us", said Prof. William Djibo, President Director-General of the Polyclinique Internationale, Centre Hospitalier Universitaire in Abidjan.

At the Regional Telecommunication Development Conference for the Arab States, which took place in Beirut in November 1996, there were telemedicine demonstrations linking a hospital in Beirut with the European Institute of Telemedicine in Toulouse. The demonstration was organized by The Midjan Group (the European Telemedicine Collaboration Group) using the telecom and satellite facilities of France Télécom and Inmarsat respectively. The issue of telemedicine was discussed during the Conference and resulted in the approval of the Recommendation *Telemedicine in the Arab Countries*. This recommendation *"... invites all Arab countries to promote collaboration between health-care officials and telecom operators in order to identify solutions to meet health-care needs, especially in remote and rural areas and for those on the move and for those who might not otherwise have access to the quality of care available in urban hospitals."* The Conference requested the Director of the BDT to organize at least two large-scale trials of telemedicine, which would serve as "test beds" and models for a successful implementation of telemedicine. The Conferences demanded also that telemedicine services and delivery should be affordable, practical, profitable, self-sustaining and available to as many people in need as possible. The Recommendation asked the Director of the BDT to convene a World Telemedicine Symposium for developing countries, and this Symposium took place in Portugal in July 1997.

The recent World Telecommunication Development Conference (WTDC-98), which took place in Valletta in March 1998, approved a Recommendation promoting telemedicine pilot projects which are intended to serve as case studies for other developing countries interested in the possibilities of extending health-care to remote and rural areas by using telecommunications. The ITU Development Sector's Study Group 2 produced a Report on *Telemedicine and Developing Countries*, which was published in the *Journal of Telemedicine and Telecare* in February 1998 and sent to all Ministers of Health around the world. The WTDC-98 approved a new study Question (Question 14/2) which is expected to result in a report based on the results of the telemedicine pilot projects in developing countries. Participants in the new Question are also expected to produce a global directory of suppliers of telecommunications and health-care technologies appropriate for developing countries. The emphasis will be on low-cost solutions

which recognize the realities of telecom networks in developing countries. The new Question is also expected to consider the policy requirements for implementing telemedicine in developing countries and, especially, the issue of how to make telemedicine services sustainable, at least in the long term.

ITU and WHO

In 1995, the Secretary-General of ITU and the Director-General of WHO signed a Memorandum of Understanding (MoU) defining arrangements for cooperation in the field of telemedicine. Under the terms of the MoU, the two organizations will help to introduce "dedicated communication and informatics technologies to facilitate the provision of health and medical services" in a bid to improve the quality of life of people living in rural and remote areas, people whose basic needs are far from being met. For this purpose, special working relations were established between the Secretariats of the two organizations. The practical cooperation between ITU and WHO commenced a long time ago within the International Programme on the Health Effects of the Chernobyl Accident (IPHECA) as regards health, telecommunications and informatics. As a telecommunication component of this programme, the microwave link connecting Moscow and the Medical Radiological Research Centre in Obninsk was built up, which helped monitoring and mitigate the adverse affects of the Chernobyl accident. It was implemented together with BHN Association of Japan, one of BDT's very active partners in telemedicine projects.

With the active participation of ITU, WHO convened an international consultation at their Headquarters in Geneva (11-16 December 1997) on telemedicine in relation to the development of the Health-for-All policy for the twenty-first century. The consultation submitted a report which outlines the strategic elements of the proposed policy as a "window of opportunity" with particular attention to the needs and capacities of developing countries. The elements include awareness and promotion, capacity-building, standards, regulation, quality of services, cost-benefit analysis, partnerships, financing and evaluation. A WHO consultation group said, *By seeking collaboration with the telecom community, health-care professionals will improve their chances of getting the facilities they need for health telematics. The two communities can gain greater political support and strengthen applications to international development agencies if they work together*.

TELEMEDICINE MISSIONS

During the period 1996-1998 BDT organized several missions of telemedicine experts to selected developing countries in order to identify their needs and priorities for the introduction of telemedicine services taking into account the state-of-the-art of the local telecommunication networks and their evolution. This task was carried out in cooperation with representatives of the Ministry of Health and the Ministry of Telecommunication, and in some cases with the local representatives of the World Health Organization.

The objective of each mission was to find suitable telemedicine projects which could be implemented on the following criteria:

– clinically useful;
– use of the existing telecommunication infrastructure;
– strategically suitable;
– technically feasible;
– realistic in cost.

The results of the telemedicine missions are presented in the Annex.

To many people, telemedicine has become synonymous of videoconferencing and, therefore, high bandwidth. Of course, it is good to have high bandwidth available. But for many practical applications, tele-

medicine services do not require videoconference facilities and thus high bandwidth. A simple telephone network can be used. At the moment, Internet is becoming an increasing important tool for telemedicine.

Let us summarize the results and findings of the telemedicine missions. What are the common and most urgent problems in developing countries which could be alleviated by using telemedicine?

Problems	Telemedicine applications
The country suffers from a severe shortage of health-care professionals. Competent medical specialists using state-of-the-art medical technology such as scanner and other sophisticated diagnostic equipment, are very rare, and – as a rule – are working in the University Hospitals of large cities. The lack of medical specialists and the difficulties to obtain consultations between doctors in regional and remote hospitals with their colleagues in the referral hospitals results in a large number of unnecessary referrals.	Telemedicine links between hospitals and other medical institutions could bring overall improvement of health-care services by centralization and coordination of resources (specialists, hardware and software packages).
The population living in rural and remote areas suffer from lack of health-care. As a first priority, there is a need to improve maternal and child care, in particular when it comes to early detection of high-risk pregnancies.	The deployment of fixed or mobile telecentres, which are now considered to be a good solution to bring telemedicine services to rural areas, could be useful to telemedicine as well. A small bus with appropriate medical diagnostic equipment and a doctor visiting rural areas on a regular basis, could be one of the possible solutions. The bus should have a mobile satellite phone for any consultation with the hospital. This mobile medical service could also play a very important role in disease prevention and health promotion.
High maternal and perinatal mortality rate. One of the major factors contributing to this situation is the inadequacy of trained staff and the very late identification of pathological pregnancies.	The maternity units in any region could be connected by a telemedicine link to the maternity service in a large regional hospital or to the referral hospital. This will allow remote monitoring of the health of pregnant women, especially those with pathological problems.
Very few doctors (in particular in rural and remote areas) have access to medical journals after graduation. As a result, their professional skills tend to become seriously out of date. There is a need for continued medical education accessible to as many health professionals as possible.	E-mail and Internet access for regional and rural health-care centres and small hospitals could be useful. The benefits from connecting as many hospitals and health-care centres as possible to a medical information system would be: • improved standard of medical practice; • improved epidemiological and other reporting; • educational benefits for doctors and medical staff outside the capital, continuous medical education. Internet provides access to several available worldwide medical databases.
Most hospitals have a poor internal telephone system.	The modernization of internal communication in the hospitals could considerably improve the efficiency of health-care delivery. It will be the basis for the introduction of telemedicine services.

Many different types of telemedicine applications may be appropriate for use in developing countries including the following:

– Distance diagnosis, treatment and prevention, which may involve image transfer and/or such services as teleradiology, teledermatology, tele-endoscopy, etc., or which may involve only the interpretation of data as in vital signs monitoring.

– Tele-consultation.

– Distance learning, training, continuing medical education (CME), including access to medical sites on the Web and/or other data bases.

– Use of telematics for health care planning and administration.

Some of these services may be delivered to primary health care clinics in fixed locations in rural areas, or between urban hospitals, or by a health care professional travelling from village to village or by an ambulance or the proverbial flying doctor.

Some of these applications can be used with relatively simple means of communications, involving the use of low speed data transfer. Other may require more sophisticated videoconferencing and other equipment. The more costly the equipment, however, the more likely it will not be appropriate or affordable in developing countries.

Conclusion

The telecommunication sector can no longer afford to be simply carriers of traffic. In the last few years we have been witnessing an increasing convergence of telecommunications, information technology, software, broadcasting and the content industries, bringing new telecommunication applications and services. Telemedicine is an excellent example of this convergence. Today's telecommunication community must not only understand new applications, but also be an active participant in the development of those applications.

ITU's Developing Sector has conducted a major study of the application of telecommunications in health-care, especially in developing countries, and its potential benefit. Now BDT's attention is turning to practical implementation by initiating and collaborating in pilot projects in several countries, which would serve as models or case studies for other countries. Many developing countries are hungry for more information about how telemedicine services could be implemented in their countries in order to overcome the severe shortages of medical expertise, and help them to improve the delivery of primary health-care to remote and rural areas.

The introduction of telemedicine services is a multidisciplinary undertaking, which requires close cooperation – at least in developing countries – between telecommunication operators and health-care authorities. The pilot projects are a good basis for the practical recommendation on how to benefit from the introduction of telemedicine services in developing countries. They show that telecommunication is also a very important tool in improving both the quality of and access to health-care regardsless of geography, and – in particular – in areas where medical structures are inadequate or non-existing. It is hoped that the collective experience of these pilot projects will also provide information that will guide the introduction of telemedicine services by other countries, and help build realistic expectations of how telemedicine will affect health-care services in developing countries.

Recognizing that countries have their own interests and are at different stages of development, countries should nevertheless start with modest pilot projects which are appropriate to their circumstances and which initially can be used to demonstrate a basic telemedicine service. Countries could implement telemedicine services gradually based on lessons they have learned and on the experience of others. Politicians and policy-makers will gain confidence in telemedicine by a step-by-step approach to pilot projects with cost-effective applications.

The main goal is to prepare a model of self-sustaining telemedicine communication systems that would operate without further outside financial support. The utilization of telemedicine networks only for clinical application may not be sufficient to sustain a system. The idea is to offer several interactive teleservice applications for different user groups in order to make a self-sustainable business plan by sharing telecommunication facilities between profitable and unprofitable applications in one business package. Therefore, this task could only be done by the telecommunication partners of these telemedicine projects, and it will be a key factor for the future extension of telemedicine services.

Successful introduction of telemedicine services requires more than just the delivery of the right equipment to the users. Much more important in each case is to find the right way of how to incorporate telemedicine services in the medical practice and routine clinical consultations. This is also relevant to organizational and administrative matters as well as to efficient training.

ANNEX

Telemedicine Missions

Country	Difficulties encountered	Proposal
Bhutan (1997)	Most hospitals in Bhutan are equipped to take X-rays. However, the only specialist radiologists are based in the national hospital in Thimphu. Outside Thimphu the X-ray units are operated by radiographers (non-medical qualified technical staff). Any specialist interpretation of radiographs can only be done by sending the films to Thimphu or by implementing a visiting radiologist service from there. Since there are only two radiologists in Bhutan (both based in Thimphu), a visiting radiologist service is hardly practicable. The rugged mountains and scattered population make the provision of health-care a very difficult task.	Radiology links connecting the regional and/or district hospitals could be a solution, thus forming a teleradiology network in Bhutan. This could be implemented in stages. In the pilot phase, a suitable hospital in a rural area could be linked to the National Referral Hospital in Thimphu. This telemedicine link could also be used to improve the referral system. Most of the required telecommunication infrastructure exists already. Bhutan is a mountainous country. Therefore, there are serious barriers to moving patients because of transport difficulties.
	In Bhutan, health workers (i.e. paramedics – not doctors) are trained at the Royal Institute of Health Sciences. The institute is also responsible for in-service training, which is very difficult to arrange.	E-mail and other network services could help to organize the distance training and to provide access to several available worldwide medical databases.
Cameroon (1996)	In Cameroon primary care is provided by health centres called "Centres de santé". A second level of primary-care providers consists of local district hospitals. At the moment there are 129 district hospitals. These primary-care centres as well as the districts hospitals, are very poorly equipped and only a few doctors are working there.	By connecting these primary-care centres and district hospitals via simple telemedicine links to provincial or referral hospitals, the quality of primary care will be improved due to the support from large hospitals.
	Maternal and perinatal rates of decease are two principal indices that are used to evaluate the level of health-care of a nation. The maternal mortality rate in Yaounde is about 500 per 100,000 deliveries, and about 800 per 100,000 for the rest of the country. The perinatal mortality rate is 50-80 per 1,000 newly born. These figures are unacceptably high compared to other countries. One of the major factors contributing to the high maternal and perinatal mortality rate is the inadequacy of trained medical staff and the very late identification of pathological pregnancies.	A telemedicine project connecting various maternity units in Yaounde to the maternity service in the General Hospital will allow remote monitoring of the health of pregnant women, especially those with pathological problems. If a project would be started in Yaounde, it could later be extended to rural areas where telecommunication facilities exist. The project could be implemented in several stages: first, a fetal ECG monitoring system – which requires only a simple telephone connection – could be used, and secondly – if the transmission quality of the connection proves to be good – ultrasound images could be sent as well.

Country	Difficulties encountered	Proposal
Georgia (1998)	The health-care system in Georgia is in dire need of upgrading. The hospital situations vary in terms of quality and equipment. The rural and remote areas are poorly served due to the lack of specialists and the non-availability of sophisticated medical diagnostic and therapeutic equipment. There is only one well equipped Diagnostic Radiology Centre in Tbilisi, headed by a well-known radiologist. The Centre is very active and busy. They will no doubt benefit from a telemedicine link with other medical centres abroad.	Two telemedicine projects were identified. A telemedicine link for second opinion between the Diagnostic Radiology Centre in Tbilisi and other similar centres in other countries would be very useful. A second project would be the introduction of transtelephonic ECG services. It could start in Tbilisi and extended to other cities and rural locations.
Mongolia (1998)[1]	The effective public health programmes such as immunization, respiratory and diarrhoeal diseases control, and essential drugs programmes have been able to keep the public's health in relatively good shape. Diseases such as poliomyelitis and neonatal tetanus have virtually disappeared. The epidemics of diphtheria and meningococcal meningitis in 1995 were brought under control through mass immunization campaigns. During recent years there has been an overall increase in morbidity rates from communicable diseases such as secually transmitted diseases, viral hepatitis, tuberculosis, brucelosis, meningococcal meningitis and scabies, the latter related to poor personal hygiene. Increases in alcoholism and smoking are factors contributing to the high incidence of cardiovascular diseases and cancer among the middle-aged.	It is proposed to set up a Mongolian medical net connecting six hospitals. Five hospitals would be connected via Internet, with a central station located in the Ulaanbaatar University Hospital. The main hospital in the Uvs region will be connected to Ulaanbaatar using VSAT (point-to-point connection). Three types of telemedicine workstations are recommended.
	At the moment the priority of the national health system is concentrated on the improvement of primary health-care by providing better support from large hospitals to small health-care centres/units, and to improve the referral system. The most common consultation will be clinical, obstetrics and paediatrics. It is also important to organize continuous medical education.	A simple workstation will operate by using e-mail and attached files. For example, if the remote station has an electronic stethoscope and needs teleconsultation of the heart rhythm, a sound file could be made, compressed and sent to the cardiology department in the University Hospital as an attached file to the e-mail. The intermediate workstation in the Uvuzhangai region will work with a scanner in order to send a still image. The advanced workstation in the Uvs region should have additional videoconference facilities.

[1] The mission to Mongolia was financed by the Asia Pacific Telecommunity (APT)

Country	Difficulties encountered	Proposal
Mozambique (1996)	There are over sixty hospitals in which X-rays can be taken. These units are operated by radiographers. The only specialist radiologists are based at the University Hospital in Maputo. The second Central Hospital is located in Beira, 1 000 km from Maputo to the north. About 30 000 films/year are taken in Beira. According to the Head of Radiology in Maputo, some 1 000 would benefit from specialist interpretation. At the moment any specialist interpretation of X-rays can only be done by sending the films to Maputo.	A teleradiology link between three Central Hospitals (Maputo, Beira and Nampula) could be a solution. The telemedicine link could be used for teleconsultation as well, which will improve the referral system. The resources saved by simply improving the selectivity of the referrals would justify the cost of the link. The reduction in the number of inappropriate referrals was estimated to be worth up to US$ 10,000/year in terms of transport costs (based on 30 cases/year travelling from Beira to Maputo). Image transmission could be performed over the public telephone network using a modem. The project could be implemented in stages. First, the University Hospital in Maputo should be connected to the Central Hospital in Beira, and later-on the link should be extended to Nampula.
	Isolation of health-care workers in rural and remote hospitals and health-care centres.	E-mail and Internet access for regional and rural health-care centres and small hospitals. The benefits from connecting as many hospitals and health-care centres as possible to a medical information system would be: • improved standard of medical practice; • improved epidemiological and other reporting; • educational benefits for doctors and medical staff outside Maputo.
	Most hospitals have a poor internal telephone system.	The modernization of internal communications of the hospitals could considerably improve the efficiency of health-care delivery.
Senegal (1998)	The lack of doctors, in particular medical specialists, is a common problem in many developing countries. This is true for Senegal as well. For example, one radiologist only is working in the hospital of Dakar Fann. No such specialist is available in the two other cities (St. Louis and Diourbel).	A telemedicine network connecting three hospitals was proposed. The hospital of Dakar Fann will be the centre of the network. The two other hospitals will be the regional hospital in St. Louis and the regional hospital in Diourbel. The network will allow to provide distance consultation, exchange of medical information, and improve the referral system. The hospitals will be connected by ISDN lines, making it possible to have video-conference sessions between them.
	There is a need to improve the maternal and child care. Senegal has a high maternal mortality rate. It is important to have early detection of high-risk pregnancies.	

Country	Difficulties encountered	Proposal
Tanzania (1996)	Most hospitals had only a few telephone lines connecting their switchboard to the public network, and often there were only a small number of internal telephone extensions. Electro-mechanical switchboards were still common.	The modernisation of the internal communications of the hospitals might significantly improve the efficiency of health-care delivery
	The only pathologists in Tanzania are located in the referral hospitals in Dar-es-Salaam and Kilimanjaro. Despite the availability of these specialists in the Kilimanjaro region, frequently patients need to travel to Dar-es-Salaam in order to obtain specialist pathology expertise, particularly on cancer cases.	The telepathology link between two referral hospitals via ISDN would be an ideal solution. At the moment ISDN is not available. Another (much cheaper) possibility would be the use of the public analogue telephone line. This would limit the telepathology activities to the exchange of static images, but experience in e.g. Italy shows that useful telepathology can be accomplished using Internet.
	There are over 100 hospitals in Tanzania at which X-rays can be taken. X-rays are taken by radiographers; the only specialist radiologists in the public sector are based in the four national referral hospitals. Any specialist interpretation of radiographs, therefore, requires either sending the films to the radiologist or implementing a visiting radiologist service.	The teleradiology link between referral hospitals and at least regional hospitals would significantly improve the situation. For teleradiology, the public telephone network could be used.
	There are currently three CT scanners in Tanzania. Two are located in the state hospitals in Dar-es-Salaam and Kilimanjaro. The third one is in the NGO hospital in Dar-es-Salaam. As there is no radiologist there, a part-time visiting radiologist service is provided from the nearby hospital.	A teleradiology link between the first two hospitals will be very useful. It would eliminate the delay in reporting the current emergency examinations. It would also allow a more rapid reporting of the films taken in the NGO hospital and which need specialist interpretation.
	Very few of Tanzania's doctors (in particular in rural and remote areas) have access to medical journals after graduation. Their professional skills tend to become seriously out of date as a result.	E-mail and Internet access in rural health-care centres will: reduce the isolation of medical staff in rural areas and support continuous medical education • improve epidemiological reporting • improve referral (patients being referred to the district hospitals could first be discussed by e-mail)

Country	Difficulties encountered	Proposal
Uganda (1996)	The Mulago Hospital is a university training hospital attached to the Medical School of the University of Makerere. It is also an important referral hospital to which approx. 90 other hospitals are referring patients for treatment. Another university hospital attached to the same medical school is the Hospital of Mbarara. The Mbarara University Hospital is lacking senior staff and could certainly benefit from remote expert consultations and second opinions from doctors at Mulago.	These two hospitals could be connected by a telemedicine link. The required telecommunication infrastructure is available. The purpose of this telemedicine connection would be to allow physicians from Mbarara to consult their colleagues in Kampala and discuss special cases for which additional expertise is required. A special emphasis should be put on radiology and pediatrics first. In a second phase extension of the telemedicine services could be provided for internal medicine, surgery and obstetrics. This service could also improve the selection of patients to be transferred from the Mbarara to the Mulago Hospital.
	In Uganda a large number of hospitals, clinics and dispensaries are under the jurisdiction of the Catholic or Protestant medical bureaux. The Catholic Church of Uganda covers approx. 50% of the health-care in Uganda. A coordinating office manages the operation of 25 hospitals and 180 small units and dispensaries. These hospitals offer many locations for training and internship. One of the priority areas concerning medical services is the better monitoring of pregnant women in order to decrease the rate of prenatal dealths.	Telemedicine can offer remote monitoring of pregnant women through a telemedicine device that can transmit the recorded tracings directly over the telephone to a doctor located several hundreds of kilometers away. This application could certainly have a major impact on pregnant women at risk. Potential complications could be prevented by the appropriate measures taken in time. The project would only require an adequate telephone communication network between the different locations and some relatively inexpensive telemedicine equipment.
	The Aids Support Organization (TASO) in Uganda is an indigenous charitable non-governmental organization. TASO offers several means of supporting aids patients on a personal, family or community level as well as at national and international levels. TASO offers counselling, education and social support. The organization would need a database of patients under treatment and counselling. Some development with regard to a medical information system has already been done.	A medical information system could benefit from a more advanced telecommunication infrastructure. The setting up of such a system would result in a regular and efficient way of storing data, and would generate statistics and reports in Kampala. Since the data collected are highly valuable and may be of interest to other aids research groups around the world, it would be useful to provide TASO with Internet access allowing to publish their data and reports on the Web.

Country	Difficulties encountered	Proposal
Viet Nam (1997)	There are three hospitals in Viet Nam, located in Hanoi, Haiphong and Ho Chi Minh City. These hospitals are small (about 100 beds each) and belong to the Department General of Posts and Telecommunications (VNPT). They provide health-care specifically for post and telecommunication staff, but also for the general population. The main objective of the project is to improve the standard of medicine practised at the VNPT hospitals	It was decided by the Vietnamese authorities to connect two of the VNPT hospitals (Hanoi and Ho Chi Minh City), and make an additional connection to the Bach Mai Hospital in Hanoi (referral hospital). Telemedicine will be used for consultations and for educational purposes, e.g. showing complex surgical procedures carried out at the Bach Mai Hospital to doctors at the VNPT hospitals. The plan calls for interactive video equipment to enable teleconsulting at each of the three locations.
	It is a common problem how to improve the health-care in rural and remote areas.	BDT/ITU is implementing multipurpose community telecentres (MCTs) in Viet Nam. Four MCT sites have been identified in two provinces: Dac Lac in the south and Ha Bac in the north. The plan calls for a fibre optic link to be provided between the MCTs and their associated provincial hospitals. The telemedicine programme is rather ambitious and includes many telemedicine services as well as an interactive video.

PART 2

TELEMEDICINE PROJECTS

Introduction

In conjunction with the work being done in the context of Question 14/2 (previously Question 6/2) of ITU-D Study Group 2, BDT has started the implementation of several small telemedicine projects in selected developing countries. Most of the pilot projects are based on requests from the countries themselves and the results of BDT's identification missions by telemedicine experts. Several telemedicine projects are presented here. Some of them have already been implemented, and other projects are in different stages of implementation.

BDT participated in the implementation of a telemedicine project in Malta, which is also presented here. Of course, we can no longer consider Malta a developing country. It made a large achievement in their development and has now reached the level of a developed country. When WTDC-98 was planned to take place in Malta, it was decided to implement jointly with the Maltese Administration, a telemedicine project for the benefit of the health sector and the population, and to show to the participants of the Conference what telemedicine in reality is.

Successful implementation of pilot projects and associated activities is based on partnership and requires good cooperation and coordination with the many different partners and organizations. The BDT budget and the TELECOM Surplus revenue are mainly used to initiate the activities and to attract other potential players. No cash contribusions can be expected from the beneficiaries, but their interest in the subject as well as local support could help to encourage those who have the resouces to make these available. We trust that PTT Administrations and local operators in the countries concerned will help with the implementation of the projects by taking into account the very important social aspects of the projects, and provide some equipment locally available as well as manpower for installation and operation. The main contributions is, however, expected from members of ITU's Development Sector and any other potential partner. **The success of a telemedicine initiative depends on the commitment of the participants and their ability to work together.**

The main objective of pilot projects is to demonstrate the potential, expected benefits and – most important – to show what is feasible with the introduction of telemedicine services using the existing telecommunication infrastructure in developing countries. The implementation strategy for many projects is to begin with a point-to-point telemedicine connection in order to develop the acceptable level of clinical utilisation before embarking on a multi-point system.

Criteria for project selection

The pilot projects described in this report have been selected to serve as case studies for other developing countries. The selected pilot projects are intended to represent examples of telemedicine activity in the different regions of the world (Africa, Asia, Europe, Latin America). They have been selected according to the following principles:

- The pilot projects should use technologies which make sense in developing countries. Different technologies should be used.
- The pilot projects should involve a diversity of participants, i.e., they should illustrate the multidisciplinary approach required for deployment of telemedicine.
- There must be a local "champion" serving as the leader of the pilot project, in other words, someone who is based in the community where the pilot project is being undertaken and who can ensure the project participants remain committed and work well together to ensure the pilot's success.

- The project should take into account the users' needs. The needs should indicate the importance of a policy and strategy. The project should not be technology driven, but should recognise telemedicine as a tool.
- The pilot projects should be sustainable.

In some cases, the projects have involved cooperation between developed and developing countries, but such co-operation is not or has not been a necessary criterion for a successful project.

Guidelines for pilot project proposals

The following guidelines could be used for selecting pilot projects for inclusion in this report. These guidelines may also serve when pilot project participants consider making applications to funding bodies which might be willing to sponsor pilot projects.

Background

What is the current situation with regard to the provision of health care in the rural areas to be involved in the project? What are their needs? Why is this project being undertaken? What are morbidity rates?

Objectives

What are the objectives of the pilot project? Be as specific as possible in order to evaluate results.

Description of project

A brief description of the telemedicine application(s) to be used in the pilot project. Include a schematic drawing, if possible. Identify as precisely as possible the equipment and services to be included in the project. Where exactly will the equipment be used and what service(s) provided?

Project leader

Identify who the project leader will be, the person who will be in charge of organizing the pilot project and its day-to-day management.

Partners

Provide the names and contact details of all those people who will be involved in the project in some way or other. Identify what each participant/partner will contribute to the project. Each partner should confirm in writing his commitment to the project.

Expected results

Will the pilot project meet real needs? What benefits are expected from the proposed configuration of the telemedicine application(s)? Is the proposed configuration of equipment and services the most cost-effective? How will health care be improved?

Costs

How much will the pilot project cost? Identify capital and operating costs. Who will share those costs?

Schedule

What are the main milestones for planning and implementing the pilot project? How long will the pilot project last?

Evaluation and sustainability

How will the project be evaluated? What are the measures of success for the pilot project? Are there any benchmarks statistics (before and after)? What lessons can be learned from the pilot project? Is the project or service sustainable? After the pilot project, what will happen next? Are there plans for continuing the service? If the project is successful, can it be expanded to include other rural areas?

Projects implemented

BHUTAN: Teleradiology link between the national referral hospital and the regional hospital

Country information

The Kingdom of Bhutan is situated in Southern Asia, in the Himalayas, between China and India, and covers an area of 47 000 km^2 for a population of 620 000[2] (similar in size and topography to Switzerland, but with a tenth of its population). The telephone density is 1.64. Rugged mountains dominate the terrain and make road construction and other infrastructures like telecommunications difficult and expensive. Bhutan has a strong traditional system of herbal medical practice linked with ritual and religious cures. Right from the start of the First Five-Year Development Plan in 1962, the Bhutan Government launched an intensive plan of action for the creation of a modern health-care system, side by side with the existing traditional system.

There are 26 hospitals, 134 Basic-Health Centres and 42 dispensaries located at strategic points all over the country. Approx. 50 Basic-Health Centres (some of which are located in very remote villages) have been connected to the national telecommunication network by single channel, point-to-point VHF systems (solar-powered in remote locations). These systems are primarily intended for voice communication but could also handle fax and low-speed communication with the appropriate terminal equipment. Between the capital Thimphu and the second largest city Tashigang, there is a 34 Mbit/s digital microwave transmission link with spurs connecting the main population centres in Trongsa, Jakar and Mongar.

Purpose of the pilot project

In the framework of the BAAP[3] Programme 9 (Integrated Rural Development), BDT/ITU launched a pilot project in Bhutan dealing with a Multipurpose Community Telecentre (MCT). The objective of this project is to evaluate the feasibility of the Community Telecentre's concept and to study different telematic applications and services, including the provision of public telephones and faxes, shared access to computers, access to e-mail, government and community information, applications in distance education and training, and – of course – telemedicine applications.

Teleradiology link

Jakar, in the Bhumtang region, was selected as the most appropriate site. Jakar has the required telecommunication infrastructure and a relatively large number of potential users, including a hospital with about 9 000 patients per year. There are also several Basic-Health Centres in the Bhumtang region. The hospital is equipped with ECG and X-ray equipment as well as the usual laboratory facilities. Computerization of patients' records and statistics is in progress. Presently the hospital staff communicate with the main referral hospital in Thimphu by telephone and mail.

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[2] 1997 estimate.

[3] Buenos Aires Action Plan (1994).

The telemedicine link will connect the hospital in Jakar via the Multipurpose Community Telecentre to the National Referral Hospital in Thimphu. How the Jakar MCT is connected to Thimphu is presented in Figure 1. The set-up of the telecentre can be found in Figure 2. The telemedicine workstation based on a PC with a digitizer, will be located in the hospital. A second workstation (without digitizer) will be installed in the hospital in Thimphu.

After the installation of both telemedicine workstations the hospital will benefit from this connection by sending to the referral hospital X-rays and ECGs in order to quickly obtain a second opinion from a specialist. This could save lives and help to avoid unnecessary transfer of patients to the referral hospital. The hospital staff is also expected to get training course from Thimphu on a regular basis, and – again – distance learning facilities could save money and improve the quality of medical services. Access to Internet will enable doctors and other medical staff to obtain information about diseases and treatment from several available medical databases, download training courses, and consult and exchange experiences with doctors and health-care workers all over the world by e-mail.

Partners

- Telecommunication Division, Ministry of Communication
- Hospitals in Jakar and Thimphu, Division of Health, Ministry of Health and Education
- ABE Sekkei Inc., Japan (donation of a laser film digitizer)
- Medical Center of Boston International, Japan (expert services, donation of telemedicine hardware and software)

Present status

The MCT was recently put into operation. The telemedicine equipment has been delivered to Bhutan but not yet installed.

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Figure 1

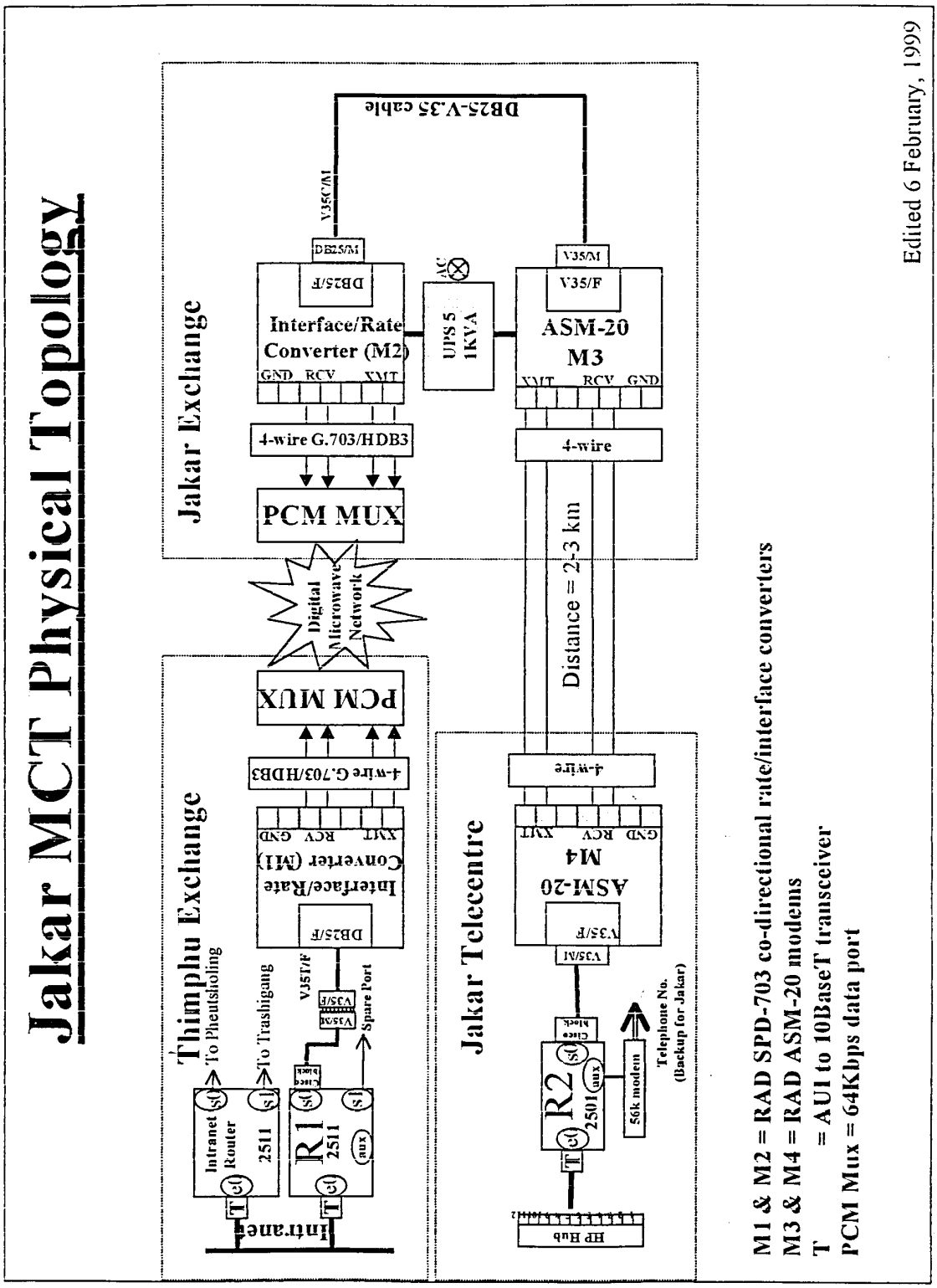
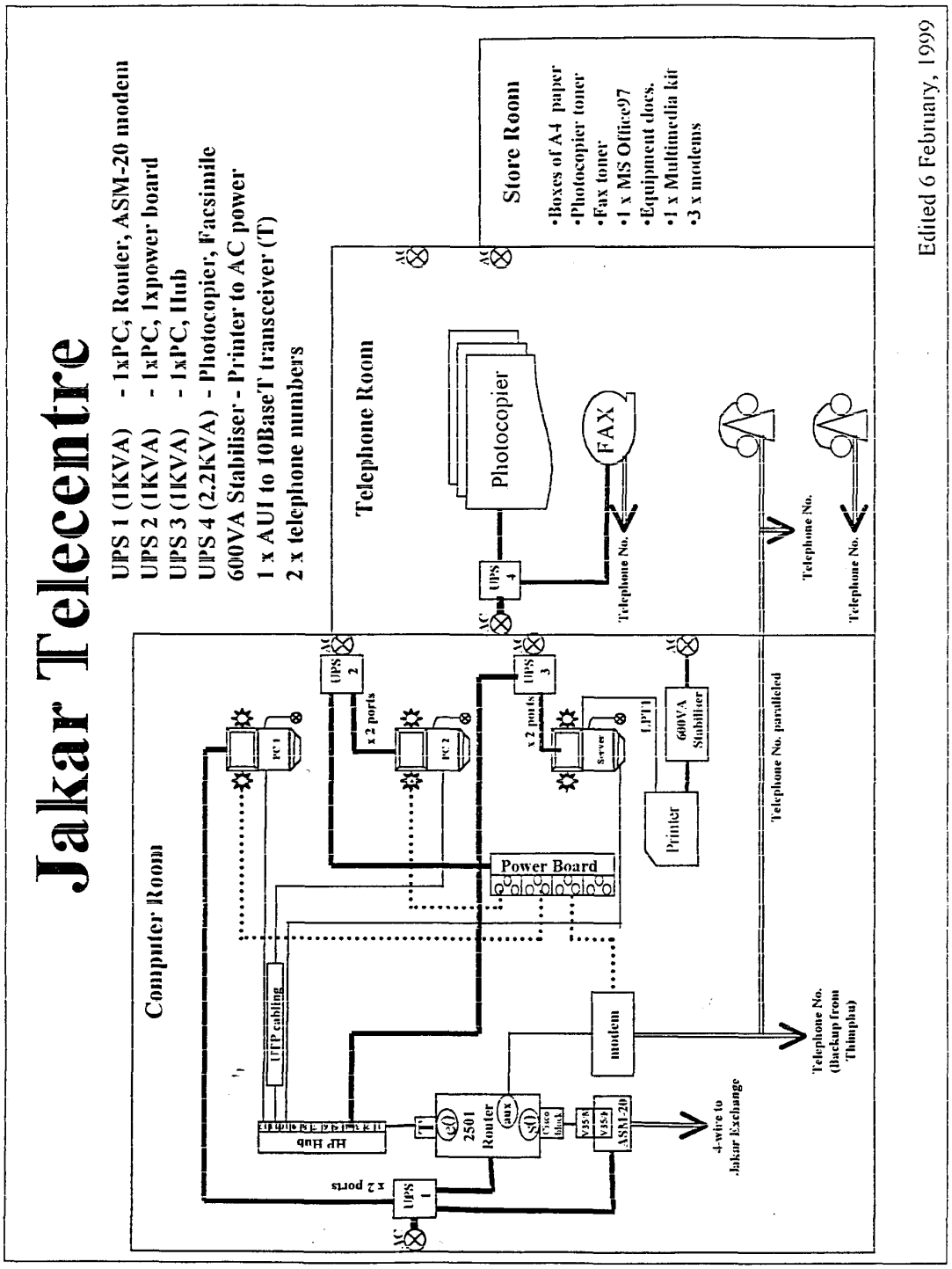

Jakar MCT Physical Topology
Jakar Exchange
Interface/Rate Converter (M2)
DB25/F
DB25/M
V35C/M
DB25-V.35 cable
GND RCV XMT
4-wire G.703/HDB3
PCM MUX
UPS 5 1KVA
AC
ASM-20 M3
V35/F
V35/M
XMT RCV GND
4-wire
Digital Microwave Network
Distance = 2-3 km
Thimphu Exchange
Interface/Rate Converter (M1)
V35T/F
V35/F
V35/M
Spare Port
Cisco block
R1 2511
aux
Intranet Router 2511
To Pheutsholing
To Trashigang
Intranet
Jakar Telecentre
ASM-20 M4
HP Hub
R2 2501
56k modem
Telephone No. (Backup for Jakar)
M1 & M2 = RAD SPD-703 co-directional rate/interface converters
M3 & M4 = RAD ASM-20 modems
T = AUI to 10BaseT transceiver
PCM Mux = 64Kbps data port
Edited 6 February, 1999

Figure 2

MCT FLOOR LAYOUT



GEORGIA: Transtelephonic electro-cardiogram (ECG) monitoring

Country information

Population: 5.4 million. Telephone density: 11.55%.

Introduction

Cardiovascular diseases are the most common cause of death in industrial countries which appear to become a serious problem in developing countries because of changes in the mortality structure (a diminished share of infectious diseases and traumata). Diagnostic and therapeutic approaches adopted by cardiologists of the developed countries are but of limited usefulness in developing countries; in fact, they are not available to the greater part of their population due to conspicuous financial problems. Therefore, it is an ultimate goal of the world commonwealth to accommodate the high-tech means of heart diagnostics and treatment to the financial reality of developing countries so as to make them free-for-all. At the same time, optimization of the cost-benefit balance of current medical procedures should be attained.

One of the modalities of medical supervision of ambulatory cardiac patients is transtelephonic ECG monitoring of a patient provided with a personal ECG transmitter the data of which is received and analyzed either by his/her cardiologist or at a health center. This modality has been gaining foot in industrial countries since the end of seventies and showed its advantages for early diagnostics of various, including life-threatening, cardiac catastrophes, and their ECG verification. It is of the essence, that transtelephonic monitoring complements other popular methods utilizing data of the ECG analysis.

The present-day market is flooded with all kinds of systems for transtelephonic ECG monitoring differing in a number of parameters of both ECG transmitters and receivers. The cheapest are systems intended to use a single ECG lead. However, judgments about these systems that are the most suitable for start-up in developing countries by the criterion of cost are virtually lacking.

The paper reviews the experience of managing two ECG receiving stations primarily intended to match with the most primitive one-channel personal ECG transmitters within the pilot projects of the Telemedicine Foundation (Russia).

The pioneering system (a receiving station) was mounted in Outpatient Clinic 1 of the Glavmosstroy Hospital in Moscow. The system was outfitted with three ECG transceivers. The purpose of the project was to assess potentiality and performance of the system when used for medical assistance to builders immediately at the construction site. The other system outfitted with 10 ECG transceivers has been in service in the Guli Cardiological Clinic (Tbilissi, the Republic of Georgia). This project has been implemented under the auspices of the International Telecommunication Union with participation, apart from the Telemedicine Fund, of the Guli Cardiological Clinic and a telecommunication company in Georgia. The main goal of the project is performance evaluation of a single one-channel ECG transmitter used to follow up patients after discharge from hospital.

Characteristics of the systems

Both systems were equipped with stock-produced items of Geolink-Electronics (The Russian Federation) certified for medical applications as appropriate. The receiving station of the system is a dedicated ECG receiver connected to the phone line and RS232-interfaced with an IBM-compatible PC. The ECG receiver is controlled by special software that also enables ECG visualization and printout, maintenance of the ECG database containing patient and transmitter identifying information. Currently, there exist two types of transmitters – personal to be used by patients, and professional.

Personal ECG transmitter (Fig. 3) with the mass of 120 g allows up to 2-minute recording no matter the length of a specific ECG check. It incorporates a memory unit to store ECG records, and acoustic connection to the telephone. Electrocardiograms can be recorded either via electrodes on the lateral faces of the unit (leads I, II, III, and CR which in clinical terms are essentially identical to the normally used chest leads V), or outer expendable electrodes connected to the recorder with wires (in any bipolar lead depending on location of electrodes). If necessary, sequential recording from several leads can be made. The ECG transmitter is controlled by simple touches of the electrodes and pushing the only key.

Figure 3 – Personal ECG transmitter in position for lead I recording

The professional ECG transmitter is an add-on unit (foreground of Fig. 4) matched with the standard Geolink-Electronics 3-channel electrocardiograph (background of Fig. 4). The mass of the set with associated electrodes, expendables and storage bag makes up about 4 kilograms. Mating of the transmitter with the electrocardiograph ends up by transmission of the very last electrocardiogram as a sequence of synchronously recorded 12 typical leads. The connection is acoustic. Should the need arise, ECG can be retransmitted.

Frequency modulation is used in these two types of ECG transmitters. The acoustic connection, even though evident drawbacks, allows fence off the phone connection problems (different types of phone sockets, permanent joints), save time of preparation for transmission, and use the public telephones. This design, as operation showed it, ensures stable ECG reception from the distance between the transmitter and phone microphone up to several dozens of centimeters at the ambient noise of up to 75 dBA. Attempts to use the cell phones were also positive.

The distinctive feature of the Geolink-Electronics ECG transmitter is that prior to sending ECG records there is an automated traffic of service messages which include the transmitter serial number, date and time of ECG record and makes presence of the receiving operator unnecessary.

Selection of Patients and Receiving Station Management

According to the pilot project on the transtelephonic ECG services in the outpatient clinic at the Glavmosstroy hospital, ECG transmitters were distributed among the first aid stations at the construction sites. Personnel of these stations were given the list of cardiovascular distresses which, if suspected in workers seeking their medical assistance, were to be responded to by recording and subsequent transmission of ECG leads I, II, and CR_5. Operators at the receiving station – a physician and a nurse of the Functional Diagnostics Department – were responsible for ECG analysis and medical advice when required. No advanced selection of patients was performed.

The Telemedicine pilot project for Georgia: Transtelephonic ECG Service with participation of the International Telecommunication Union involved lending of ECG transmitters to patients who had been given cardiological treatment in hospital or were followed up by ambulance stations and needed ECG monitoring of cardiac rhythm, conduction or possible ischaemic signs. The patients were selected by the Guli personnel based on the review of clinical data. Each patient was to continuously use the ECG transmitter over a 2-wk period; on completion, efficiency of a patient's monitoring was evaluated. Managing physicians instructed their patients on the regularity of ECG monitoring and transmission. Also, the most informative leads for a specific patient were identified. Patients' calls to the clinic were picked up by high-graded orderly cardiologists.

Figure 4 – Set of devices for professional ECG transmitting in operating position.

Results

Within the first project, no advanced selection of ECG for consultation was performed; in three months, 231 ECG records were received from 74 different patients of whom seven sent their ECG twice and one – thrice. The quality of all the ECG records was good enough for interpretation. The service messages were automatically recognized in 229 cases; in two cases the data required manual correction. Distresses diagnosed after analysis of the ECG records are presented in the table below.

Type of ECG deviation	Number of ECG records
No findings	198
Marginal alterations of varying origin followed by the advice to repeat ECG in clinic	17
Arrhythmias	12
Conduction disorders	4

The case is offered as an illustration. Patient T., age 48, w/o complaints, came to the first aid station for a health statement. Examination by the nurse revealed AP elevation up to 160 and 100 mm Hg; ECG from leads I, II, and CR_5 was transmitted by phone. The ECG records displayed a negative T-wave in II and CR_5, and ST segment depression by 0.05 mV in CR_5. The receiving physician told him to urgently visit policlinic in order to make standard ECG and to consult a cardiologist. The patient ignored this advice and three days afterwards was admitted to the hospital with non-Q-waved lateral myocardial infarction affected by a significant AP drop.

In clinic Guli (Georgia) the ECG transmitters were lent to eight patients for the period of 2 months. The patients made 67 ECG-transmitting calls and sent 165 ECG records. The electrocardiographic statements of orderly physicians are summarized in the table below.

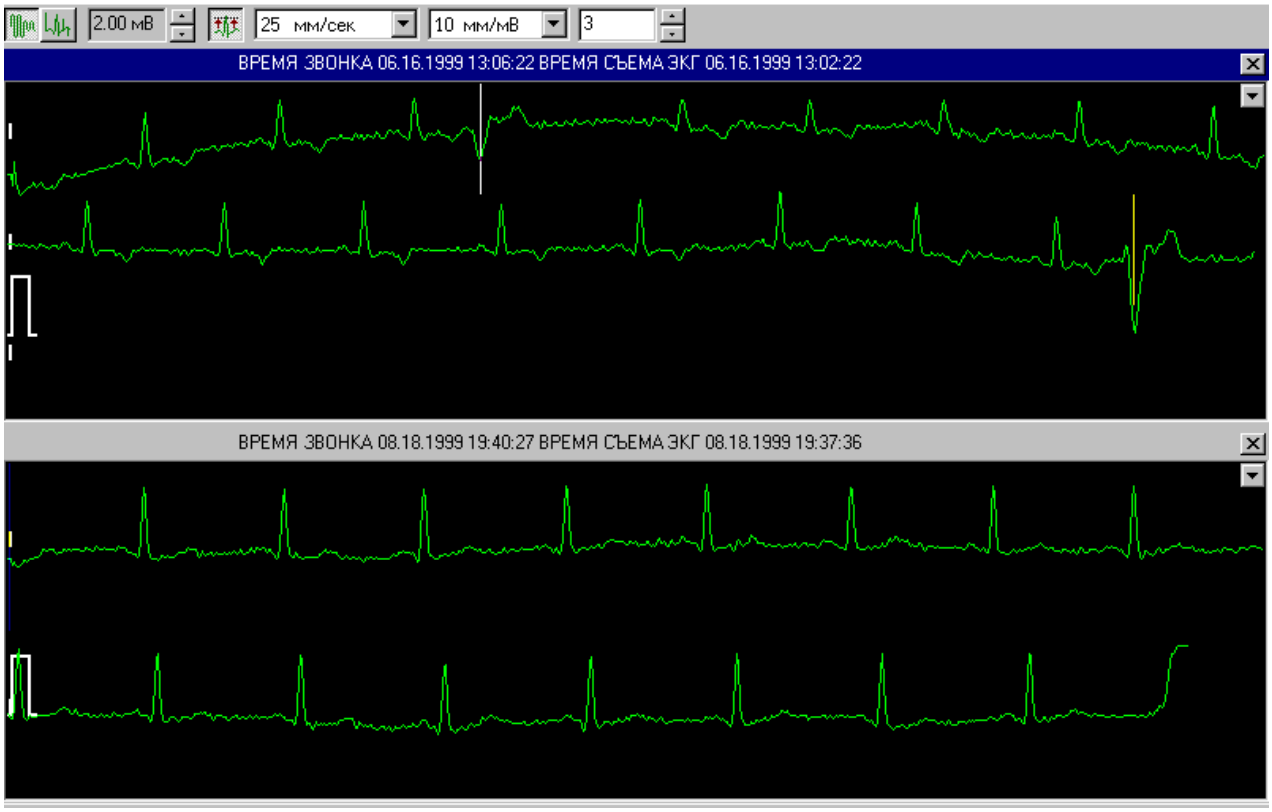
Type of ECG deviation	Number of ECG records
No dynamics as compared with the records during consultation or hospitalization	140
Superventricular arrhythmia	7
Ventricular arrhythmia	17
ST segment dynamics, T-wave alterations	1

The next clinical observation is offered as an illustration. Patient P., age 52, male, was admitted to the GULI with the diagnosis of ischemic cardiac disease: acute lower Q-waved myocardial infarction, heart failure f.c. IV (Killip), ventricular extrasystoles, postinfarction cardiosclerosis (lateral Q-waved myocardial infarctions in 1992 and 1995), f.c. IV chronic heart failure (NYHA). As a results of the treatment in clinic (pressor amines, beta-adrenoreceptor blocking agents, diuretics, ACE-inhibitors, anticoagulins and antiaggregants, hypolipidemic agents class of statines) the patient was stabilized and discharged in a satisfactory condition. On the day of discharge ECG did not evidence any extrasystole. The patient was given an ECG transmitter and instructed to send ECG records every other day. Some days later the patient complained of some discomfort in the heart area. The transmitted ECGs displayed frequent ventricular and supraventricular extrasystoles. The therapeutic course was supplemented with amiodaron. On days 3 and 4 extrasystoles noticeably reduced their number in ECG records and were not seen anymore the next week. The discomfort was also gone. At present, the patient's state is satisfactory; the chronic heart failure is f.c. III rather than IV (NYHA). The patient does not voice any complaints and regularly sends ECG records; no dynamics has been observed since.

Figure 5 – ECG of Patient P. Upper is recorded 16 July 1999 (ventricular extrasystoles marked), lower is recorded 18 August 1999. Patient identification data are erased.

Another case demonstrates the possibility to differentially diagnose genesis of a painful syndrome on the background of angina pectoris and extracardial chest pains. Patient D., 62, female. Supervised by the GULI cardiological clinic because of diagnosed ICD, postinfarction cardiosclerosis, angina pectoris, arterial hypertension II (ISN VI), insulin-dependant diabetes mellitus. Was repeatedly admitted to the clinic with the diagnosis of unstable angina pectoris. In addition to classic angina pectoris, the patient experienced pains in the cardiac region atypical for her disease (w/o distinct correlation with loading, sharpening or appearing during palpation of the left chest). ECG records in painful periods did not state any "ischemic" dynamics. Recently the patient was discharged from the hospital with a personal ECG transmitter. She regularly telephoned her ECG records. During one of the records against painful sensations the T-wave was found to be inverted in lead I and two-headed in CR_5. An orderly physician analyzed the ECG and advised nitroglycerin. Pains stopped by nitroglycerin, another ECG did not record the above alterations. The therapeutic course was supplemented by small doses of beta-adrenoreceptor blocking agents and preductal, the dosage of prolong-released nitrates was changed; within the next few days the patient improved and was not much bothered by pains. The patient is still regularly sending her ECG records.

Figure 6 – ECG of Patient P. Upper is recorded 24 August 1999, lower is recorded 11 July 1999. Patient identification data are erased. Pay attention for T wave form.



Discussion

Despite the obvious constraints caused by the limit of one ECG lead at a time, the system demonstrated quite good performance while some differences from its analogs can be successfully exploited in the situation of scanty financial resources. As for the quality of ECG reception, we may conclude that all the received ECG records were good enough to interpret. Among other things, this is probably due to the special ECG filtration efforts undertaken by GEOLINK-ELECTRONICS.

Considering the medical benefits from very short experience of operating the system, it can be concluded that even one-channel ECG provides information sufficient to draw diagnostic statements in an impressive number of cases, particularly of those associated with cardiac arrhythmia and abnormal conduction. With obvious constraints there is still a possibility for identification of "ischemic" changes in ECG; in fact, even rough ECG analysis (on the principle of "yes or no" changes comparing with the preceding record) appears to be very useful as it extends capabilities of the consulting cardiologist. Attachment of electrodes to the walls of the unit allows one-lead ECG recording without the need to take off clothes, and catch brief paroxysmal disorders in the absence of event recorder. It is out of question, that integration of an event recorder into the model rule of ECG transmitters could significantly expand fields of application of the system. ECG recorded by skillful personnel, e.g. at institutional health centers, it might be more appropriate and useful to procure a serial professional recorder.

The economic-social merits of these systems are a special subject. On both projects the patients were given medical services which they could not have had earlier or in some other ways – this is the key goodness of fit. It is important that the transmitting unit does not require the electric connection to telephone lines; therefore, many problems, certification in the first place, are resolved and manipulation is facilitated, especially under the condition of time shortage. Design of the system, as was confirmed by operation, allows indeed utilization of low quality phone lines (according to their users).

The positive feature of the ECG transmitters is easy handling. Instruction does not cause problems; as a rule, training and demonstration takes no more than 10 to 15 minutes. In due course, patients develop strong skills of manipulating the devices which considerably reduce the probability of misdoing.

Another big advantage is that besides the additional opportunity to communicate with the managing physician, a patient who has been lent an ECG transmitter acquires the method for objective assessment of his/her health favorable to the frame of mind. To date this problem has not been properly studied (according to the literary data); however, preliminary consideration of our own experience infer the wholesome effect of telephonic ECG monitoring on patient's psyche.

The structure of team work implemented in each of the projects led to minimal outlay on the personnel at the initial phase of operating the transtelephonic ECG monitoring systems as physicians and other medical personnel of the clinics were involved. The tradition to sign up full time personnel for receiving station makes expensive the early phase of operation with a small number of connections and much less calls than expected. Since ECG records can be received automatically, services of the personnel of hosting clinic can significantly minimize expenses.

Both projects are now in full swing. Clearly, the next step should be outfitting patients with multi-channel ECG transmitters and health centers with professional units when it is reasonable, e.g. "ischemic" ECG is expected.

It should be emphasized that establishment of the system for transtelephonic ECG monitoring is properly the outset of an active telemedicine network. Weighing moderate seed money, the piloting system is likely to be the choice for developing countries, and launching cardiological clinics in developed countries. In future, digitized ECGs can be passed on for further consultation to other medical institutions or more knowledgeable experts.

Acknowledgment

The authors express their gratitude to the personnel of the Geolink-Electronics company (Moscow, Russia) and personally to deputy director Mr A.I. Egorov for equipment and technical advice (our special thank goes to programmer Mr D.N. Mironov) on the use of soft- and hardware.

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JORDAN: Transtelephonic electro-cardiogram (ECG) transmission

Country information

Population: 5.7 million. Telephone density: 8.55%. The Ministry of Health in Jordan operates 23 major hospitals scattered randomly. These hospitals provide 2,673 beds for the entire population. The majority (55.5%) of these beds are present in Amman, Zarqa, Irbid and Salt, leaving many populated areas medically underserved. Hence, there exist geographical disparities of distribution of medical resources.

In addition to the above-mentioned hospitals, the Ministry of Health provides three kinds of medical services which lack tertiary care:

1. Comprehensive Medical Centres (30) equipped with basic medical equipment and staffed by qualified medical personnel
2. Primary Health Centres (313) equipped with basic medical equipment and staffed by residents (no ECG)
3. Secondary Health Centres (263) lack both basic medical equipment and staff

Introduction

The heart disease is the single most fatal disease of our society. It is responsible for more death than any other disease. In the USA, 45% of the total mortality rate is contributed to cardiac-related disease. Many of these deaths are the result of the time elapsed between the cardiac event and the medical assistance provided to the patient. It is estimated that 2-4% of the general population suffer from hearth disease. 10-12% of the general population is considered to have two or more heart disease risk factors which would ideally require periodical diagnostic or preventive medical treatments.

One of the leading factors in the diagnosis of a person's heart condition is his electro-cardiogram (ECG) data. The activity of the heart is regulated by electrical impulses which can be measured and presented, for diagnostic purposes, in the form of an ECG. To acquire a person's ECG, it is required to physically attach electrodes in designated positions on his body in order to pick up his electrical impulses. These impulses generate surface potentials that are transmitted to an electronic device which acquires the signal, amplified and filters it, to provide a visual, high-quality/low-noise signal adequate for medical diagnostic purposes. A full ECG can be obtained by utilizing a 12-lead (10 electrodes) ECG device. However, different devices with a small number of leads, ranging from 1-12, can also provide ECG signals which may be sufficient for certain diagnostic purposes.

Traditionally, ECG diagnostics were carried out at hospitals or clinics where the patient would be phusically attached to an ECG machine and the doctor would simultaneously diagnose his condition. In the past decade, with the development of advanced microprocessors, computing and transmission technologies, remote transmission and acquisition of ECG via the telephone became possible, presenting new possibilities for a wide range of applications ranging from home care to preventive diagnosis and emergency services.

A variety of trans-telephonic ECG acquisition and transmission products have been developed, all specifically designed for the above-mentioned applications. Generally, there are two types of cardiac services which have a clinically proven and commercially viable track record. One is the provision of *diagnostic services and professional counselling* to patients with suspected cardiac symptoms. The second is the provision of *emergency-type services*, primarily to patients with heart condition who would subscribe to a service centre for monitoring and emergency assistance. Both types of services are based on trans-telephonic transmission of ECG by the patient/subscriber to a computerized ECG receiving station at the service centre. Using the above-mentioned service centre infrastructure, additional services can be provided in related medical areas, such as blood pressure montoring, asthma control, fetal monitoring services, and even the combination of emergency/alert notification with medical services.

Purpose of the pilot project

The main goal of the project was the introduction of telemedicine services in Jordan starting with the trans-telephonic ECG transmission and to study how it works in a developing country's environment. This project was initiated in Jordan and presented to the First Telemedicine Symposium for developing countries, which took place in Portugal in 1997. The project raised great interest from representatives of many countries, upon which BDT established a working relation with the leaders of the project and other staff in order to obtain more information to be presented to developing countries and to provide advice and know-how in areas where it was required.

Heartbeat Jordan

A group of doctors and telecommunication specialists, together with two hospitals in Amman, set up a private company called Heartbeat Jordan. Its missions statement is tocombine highly trained medical providers with state-of-the-art telecommunication technologies and deliver quality health-care beyond all boundaries. A monitoring/receiving centre was set up. With the use of portable medical terminals/ transmitters, the vital medical data can be sent via any telephone line to the centre, where the ECGs can be analyzed by qualified specialists, evaluated and appropriate professional advice given.

Problems with unnecessary referrals

This is a common problem in many developing countries. Let us look at it from the point of view of cardiac-related diseases. Even though chest pain is the leaden physical complaint that may be symptomatic of heart disease or of disease of the lungs, other sources of chest pain may also be musculo-skeletal, gastro-intestinal or psychological. In fact, statistics and various studies indicate that over 60% of chest pain is non-cardiac in nature. Some of the studies subscribing to this fact are the following:

1. A study in Al-Salt Hospital done during the period October 1994-September 1995 showed that 159 patients out of 275 (57.8%) admitted to the Centre, were experiencing chest pains of a non-specific nature and hence unrelated to the heart.

2. This is further supported by a study completed at the Al-Bashir Hospital during the period October-December 1992 showing that 50% (60 patients) of daily emergency department admittances are patients suffering from non-specific chest pain. All these cases had originated from Ministry of Health clinics all over the country. Out of the 60 patients only 10% needed admission for further observation and treatment to the Centre. Hence 90% are being dismissed with chest pains of non-cardiac origin. The remaining cases that are in need to be admitted to the CCU are being delayed because of the unnecessary cardiac referrals crowding the already limited facilities and qualified medical specialists.

3. Another Al-Bashir study (1994) shows that only 30% of acute myocardial infarction patients are eligible for streptokinase therapy, mainly because they are admitted later than 6 hours from the on-set of the myocardial infarction.

Summarizing the Ministry of Health problems:

– unnecessary cardiac referrals due to inefficient screening.
– delay in treatment of critical cardiac patients due to the high occupancy rate of Ministry of Health hospitals.

These facts clearly indicate the necessity for a better screening method to try and decrese the number of false referrals, thus ensuring that the hospital beds are made available for patients in grave need. This can only be accomplished via two elementary factors:

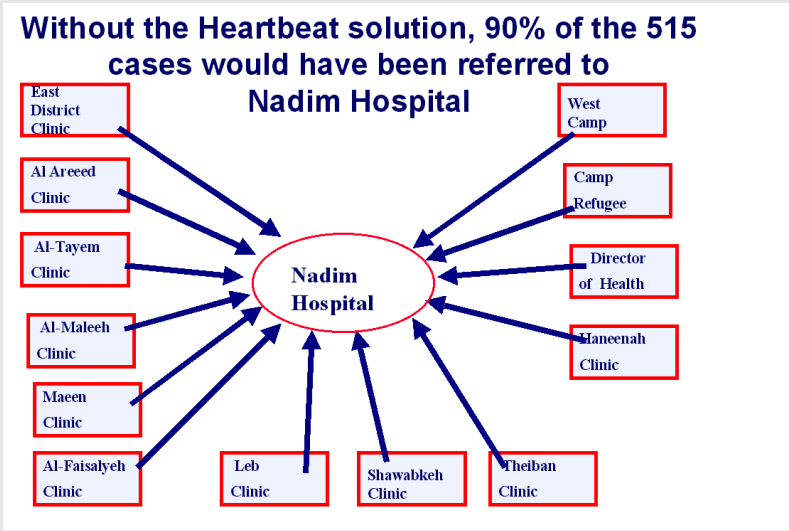
– basic medical equipment in all clinics;
– qualified medical personnel in all clinics.

The financial burden and the unfeasibility of implementing the above, leaves the Ministry in a dilemma. A tele-ECG service could be the solution.

The Mabada District pilot project

In March 1998, Heartbeat launched a three-month pilot project in cooperation with the Ministry of Health in the district of Mabada. The Governorate of Mabada was chosen for this experient because of its closeness to the capital Amman, and because of the high number of primary and secondary health-care centres within the governorate. Sixteen monitors were placed in the peripheral Ministry of Health clinics of Mabada. Heartbeat received 515 ECG calls in a period of almost four months for typical and atypical chest pain. The experiment began on 7 February 1998 and ended on 31 May of the same year.

The number of readings sent via telephone to Heartbeat" during this was 515 cases. The diagnosis of these cases was indicated in Table 1. Sixty-five per cent or 335 of the 515 ECG calls were non-pathological and hence non-cardiac in nature. They were treated (on the spot) at the clinics and either discharged or referred to the appropriate non-cardiac specialist. Without the Heartbeat solution, 90% of the 335 EcG patients would have been referred to Nadim Hospital to rule out cardiac complications which would have resulted in unnecessary cardiac referrals, crowding the already limited facilities and overloading the qualified medical specialists in Nadim Hospital.



Thirty five per cent or 180 of the 515 ECG calls were pathological and hence needed further cardiac consultation. Treatment was immediately initiated. The patients were referred to Madaba Nadim Hospital. Out of these 180 ECG calls, some of the significant results were as follows:

– 51 cases of stable angina;
– 19 cases of unstable angina;
– 14 cases of myocardial infarctions;
– 26 cases of tachycardia;
– 23 cases of bradychardia.

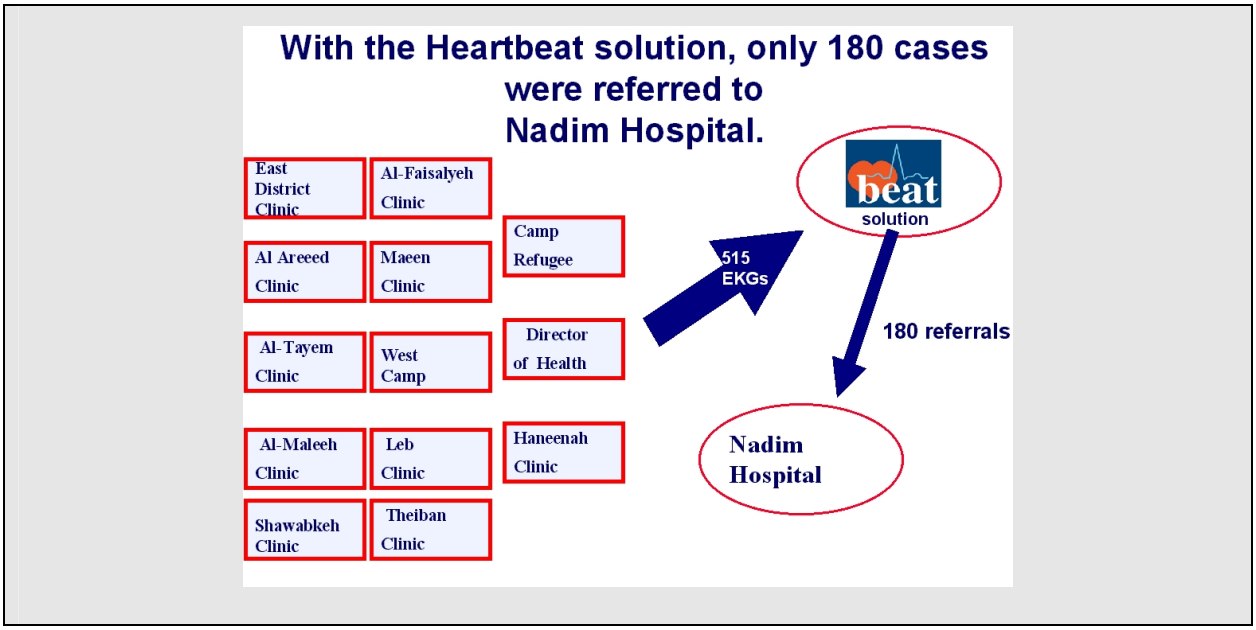
The Madaba Ministry of Health pilot project was able to prove beyond a doubt the effectiveness of tele-medicine in meeting the public health sector needs of developing countries by accomplishing the following:

– Offer better access to its population;
– Improve both the economic and clinical efficiency of the system.

– Raise the quality of its delivery system. Prompt diagnosis of cardiac problems in medically under-served areas and hence offering cardiac consultations by specialists via telephone;

– Early detection of cardiac disorders enabling the use of non-invasive medical techniques and hence reduced healthcare costs;

– Eliminate a minimum of 50% of unnecessary cardiac referrals, which will alleviate pressure on Ministry of Health specialists, hospitals and clinics, and hence reduced health-care costs.



Reiterating the public health sector's objection centers falsely on cost. Without the Heartbeat solution an additional 335 cases would have been referred to Nadim Hospital. These cases would have incurred the following for further cardiac evaluation: Specialist, X-ray, Laboratory, ECG and other miscellaneous charges would amount approx. to US$ 500 per referral:

– 335 cases × US$ 500 = US$ 167,500;

– In a period of THREE months;

– In just ONE district of the Ministry of Health.

Other cost reductions that are harder to calculate:

– rapid diagnosis which allows the patient the option of non-invasive treatment and hence reduced health-care costs. Essential in cases of myocardial infarction, when the first six hours are the most critical in administering the necessary medication to dissolve any clot and thus limit the damage to the cardiac muscle;

– burden of disease on society;

– the value of a life.

Heartbeat is looking forward to implementing its telemedical solution in all the Ministry of Health peripheral clinics.

Table 1 – Ministry of Health Madaba results

Findings	Feb. 98	Mar. 98	Apr. 98	May 98	Total
Angina (IHD)	28	15	6	2	51
Unstable Angina	10	5	4	0	19
Acute MI[4]	12	2	0	0	14
Sinus Tachy.	11	8	3	4	26
Bradychardia	13	5	1	4	23
RBBB	5	1	0	3	9
LBBB	0	3	0	3	6
IRBBB	0	0	1	0	1
C.H. Block	0	1	0	2	3
S.V.T.	1	0	0	0	1
VT or VF	0	0	0	0	0
WPWS	0	0	0	0	0
Atrial Flutter	0	1	0	0	1
Atrial Fibrilation	3	3	1	0	7
Digoxin Toxicity	0	0	0	0	0
H.B.	0	0	0	0	0
LVH	4	3	0	0	7
RVH	0	0	0	0	0
PVCs	7	3	1	1	12
Normal	123	110	58	44	335
Number of calls	217	160	75	63	515
% Pathological	43%	31%	23%	30%	35%
Measures taken					
Cardiac investigation	64	26	13	14	117
Follow-up	43	21	7	4	75
Refer to hospital	30	22	11	3	66
Reassurance (N.S.R.)	54	41	16	26	137
Advised treatment	18	19	9	3	49

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[4] Myocardial infarction.

MALTA: Telemedicine link between hospitals in Malta and Gozo[5]

Country information

Malta is an island nation with around 380 000 inhabitants situated close to Italy in the middle of the Mediterranean Sea. It is a highly developed country with levels of health and health services that are on par with those found in Western European countries and having an information and communication technology infrastructure that is among the most advanced in the region. In 1998, Malta hosted the World Telecommunication Development Conference (WTDC). In the run up to this Conference, the national telecommunications operator, Maltacom plc, encouraged the Government of Malta to consider undertaking a pilot project in the field of telemedicine.

A report that was drawn up in March 1997 looked at the potential benefits that telemedicine could have in the Maltese scenario:

Improvement in access to care: Classically this is one of telemedicine's greatest benefits. It was considered unlikely to be an important benefit in Malta in view of the small size of the mainland and the limited dependence of the Maltese health service on foreign health resources. However, it was considered relevant to the care provided to the inhabitants on the sister island of Gozo, a separate island a few kilometres north of mainland Malta with about 30 000 inhabitants.

Reduction in professional isolation: This was considered to be an area in which telemedicine would certainly be of benefit to Maltese health professionals, especially those on the island of Gozo.

Improvement in quality of care: This benefit of telemedicine was considered to have great relevance to both public and private health services in Malta, to be achieved through improved continuity of care and collaborative decision-making.

Reduction in costs: Telemedicine can reduce duplication of services and specialists and reduce the time and money spent on patient and provider travel. It was envisaged that this effect could be relevant both to the Malta/Gozo situation and to the Malta/abroad situation.

The objective of improved quality of care was already being strongly pursued in the existing Healthcare Information System, that was (and remains) effectively Malta's largest telemedicine project. This is a comprehensive telehealth network that includes all public hospitals and health centres in Malta and in Gozo and meets operational needs at both the clinical and the administrative levels.

On the other hand, there was relatively little activity in the area of improvement of access to care to Gozitan patients and that of reduction in professional isolation, especially for health professionals in Gozo. This fact led the Maltese Government to accept a proposal by the Development Bureau of the International Telecommunication Union (ITU/BDT) to set up a project establishing a telemedicine link between St. Luke's Hospital in Malta and Gozo General Hospital.

ITU/BDT requested Telia Swedtel to assist Maltacom plc and the health authorities in Malta to define, plan and implement a telemedicine system for Malta.

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[5] Dr Hugo Agius-Muscat, MD MSc, Director Health Information, Government of Malta.

Objectives

The Health Division of the Government of Malta articulated the following formal objectives for this telemedicine project:

– further enhancement of the health care system in Malta;

– reduction in costs;

– acquisition of experience and competence.

Description of the project

The heart of the project was the setting up of a real-time dedicated teleconferencing link between St. Luke's Hospital (SLH) in Malta and Gozo General Hospital (GGH) that would be available to clinicians at both the Gozo and Malta ends 24 hours a day, 7 days a week (see Figure 8).

Early on there was much discussion about the type of telemedicine modalities that were to be handled by the link. In fact, for some time, it was thought that a specific teleradiology link would be the most desirable modality. However, after initial interviews and discussions with staff at both SLH and GGH, the decision was taken to start off with a generic link that would allow clinical case discussions and/or interactive education and training. This would be achieved by using PC-based videoconference terminals that would allow video-conferencing of a "social" nature together with the grabbing of higher quality images using a high-end camcorder at the Gozo end. The link would allow physicians from different medical disciplines in Gozo to have peer to peer consultations with physicians at SLH in Malta.

It was decided that at the Gozo end the telemedicine terminal would be located in the Medical Library of the Gozo Hospital, that had an open area suitable for this purpose. At the Malta end, it was originally proposed to locate a terminal near the Accident and Emergency (Casualty) department. However, this was a busy area used by many different staff and it was advised that it might not be the best place to accommodate the terminal. Eventually it was decided to place the terminal in the Gamma Camera Unit at the Radiology Department, partly for security reasons.

Telecommunication link

Before the start of the project, both hospitals already had Local Area Networks (LAN's) with a 10 Mbit/s capacity that were linked through a 64 kbit/s digital leased line provided by Maltacom. This was used for the Patient Administration System functionality of the Healthcare Information System.

When the project was initiated, Maltacom worked to set up a 2 Mbit/s link between SLH and GGH that would provide not only a dedicated high speed data link for the telemedicine applications but also added capacity for the provision of Internet and e-mail access services through the Malta Government network.

The existing telecommunications network utilised digital transmission over copper wire from the hospital internal termination points to the nearest Maltacom exchange and between exchanges via fibre optic cable. The data communication link was established through a cross-connect exchange that could aggregate several data links ranging in speed from 2.4 kbit/s to 64 kbit/s.

Maltacom offered a data circuit with 2 Mbit/s capacity by utilising HDSL on copper wire. As has already been stated, within the hospital premises at St. Luke's and Gozo, LAN's at 10 Mbit/s capacity with central servers and routers had already been installed under the supervision of Malta Information Technology and Training Services Ltd (MITTS), the Malta Government's principal IT agency.

Technical details on video conferencing setup[6]

One of the main requirements of this pilot project was to utilise existing infrastructure as much as possible with a view of minimising the cost involved of using video conferencing equipment. Hence, due to the extensive coverage of the data network already in place on the Hospital campus network, it was felt that the video conferencing and image capturing devices would transfer their images over the existing data network. Within the hospital campus in Malta, data points running at 10 Mbit/s where quite widespread and so, connecting the PC based video conferencing unit was not a huge problem. The data rate between the Malta and Gozo hospitals decreased to 2 Mbit/s and hence, this part of the infrastructure was most vulnerable for congestion.

The video codecs required to transform the video signals from the PC-based cameras into a data transportable protocol were purchased from Picturetel. The video and audio signals were hence transformed into the H.323 standard that allows video and audio signals to be transported over a TCP/IP data network and also allows other types of workstations to be included as possible end stations. This would allow a truly multipoint video-conferencing setup. For this particular trial, two PC workstations were setup utilising the Picturetel codecs attached to a high resolution Sony camera at the Gozo end but keeping a standard Picturetel camera at the Malta end. A further enhancement to the system was also included by adding a pair of Intel capture cards which enabled static X-ray images to be digitised directly into a stored file rather than being captured via a screen dump from the Video Conference session window (the latter lower resolution picture would have been filtered through the video codec hence losing some of the clarity necessary for X-ray images).

The main issue that arose from the trials was that, at times, the moving image froze for short instances.This mainly happened because of the bursty nature of a data traffic profile which does not immediately transform well into a smoothly running video. Hence, some adjustments were made over the data network in order to set such parameters as prioiritisation and bandwidth reservation in order to minimise such ‘freeze-outs’. It is also envisaged that a further upgrade of the data networking equipment being used would help eliminate this problem. Finally, one could also add that by installing a single ISDN gateway on the data network, it would also be possible for all video conferencing stations on the health network to access other international sites.

Installation and putting into operation

The project was defined and initiated in November 1997. A project plan was prepared, and formed the basis of activities between January and March 1998 that culminated in the successful demonstration of the operational telemedicine link between GGH and SLH during the WTDC in Valletta on 24 March 1998.

By January, all equipment procurement had been approved and initiated. The sites where the telemedicine terminals were to be set up had been identified, and new LAN points had been put in place. By February, the new 2 Mbit/s link between SLH and GGH was in place, computer equipment and peripherals were in place, and identification and training of end-users at both ends had started. During March, trial runs were carried out and by the third week of March the link was in live operation. (Also see diagram – Figure 7.)[7]

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[6] Mr Mark A. Gialanze, MITTS, Malta.

[7] Mr Michael Mifsud, MITTS, Malta.

Doctors' opinions[8]

The doctors involved in running the telemedicine link between St. Luke's Hospital and Gozo General Hospital reported that the link was used for a number of peer to peer clinical discussions, in one case directly involving the patient. However, they agreed that the link was utilised far more for experimentation and research than for operational clinical reasons.

The number of formal clinical consultations that were carried out using the system was very small. Not more than ten real cases were discussed over the link. However, in the cases discussed there was clinically significant decision-making and the process contributed to the well-being of the patients.

The equipment performed well, however the performance was not "spectacular". At times there were irritating dropouts in transmission that interrupted the smooth flow of the discussion. The video quality though good enough for person-to-person ("social") contact was too poor for real-time transmission of clinical quality images from Gozo to Malta. This led to the use of the camcorder for video capture of a higher resolution image, followed by capture and forwarding using the white board application. This was time-consuming and had to be prepared well in advance of the actual consultation.

The digitisation of X-rays at the Gozo end was time-consuming. Each image had to be optimized, by masking off the parts of the X-ray viewer not covered by the X-ray film, in order to achieve good image quality. Zooming in on areas of interest at the Gozo end relied on the assumption that there was the expertise to identify all potentially abnormal parts of the film – something which only the radiologist at the Malta end could actually do.

Detailed non-radiological pictures, e.g. of skin lesions, were pre-recorded on video tape by the bedside prior to replay and frame grabbing.

The extra dimension which videoconferencing added to the usual telephone-based consultations between physicians at GGH and SLH was offset by the need for the Malta-side physician to leave his place of work, go to the Gamma Camera Unit (where the SLH telemedicine equipment is located) and operate the telemedicine terminal. It is for this reason that the consultations were actually carried with radiologists. In practice, fixing an appointment for a video link consultation proved to be time consuming. This difficulty was likely to persist until telemedicine workstations running videoconferencing software became available in several major clinical areas at SLH.

During the first year of the project, the head of the Gamma Camera Unit at St. Luke's Hospital left this position. This was a significant blow to the project as this physician had been one of its main champions.

The equipment at the Gozo end was not idle, and was used regularly by various hospital staff to carry out research not only on the telemedicine link but also through the other facilities provided through the same PC-based equipment, such as the Internet and e-mail access facilities. The video camcorder was also used to record interesting medical images from time to time.

The doctors at the Gozo end found it reassuring to know that the facilities existed and could be used if the clinical need arose. Eventually interest in their use may increase in the future.

Description of clinical cases discussed over the link

Congenital hypertrophic pyloric stenosis: Evaluation of barium studies. A conclusive diagnosis was reached with excellent patient outcome post-surgery.

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[8] Abstracted from reports by Dr Victor Mercieca and Dr Malcolm Crockford, Telemedicine Coordinators at GGH and SLH respectively.

Calcified cerebral arterio-venous malformation: CT brain scan images and angiographic images sent over the telemedicine link: arrangements for further imaging studies were made.

Osteomyelitis of rib: Transmission of X-ray images and live images of patient examination, patient directly interviewed over the link: arrangements for further imaging studies made.

Vesico-ureteric reflux: DMSA renal scan images and discussion.

Pericardial cyst: Transmission of X-ray and ultrasound pictures; reassurance of benign nature of the lesion and plans for follow-up.

Evaluation and sustainability

Evaluation of a project should be carried out strictly against the objectives set at the outset of the project.

The first objective was *to further enhance the quality of the healthcare system*. This was achieved, as physicians in Gozo now have added tools at their disposal, that they previously did not have, with which to exchange clinical data with peers in Malta. In the few cases when these tools were actually used, there were definite indications that the quality of patient care was improved.

The second objective was *to reduce costs*. This was not achieved, as the volume of use of the link never reached a level that would give tangible cost savings from reduced patient/provider time and travel. Only with greater usage would the less tangible savings resulting from improved patient care become measurable.

The third objective was to *acquire experience and competence*. This was certainly achieved! The clinicians and managers involved now have a much clearer idea of what a real-time telemedicine link involves and can give clearly focused opinions on the modalities that would be of greatest benefit to patients and their providers in the Malta/Gozo situation. The health authorities have also been sensitised to the relevant issues, especially regarding organization, human resourcing and financing.

The *sustainability* of the project was never in doubt. Unlike so many telemedicine demonstrations, which are set up merely to impress at conferences, this project was designed from the very outset to remain operational. The equipment is available for use 24 hours a day, 7 days a week. The significant recurrent expenditure involved in the 2 Mbit/s link between SLH and GGH was planned for and falls within the Health Division's ongoing commitment to the provision of a high capacity wide-area-network between all of Malta's public hospitals.

Obviously, it is disappointing that the link was seldom used. With the benefit of hindsight, it is useful to revisit some of the assumptions made during the project planning phase:

1. In the March 1997 report on the feasibility of telemedicine projects in Malta, it was stated that if the emphasis of a telemedicine link between St. Luke's Hospital and Gozo General Hospital was to be on improved access to care, then this should be located in the respective Casualty departments. In practice, mainly for security and "ownership" reasons, the Malta-side terminal was located in the Gamma Camera Unit of the Radiology Department. Ownership of the project on the Malta side by acute care clinicians, as opposed to radiologists, may well depend on succeeding to set up a terminal at SLH Casualty.

2. In the March 1997 report, it was also stated that if the main aim of the telemedicine link was the reduction of professional isolation, then the Malta side should be located in the Medical School, and University collaboration would be a *sine qua non*. Early in the project, one of the partners recommended that the University was not to be involved. Now it is clear that if it had been involved, things may have evolved differently. In fact, the most likely future development of the Gozo/Malta

link is in the modality of tele-education. The Institute of Health Care (IHC), part of the University of Malta, is responsible for the training of nurses and other paramedicals. The IHC is developing its own telemedicine capability and is now seeking to link up with the capability developed by the Health Division in order to provide distance learning to nurses and other health professionals in Gozo. Videoconferencing and image/data transfer will take place between lecture rooms at the IHC and the Medical Library at GGH.

Health professionals at both the Malta and Gozo ends perceive this to be an important opportunity, possibly even more relevant than the clinical application, and one which could eventually be extended to include the Medical School, where the clinical training of physicians is based. There is potential for the system to be used for post-graduate and continuing medical education for GGH staff. Certain lectures held at the Main Conference Hall of the Medical School could be made available over the link.

3. During planning, it was decided that a generic teleconferencing link may be more useful than a specific teleradiology link. Although this decision was probably sound, the fact that in practice the link was mainly used for the discussion of X-ray images, and that this was laborious and time-consuming, suggests that the procurement of equipment that is more specific for the capture, storage and forwarding of X-ray images may be a useful next step to enhance the clinical value of the link.

Partners

The project was led by the Director of the Department of Health Information of the Government of Malta.

Health Division, Government of Malta

The Health Division financed the investment cost for the telemedicine system, including associated software. The planning, purchase and implementation of the telemedicine system was the its responsibility, although it was assisted in various aspects by Swedtel, MITTS and Maltacom. It ensured approval for the procurement and financing of the system components and prepared premises for telemedicine workstations at both St. Luke's Hospital and Gozo General Hospital. The Hospitals assigned the telemedecine coordinators that were responsible for the terminal equipment, premises and evaluation of the project.

Telia Swedtel

Telia provided expert assistance from November 1997 to March 1998, at its own expense. Telia Swedtel supported this project by assigning expertise for studying the feasibility, determining standards and specifications for a system and assisting in the overall planning and implementation of the telemedicine pilot project.

Malta Information Technology and Training Services Ltd (MITTS)

MITTS assisted in the purchase and implementation of the system components. MITTS also took care of the installation of all supplementary equipment required for the existing LAN's at SLH and GGH.

Maltacom plc

Maltacom set up the external 2 Mbit/s link that is used for the data and video conferences between SLH and GGH. Maltacom was responsible for the arrangements necessary to demonstrate the telemedicine link at the WTDC in March 1998, including the installation of the terminal equipment at the Mediterranean Conference Centre (MCC) and SLH and the transmission facilities between the MCC and SLH.

International Telecommunication Union (ITU)

The ITU, through the BDT, provided overall project coordination with all partners and authorities. ITU maintained regular contact with the Project Leader after the launch of the project in order to evaluate the progress of the project.

Cost

The capital cost of the operational system telemedicine equipment was borne by the Health Division. This is estimated to have been in the region of US$ 17,000. The recurrent cost of the operational 2 Mbit/s link provided by Maltacom is in the region of US$ 7,500 p.a. The human resource involved, especially on the part of the Department of Health Information and the medical consultants, was not costed.

The exact costs incurred by ITU, Telia Swedtel and Maltacom specifically in the setting up of the Malta/Gozo link were not known to the Project Leader.

Conclusion

The SLH/GGH Telemedicine Link is a relatively successful ongoing example of the use of information and communication technology to enhance the quality of health care delivered between two geographically separate sites. Optimization of the organization and equipment involved in the link would increase the utilisation and hence cost-effectiveness of the link, which at present are low. The design of the system is highly resilient, in that telemedicine terminals can be located anywhere on the respective hospital LAN's. In fact, in the near future, through partnership between the University of Malta and the Health Division, a tele-education initiative will be launched based on the same technical infrastructure set up for the Malta/Gozo telemedicine project. There is no doubt that the project that led to the setting up of the Malta/Gozo link was a significant step in the development of Malta's health telematics services.

Acknowledgements

I take this opportunity to thank the following individuals who made an important contribution to the development of the telemedicine link between Malta and Gozo (in alphabetical order): Prof. Leonid Androuchko, Dr Malcolm Crockford, Mr Mark Gialanze, Mr Anders Hulterstrom, Mr Per Olof Jansson, Dr Victor Mercieca, Eng. Charles Mifsud, Eng. Reuben Muscat, Mr Silas Olsson, Dr Joseph M. Pace, Dr Anthony Samuel.

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Figure 7

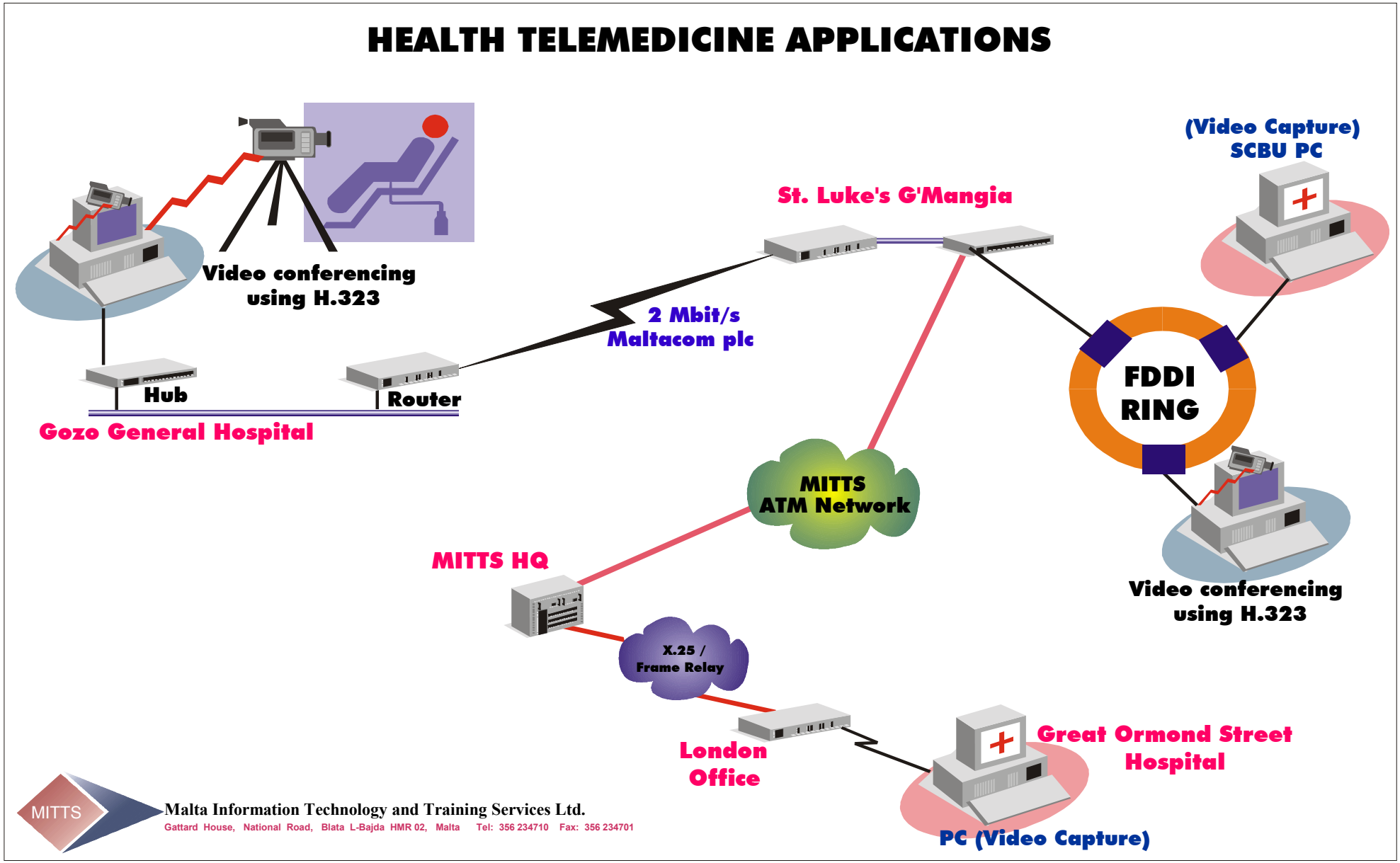
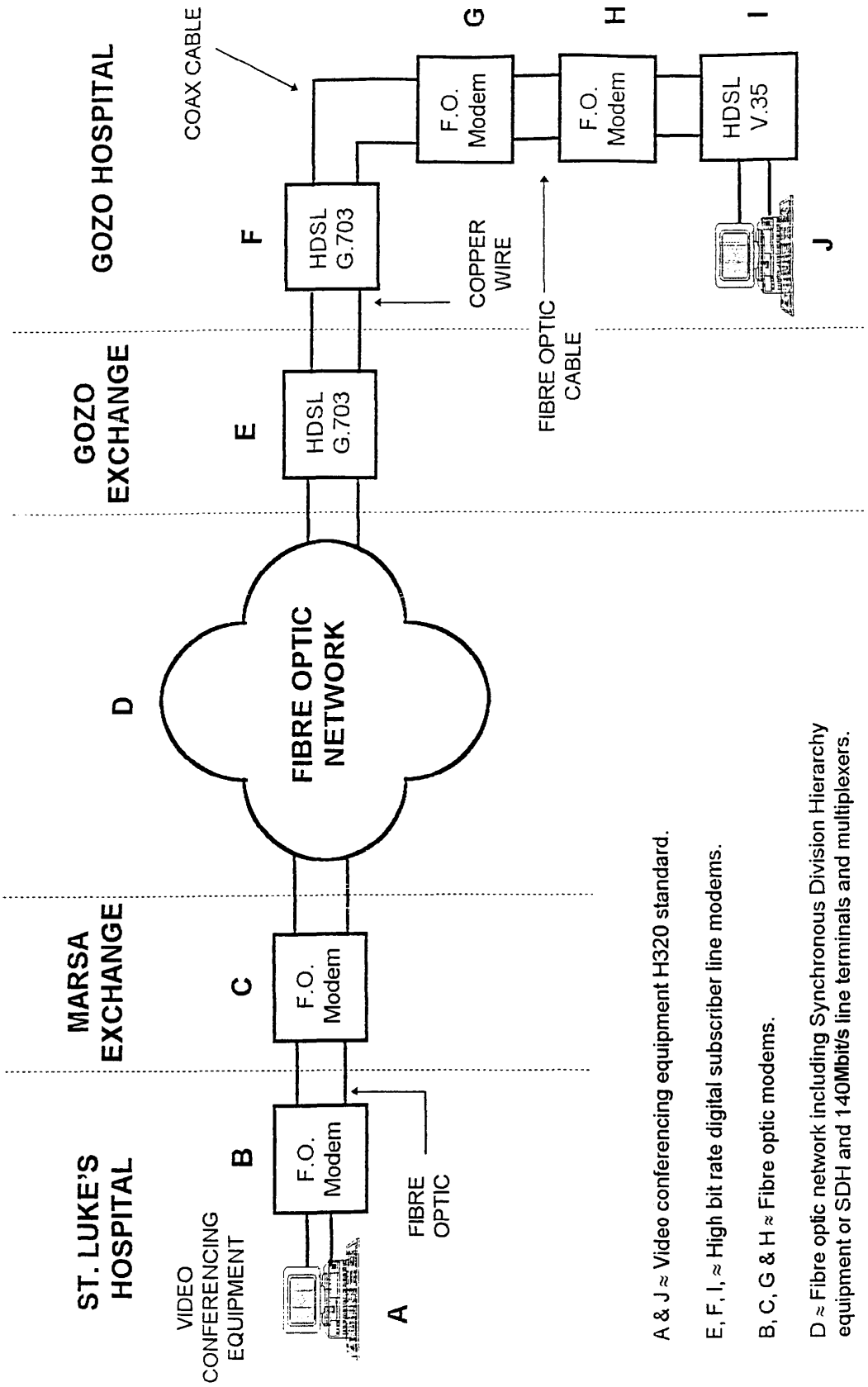

HEALTH TELEMEDICINE APPLICATIONS
Video conferencing using H.323
Hub
Router
Gozo General Hospital
2 Mbit/s
Maltacom plc
St. Luke's G'Mangia
(Video Capture)
SCBU PC
FDDI RING
Video conferencing using H.323
MITTS ATM Network
MITTS HQ
X.25 / Frame Relay
London Office
Great Ormond Street Hospital
PC (Video Capture)
MITTS
Malta Information Technology and Training Services Ltd.
Gattard House, National Road, Blata L-Bajda HMR 02, Malta Tel: 356 234710 Fax: 356 234701

Figure 8



A & J ≈ Video conferencing equipment H320 standard.

E, F, I, ≈ High bit rate digital subscriber line modems.

B, C, G & H ≈ Fibre optic modems.

D ≈ Fibre optic network including Synchronous Division Hierarchy equipment or SDH and 140Mbit/s line terminals and multiplexers.

MOZAMBIQUE: Teleradiology link between two hospitals

Country information

Population: 18 265 million. Telephone density: 0.4%. Capital: Maputo (1 132 000 inhabitants). Second largest city: Beira (350 000 inhabitants).

Introduction

As a result of a BDT telemedicine mission, this project was identified after seeing the situation in the health-care system in Mozambique and discussing it with local health and telecommunication authorities.

Objectives

Two central hospitals, one in Maputo and one in Beira were connected by a telemedicine link using the existing telecommunication infrastructure. Terrestrial and satellite links were used. The link is a dual purpose one for teleradiology and teleconsulting.

Description of the project

The project used standard low-cost teleradiology equipment which is based on two conventional PCs (e.g. Pentium MMX200) equipped with a radiological film digitizer (CobraScan CX-612T) and the appropriate software and telecommunication interfaces. The system conforms to the guidelines stipulated by the American College of Radiology concerning image quality. Radiological images are digitized in less than 30 seconds in up to 4 096 gray-levels with up to 300 pixels per inch. The digitizer also functions as a light-box which allows easy comparison of the original and the digitized image before sending it. Images are compressed automatically without any loss of information at a factor ranging from 1.5 to three. A special tool permits erasure of all names on the image in order to guarantee partial or full anonymity. Appropriate demographic or other kinds of information can be added to the image. It is then sent by dial-up telephone lines using digital transmission by means of a modem (up to 56 kbit/s). The link between Maputo and Beira uses digital microwave transmission between Maputo and Boane, and from Boane to Beira the signal is picked up by Intelsat VI 63° (see Figure 9). In April and May 1997, Telecomunicações de Mozambique, the main telecommunication operator in Mozambique and one of the partners in this project, ran tests of the transmission system between these two hospitals. The results were satisfactory.

The teleradiology software, designed by WDS Technologies (Switzerland) and tested at the University Hospiotal of Geneva, provides support for the exchange of images and for the visualisation software. It was designed taking into consideration the years of study done. The user interface is state-of-the-art but nevertheless remains simple and can be used by any technician or doctor familiar with the widely-known Windows 95/NT operating systems after a short introduction time. The software permits selection and manipulation of several images (interactive zoom, self-adjusting magnifier, inversion, etc.). In order to increase the usability and efficiency of the system, a small desktop scanner is attached which permits scanning of any paper document, which can then be transmitted as well. A CD-ROM drive will allow loading of additional software, such as teaching files or case studies, or storing of collections of images in order to build a small archive of interesting cases. The monitor is a 21 inch colour screen of high quality.

Since the telemedicine workstation is based on off-the-shelf hardware, the maintenance of it (except the film digitizer) can be done locally.

Implementation

On 30 January 1998, the Prime Minister of Mozambique, Mr Pascoal Mocumbi, inaugurated the country's first telemedicine link. "Telemedicine will end the isolation which has, until now, existed between health professionals in the country", the Prime Minister told participants who witnessed the historical launch of one of Africa's first pilot projects in telemedicine. "I urge all participants in this project, in particular the Empresa Nacional de Telecomunicações de Moçambique, to continue their efforts in finding innovative applications to telecommunications for the benefit of the entire society", he added.

The project has been carried out under the leadership of BDT/ITU by a multidisciplinary group of partners, including medical and telecommunication authorities, notably the Empresa Nacional de Telecomunicações de Moçambique (TDM – the country's main telecommunication operator), the hospitals in Maputo and Beira and a telemedicine equipment vendor (WDS Technologies of Switzerland).

Telemedicine experience

The teleradiology link has in operation since January 1998. In general, doctors from the two hospitals in Maputo and Beira have expressed their strong feeling that the system is useful and that they would like it to be upgraded in order to extend the range of telemedicine services. There is a need for telepathology and teledermatology.

Every month several files are received from the hospital in Beira. As a rule a file consists of the patient's history, the radiographs and laboratory tests. The doctors discuss the diagnosis and treatment. In the majority of cases the transmission speed is only 9.6 kbit/s, which is 15 minutes and rather long. High speed was possible only in a few cases. With the introduction of ISDN, this problem will have been solved.

The telemedicine link was also used for teleconsultation in such specialities as internal medicine, neurosurgery and orthopaedics. Unfortunately, the teleradiology link was not used as frequently as it could have been. There are several reasons behind this. First of all, many doctors in both hospitals are still unaware of the potential benefits of telemedicine for the patients and themselves. Secondly, not enough training has been done on how to use the telemedicine link.

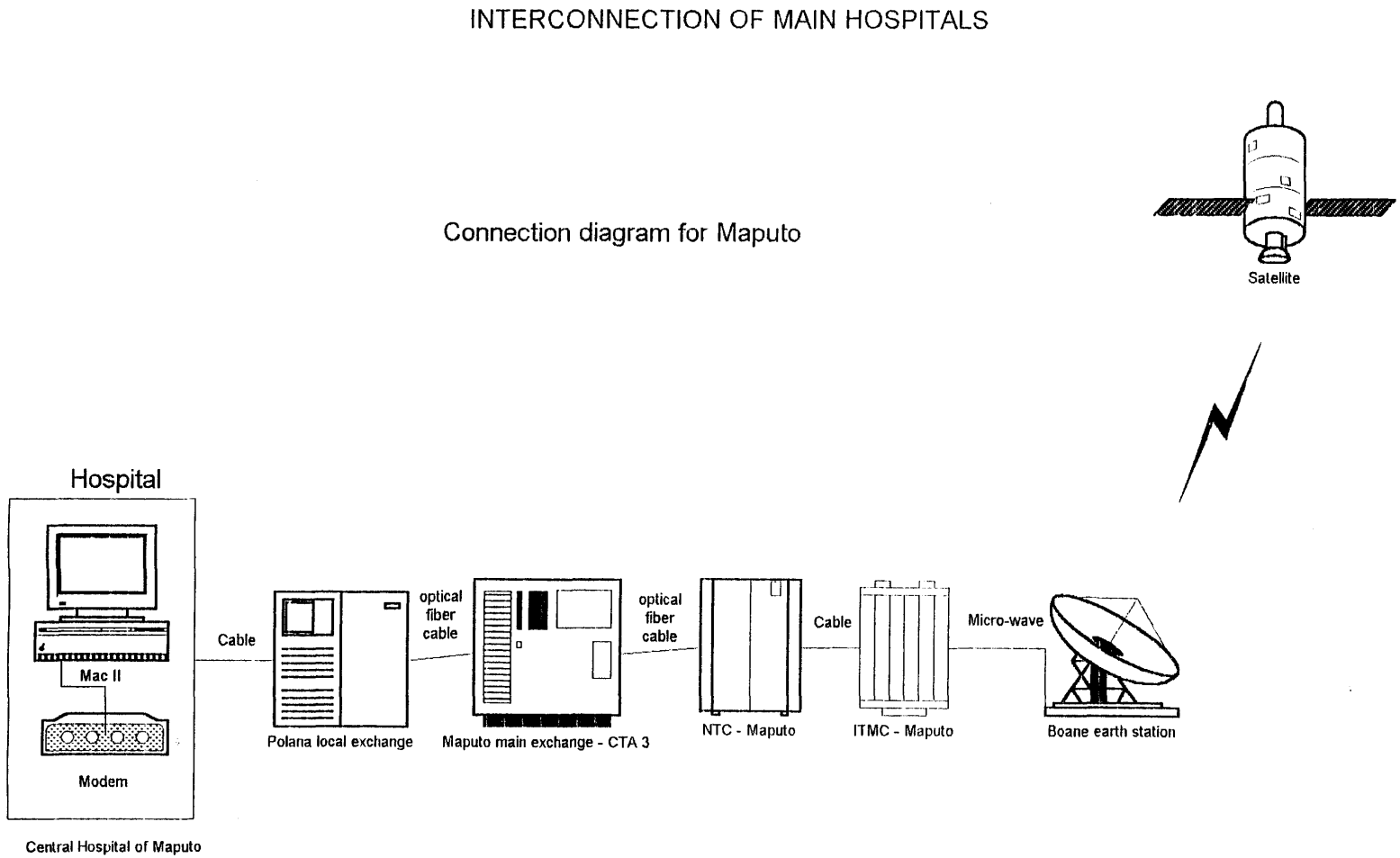
Maintenance of the system is very important for reliable communication. The technical staff of the hospital needs good support from the TDM specialists.

Conclusion

The teleradiology link between the two hospitals is beneficial for clinical and educational purposes, and – more generally – for a spirit of collaboration and exchange between the medical institutions. Doctors are now able to discuss cases that require high-level interpretation and obtain a second or third opinion. It is possible to send images and other medical information in advance from one site to another in order to check if it is necessary to transfer a patient.

For a more extensive use of telemedicine in Mozambique, it is essential to organize training seminars in which can be shown the benefit of health-care delivery to the population. The Medical School would be the appropriate place to undertake this.

Figure 9 – Telemedecine Project for Mozambique



MOZAMBIQUE: Phase II – Extention to Nampula and upgrading to ISDN connection

Introduction

BDT received a request from the Prime Minister of Mozambique for an extension of the teleradiology link to Nampula, Mozambique's third largest city. The Empresa Nacional de Telecomunicações has agreed to contribute part of its 1999 investment budget to this second phase of the telemedicine project in Mozambique.

Objective

Based on the experience gained from the operation of the first teleradiology link connecting two hospitals in Mozambique and taking into account the availability of ISDN lines by the end of 1999, three main referral hospitals (Maputo, Beira and Nampula) will be linked in one telemedicine network in 2001. The transmission made via ISDN give superior image quality. The Medical School of the University in Maputo will also be included in this network. These four important medical institutions will establish the backbone telemedicine network of Mozambique (see Figure 10). This network will be the core for the national medical information network connecting in due course all hospitals of the Ministry of Health in one net.

Project requirements

- The telemedicine network will consist of three cities: Maputo, Beira and Nampula, as well as the Faculty of Medicine in Maputo.
- All three hospitals should be linked for telemedicine services. A digitizer for image transmission should be available in all hospitals.
- Videoconference facilities should be added depending on the availability of ISDN.
- The software should be able to support teleradiology, videoconference sessions and teledermatology. Telepathology should be studied separately as an option, if the budget permits it.
- The telemedicine workstation should be able to work using Internet protocol.

Partners

In accordance with BDT's strategy to implement any telemedicine project on a partnership basis, a list of partners and their role and contribution is presented.

- *Telecommunication Development Bureau (BDT) of ITU*
  - Coordination with all partners.
  - Financial support to the project.
  - Telemedicine expert service.
  - Participation in the evaluation and monitoring of the work of the system during the pilot period (one year).

- *Ministry of Health, including three hospitals*
  - Administrative support of the project, nomination of the project manager.
  - Coordination of all medical aspects.
  - Preparation of the instructions to the hospitals on how to use the telemedicine connection efficiently.
  - Identification of additional appropriate telemedicine applications according to the local needs and environment.
  - Custom clearance of all equipment for the project.
- *Faculty of Medicine*
  - Participation in the installation of the telemedicine workstations.
  - Introduction of a telemedicine training course for students.
  - Preparation of the training and information material to be delivered to the hospitals via the telemedicine connection.
  - Coordination with the Ministry of Health on how the telemedicine connection could be used for medical training.
- *Telecomunicações de Moçambique (TDM)*
  - Participation in the project engineering.
  - Participation in the installation of the telemedicine network.
  - Maintenance support of the telemedicine network during the pilot period.
  - Financial support to the project.

Present status

The telemedicine mission to clarify the configuration of the project was implemented in June 1999. The project document has been drafted and circulated among potential partners. Mobilization of resources is under way.

Contact person

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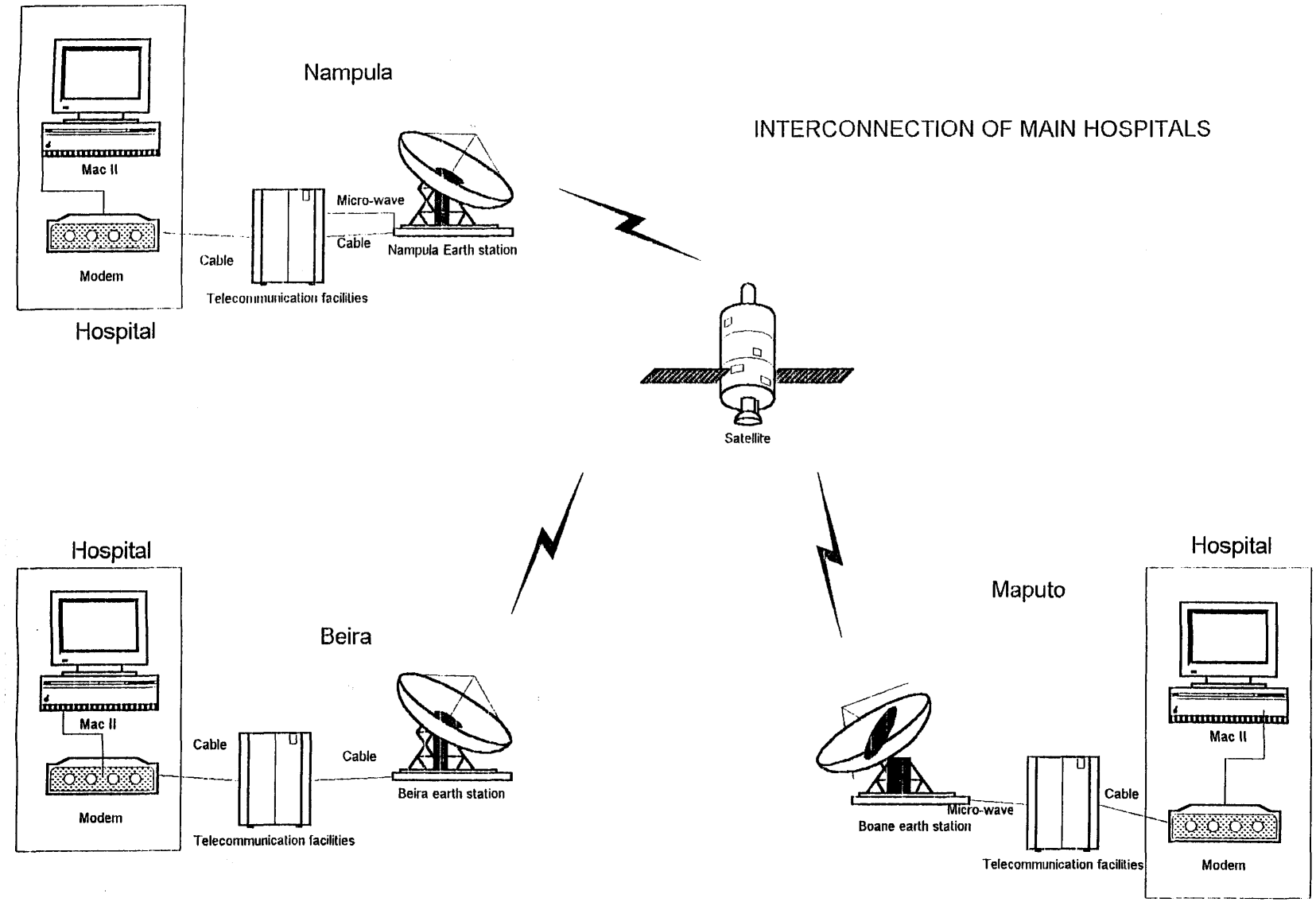
Figure 10 – Telemedecine Project for Mozambique



MYANMAR: Medical information/communication system for the General Hospital in Yangon and a teleradiology link between this hospital and the University Medical School

Country information

Population: 46.4 million. Telephone density: 0.46%.

Introduction

The Yangon General Hospital was founded in 1898 and is the largest hospital in Myanmar (14 ha) with 1 500 beds. The medical staff consists of 200 doctors and 400 nurses. The hospital receives 20 000 in-patients and 47 000 out-patients per year. The telephone system consisted of 10 outside lines, one crossbar exchange (dating from 1960) and 100 terminals. This system was very noisy because of the age of the PBX and the decayed cable, and was unsuitable for use by the staff. Therefore, it was hard to contact doctors in case of an emergency, and it was difficult to make contact among medical and administrative staff. It was also impossible to advise doctors who called from other hospitals outside Yangon.

Objectives

The first objective of this project was to install a new digital telephone system in the Yangon General Hospital, which will improve the communication between doctors and other medical staff within the hospital, and provide the basis for the hospital's medical information system. The second objective is to connect the hospital and the University Medical School by a modern teleradiology link which will be used for image transfer and teleconsultation. This teleradiology link will also be used for the training of students on new medical technologies.

Partners

In accordance with the BDT strategy to implement any telemedicine project on a partnership basis, a list of partners was prepared to clearly define their role and contribution:

- *Telecommunication Development Bureau (BDT) of ITU:*
  - Coordination with all partners and relevant local authorities.
  - Telemedicine expert service.
  - Financial support (partly).
  - Participation in the evaluation and monitoring of the work of the system during the pilot period.

- *BHN Association, together with NEC, NTTI and Coronet (Japan)*
  - Identification of the configuration of the information system.
  - Participation in the project engineering.
  - Financial support.
  - Provision and installation of a medical information system.
  - Training of local doctors and other staff on the use of the system.
  - Participation in the evaluation and monitoring of the work of the system during the trial period.
  - Coordination with the other partners from Japan.

- *Ministry of Communications, Posts and Telegraphs (Myanmar)*
  - Participation in the project engineering.
  - Participation in the installation of the system.

- Participation in the training course for doctors and other staff on the use and maintenance of the medical information system.
- in the training course for doctors and other staff on the use and maintenance of the medical information system.
- Other local support.

Ministry of Health (Myanmar)

- Identification of appropriate telemedicine application.
- Administrative support of the project.
- coordination of all medical aspects.

- *Yangon General Hospital (Myanmar)*
  - Identification of the appropriate configuration of the information system to meet medical applications.
  - Coordination of all medical aspects concerning the applications of the information system.
  - Administrative and logistic support in Myanmar (local transport, storage of equipment/material, etc.).
  - Custom clearance of all equipment for this project.

Implementation

The installation of the digital telephone system was completed in April 1998. The inauguration ceremony took place in 24 April in the Yangon General Hospital. The Deputy Minister of Health, Dr Mya Oo, congratulated BDT and BHN Association for the initiative to promote telemedicine services in developing countries. The WHO representative in Myanmar, Dr Klaus Wagner, expressed his great satisfaction with the results of the multidisciplinary cooperation and he thanked BDT for the leadership in the field of telemedicine for developing countries. The General Hospital in Yangon received a new digital telephone system which is the basis for the introduction of any telemedicine service.

The telemedicine workstations for the teleradiology link were delivered in Myanmar in May 1999. Both workstations have been installed in the University Medical School. In July 1999 BDT provided expert service for the installation and operational test of the teleradiology link. The General Hospital has not yet been connected to the Medical School due to some technical problems with the transmission lines between these two destinations.

Comments

The telecommunication infrastructure in Myanmar, unfortunately, does not allow easy implementation of telemedicine. In Yangon, the capital, only one TMX-100 X-bar exchange exists. The Yangon General Hospital is situated in this X-bar exchange area. Both the Ministry of Health and the Ministry of Communication, Posts and Telegraphs are responsible for this project. The Myanmar Director General of Posts and Telecommunications is the liaison with ITU activities.

Contact persons

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SENEGAL: Telemedicine network

Country information

Population: 8.762 million. Telephone density: 1.55%.

Introduction

This project was initiated by Sonatel, the main telecommunication operator in Senegal. Sonatel is also providing financial support to the project by making a cash contribution. The Ministry of Health has already provided offices in hospitals and specific medical equipment. As a result of BDT's telemedicine mission, the configuration of the project was identified. All medical applications were coordinated with the Ministry of Health. In line with their needs, three hospitals in three different cities will be connected to one telemedicine network.

Objectives

The main objective is the potential improvement of the treatment of patients by using distant telemedicine consultation and thus obtain better access to medical expertise and knowledge. For example, a radiologist is working in the hospital of Dakar Fann. No such specialist is available in the two other cities (St. Louis and Diourbel). The telemedicine network connecting the three hospitals will allow to provide distance consultation and reduce travelling.

Description of the project

As a result of this project the three hospitals in three different cities, namely Dakar Fann, St. Louis and Diourbel, will be connected to each other by telemedicine links allowing transmission of medical images and other medical information. The "Store and Forward" method for transmission of patient data will be used, and it will be possible to have video-conferencing facilities as well. The project will be implemented in phases according to the availability of financial resources. The present condition of the telecommunication network in Senegal will allow to connect all three hospitals by ISDN lines (see Figure 11).

Partners

- *Telecommunication Development Bureau (BDT) of ITU:*
  - Coordination with all partners and relevant local authorities.
  - Telemedicine expert service for identification of the configuration of the telemedicine network.
  - Partial financial support (in cash or in kind).
  - Participation in the evaluation and monitoring of the work of the telemedicine network during the pilot period (six months).
- *SONATEL (Société nationale des télécommunications du Sénégal)*
  - Coordination with local partners.
  - Participation in the project engineering.
  - Partial financial support to the project (in cash or in kind).
  - Participation in the project implementation.
  - Provision of the ISDN transmission line between three hospitals.
  - Provision of maintenance support to all three hospitals for the telemedicine network and telemedicine terminal equipment.
  - Participation in the evaluation and monitoring of the telemedicine network.

- *IDRC (International Development Research Centre)*
  - Partial financial support to the project (in cash).
  - Participation in the project implementation.
  - Participation in the evaluation and monitoring of the telemedicine network.

- *Ministry of Health of Senegal*
  - Selection of hospitals for the telemedicine network.
  - Selection of the telemedicine application according to the needs.
  - Future financial support to the telemedicine network in Senegal after the first phase.
  - Participation in the evaluation and monitoring of the telemedicine network.

- *University Hospital in Dakar-Fann*
  - Coordination of all medical aspects of the project.
  - Participation in the selection of the telemedicine applications.
  - Financial support (in kind).
  - Participation in the implementation of the project.
  - Participation in the evaluation and monitoring of the work of the telemedicine network.
  - Based on the results achieved, make a proposal, together with SONATEL, for a further extension of the telemedicine network in Senegal.

Present status

The implementation of this project is planned for March 2001. As a first phase, two hospitals (in Dakar Fann and Diourbel) will be connected.

Contact persons

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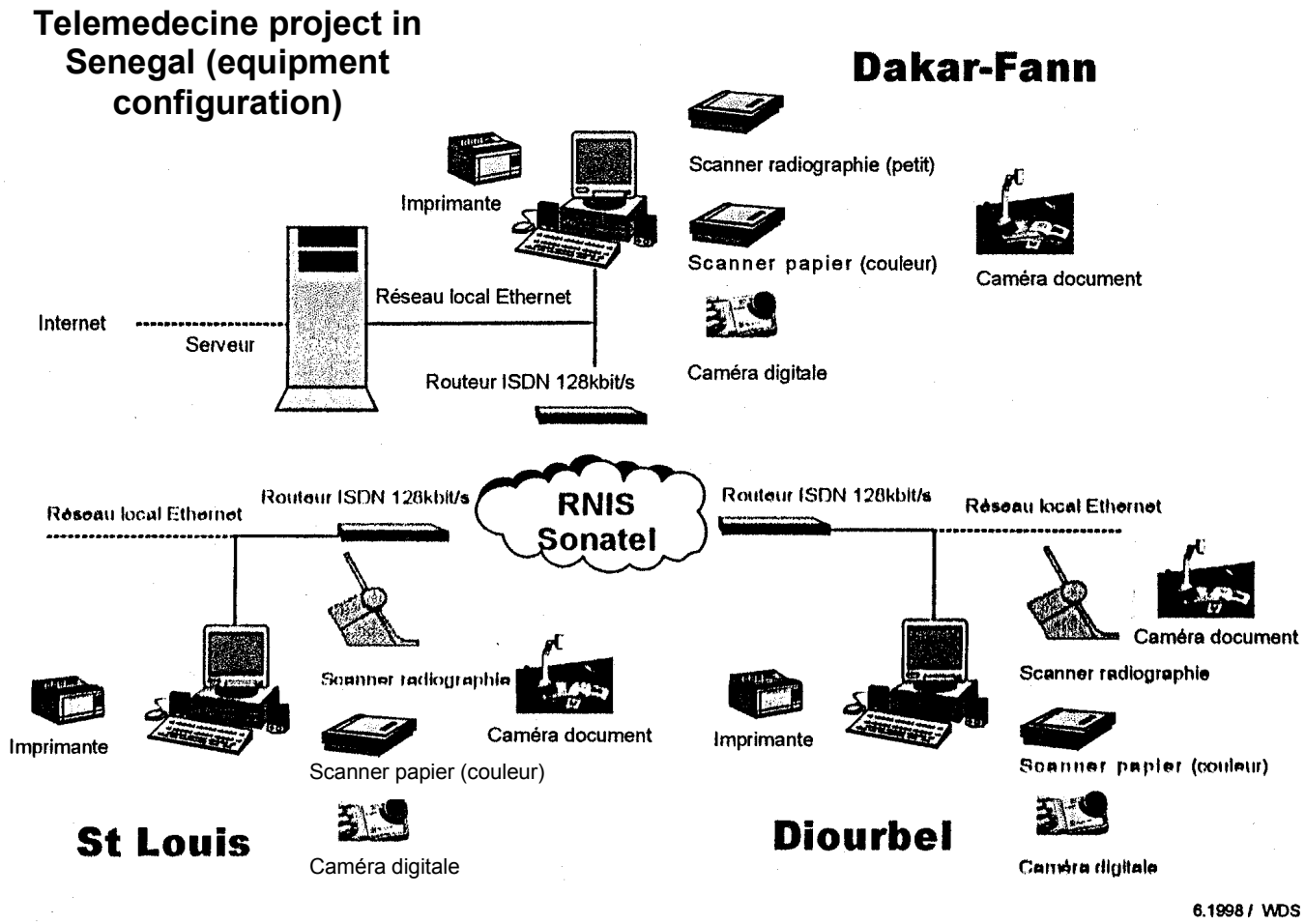
Figure 11 – Practical configuration for the telemedecine project



UGANDA: Telemedicine network between Mengo and Mulago hospitals in Kampala

Country information

Uganda is a land-locked country on the northern shore of Lake Victoria in the East-African region. The equator runs through the country, which is bordered by Sudan, Kenya, Tanzania, Rwanda and the Democratic Republic of Congo. The population is 21 million, of which almost 88.7% rural and 11.3% urban. The telephone density is 0.28%.

Introduction

Government, NGOs and the private sector provide health services in Uganda. Public health expenditure is US$ 4 per person. The health services are heavily burdened by preventable public health disorders. 49% of all out-patients attendance at health units are attributed to poor sanitation-related diseases. The maternal mortality rate is very high ranging from 500 to 2 000 deaths per 100 000 live births. The national average is 506 per 100 000 live births. The infant mortality rate is 97 per 1 000 live births.

As a result of the above, the Ministry of Health in its Health Policy Document puts forward a plan for strengthening health services at the lower primary levels of the health-care system. The health-care system is structured according to three broad classifications of primary, secondary and tertiary care. The lowest level of care is the primary care offered at sub-health centres (units) and health centres at parish and sub-county levels. Within this strata are rural hospitals.

Under the secondary care category are the referral hospitals at district and regional levels. There is an attempt to distribute specialists and support equipment in the four main fields of surgery, paediatrics, obstetrics and gyneacology and internal medicine to the referral level hospitals, but this has not been possible. Many regional referral hospitals have only one or two specialists. Sub-specialists such as psychiatrists, anaesthetists, ENT specialists, ophthalmologists, etc. are even more difficult to find in the up-country stations.

At the apex of the structure are the two national referral hospitals of Butabika and Mulago. Mulago Hospital is the national referral and teaching hospital. It provides specialist training to post graduate medical students in the various disciplines. The Department of Paediatrics at Mulago Hospital had a telemedicine experience from a pilot project between Kampala and Nairobi Medical School. Currently, the medical school has access to e-mail and has been using it to access Medline and other health-net databases.

According to 1993 statistics, the total number of doctors is 722, out of which 50% are in Kampala. 1999 figures at the Ministry of Health indicate that 130 specialists are based at Mulago and Butabika National Referral Hospitals and at Makerere Medical School. Mbarara University of Science and Technology has 20 specialists, of whom only four are Ugandans. The eight regional referral hospitals have only 29 specialists in total, making it an average of 3 per hospital. The reality is that some hospitals have up to six while other have only two. The total number of nurses is 14 250, of which 60% are rural-based. The majority of lower-level health units are manned by nursing aids with no formal training.

Objective

To establish a telemedicine link between Mengo and Mulango hospitals via ISDN and to set up a Health Management Information System.

Description of the project

Two hospitals will be connected by using ISDN. This is a point-to-point data link (see Figure 12). The telemedicine workstation should be able to transmit the medical information, including images. Therefore, digital scanners should be provided at both end. In addition, the possibility to have videoconference sessions should be included as well.

The telemedicine link will strengthen the working relation between the two hospitals, reducing travelling time for consultations, and give better support to the Mengo hospital. This means that consultatns will be more available to carry out their work in the Mulango hospital. The management of health information will be improved and will be more efficient. In general, the project will improve the access of health-care personnel to specialist information and reduce time when obtaining response and support. The system comes into service in August 2000.

Partners

- *Uganda Telecom Ltd*
- *Ministry of Health*

Present status

The composition of the partners as well as resource mobilization have not been finalized yet.

Contact person

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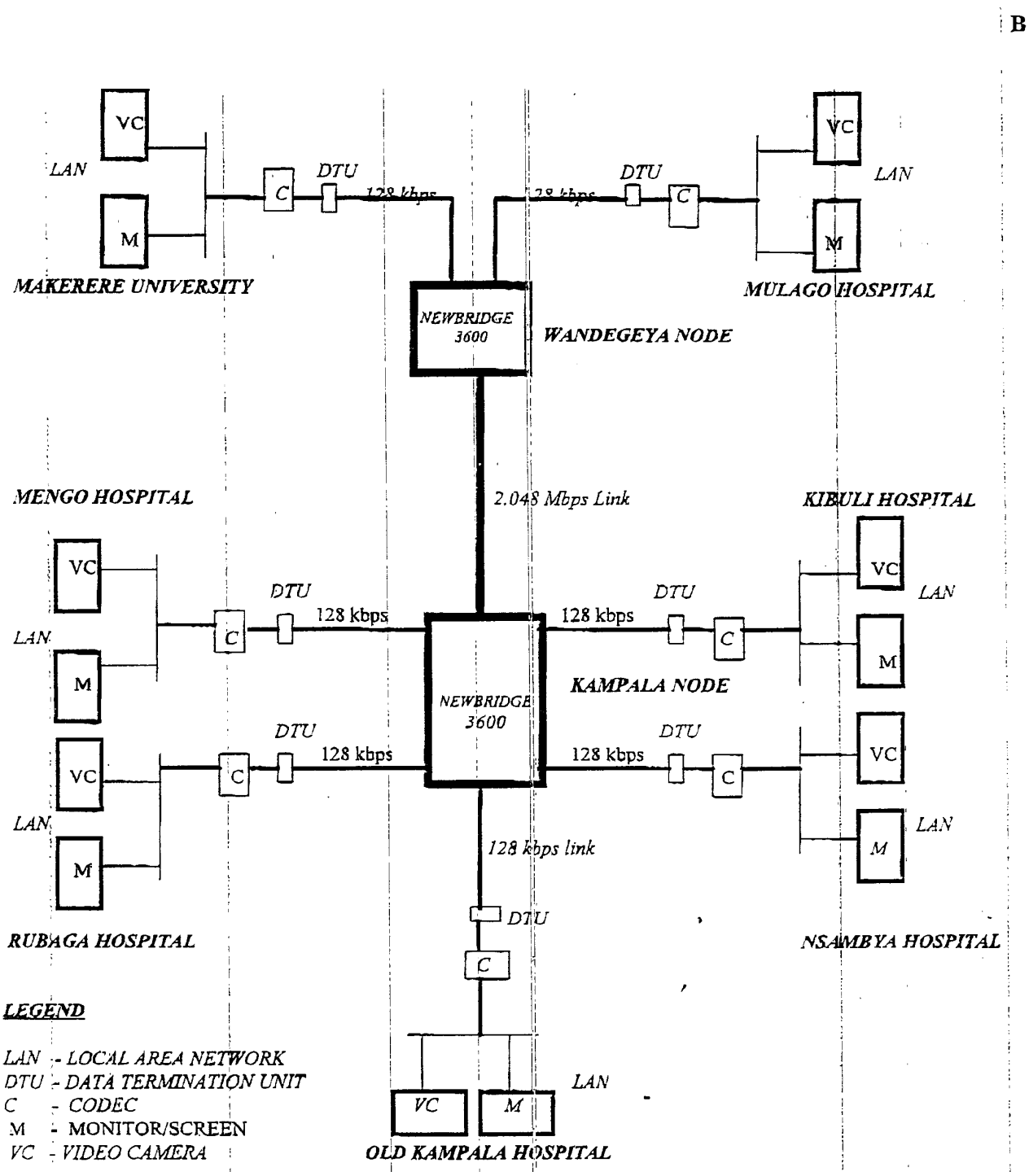
Figure 12 – Data Network for Kampala City Hospitals and Makerere University Telemedecine Project



UKRAINE: Introduction of a PBX-based mobile personal handy-phone system in the Ukrainian central emergency and trauma hospital in Kiev

Country information

Population: 50 million. Telephone density: 19.07%.

Introduction

The world's worst nuclear accident took place on 26 April 1986 in one of the four reactors of the Chernobyl nuclear power station in Ukraine. It resulted in the release of large amounts of radioactive nuclides to the surrounding areas. The continued release of radioactive nuclides over a period of several months and their spread in the environment posed major problems to the population in the areas surrounding the nuclear plant. Evacuation of all residents within 50 km of the accident took place within several days.

Large-scale programmes of medical surveillance were soon initiated for the population of the contaminated areas, and still continue. The world community also responded positively by assisting the Ukrainian people in various ways. The government of Japan offered the larget contribution in cash for the implementation of an International Programme on Health Effects of the Chernobyl Accident (IPHECA) administered by the World Health Organization. Japanese non-governmental organizations have been providing humanitarian aid to the population residing in the contaminated areas, and especially to children. The necessity to continue these activities has been unanimously recognized by the scientists and practitioners concerned.

Objective

The main objective of the project was the introduction of mobile communication in the Ukrainian central emergency and trauma hospital in Kiev with the aim to improve hospital management and enable remote medical consultations.

Partners

- *Telecommunication Development Bureau (BDT) of ITU*
  - General management and supervision of the project.
  - Coordination with local authorities in Ukraine.
  - Participation in the evaluation and monitoring of the telemedicine service during the pilot period.

- *BHN Association (Japan)*
  - Mobilization of funds for project implementation.
  - Coordination with other partners from Japan.
  - Coordination for shipment of PHS system from Japan to Kiev.
  - Participation in the evaluation and monitoring of the telemedicine service during the pilot period.

- *NTT DoCoMo (Japan)*
  - Project engineering.
  - Provision of the required PHS system for the pilot project.
  - Technical and operational assistance to solve possible interconnectivity problems.
  - Participation in the evaluation and monitoring of the telemedicine service.

- *Ministry of Health of Ukraine/Central Emergency Hospital in Kiev*
  - Coordination of all medical aspects concerning specialized assistance during the operational pilot period.
  - Identification of appropriate telemedicine applications.
  - Preparation of application for the operational license.
  - Administrative and logistic support in Ukraine (local transports, storage of equipment/material, etc.).
  - Administrative and logistic support in Ukraine (local transports, storage of equipment/material, etc.).
  - Participation in the evaluation and monitoring of the telemedicine service during the pilot period.

- *Ukrtelecom (national telecom operator)*
  - Participation in the project engineering.
  - Participation in the installation of the PHS system in a hospital.
  - Technical and operational assistance with interconnection to PSTN.
  - Assistance for setting the operational license.

Description of the project

The central emergency hospital consists of several buildings spread over a large territory. Reliable telecommunications is a very important component for the work of the hospital. NTT DoCoMo, the main mobile operator in Japan, donated a Personal Handy-Phone System (PHS) to the hospital. This system is local, operates only at the territory of the hospital, but every holder of a mobile terminal has access to an external line and he/she can also receive a call from the city's public network.

The project engineering was done by NTT DoCoMo specialists. Ukrtelecom provided all the necessary technical and operational assistance. The installation of the PHS was implemented mostly by Japanese experts with the assistance from local partners.

Project's hand-over ceremony

The inauguration of the pilot project took place in Kiev on 15 October 1997. The then-Secretary-General of the ITU, Dr Pekka Tarjanne, said that the ITU had collaborated with the World Health Organization, BHN Association of Japan, Inmarsat, Morsviazsputnik and others in a telemedicine demonstration involving Chernobyl victims and doctors at Obninsk (Russia) during ITU's TELECOM 95. "Now I am very happy to see a demonstration converted into a pilot project." The hand-over ceremony was attended by a group of important persons from Japan who supported this project.

Doctor's opinion

This project has been operational for more than one and a half years. The PHS is working without any problems. The mobility of telecommunications for the environment of the emergency hospital is a very important feature. The response to every call for emergency medical assistance is much quicker today. There is only one problem: the system is already too small for this hospital and it requires some extension in the near future.

UKRAINE: Remote monitoring of the health-care of children living in the rural radio-contaminated areas and suffering from the Chernobyl nuclear accident

Country information

Population: 50 million. Telephone density: 19.07%.

Introduction

This project is also related to the nuclear accident which took place on 26 April 1986 in one of the four reactors of the Chernobyl nuclear power station in Ukraine (see previous chapter on Ukraine).

Objective

To improve the health-care opportunity for the benefit of the population, in particular children residing in the radio-contaminated area and suffering from the Chernobyl nuclear accident by providing mobile satellite communication between the mobile medical laboratory and the central hospital in Kiev.

Description of the project

The Ministry of Health of Ukraine has two buses equipped with medical apparatus in order to check the health condition of people, in particular children who live in the rural areas surrounding Chernobyl. These buses are the donation from the Sasakawa Memorial Health Foundation (Japan). It is possible to improve the efficiency of these mobile medical laboratories by providing the telecommunication link between them and Kiev. A solution was found in the application of an Inmarsat mini M mobile terminal. The mobile satellite communication was used not only for administrative purposes, but also for remote medical consultations with other doctors and for the transfer of medical data from remote sites to Kiev for quick advice.

Partners

- *Telecommunication Development Bureau (BDT) of ITU*
  - General management and supervision of the project.
  - Coordination with local authorities in Ukraine.
  - Telemedicine expert support.
  - Participation in the evaluation and monitoring of the telemedicine service during the pilot period.
- *BHN Association (Japan)*
  - Mobilization of funds for project implementation.
  - Coordination with other partners from Japan.
  - Coordination for shipment of Inmarsat mini M terminal from Japan to Kiev.
  - Participation in the evaluation and monitoring of the telemedicine service during the pilot period.
- *Inmarsat*
  - Project engineering.
  - Provision of the required space segment capacity (free or at reduced rate) for the duration of the pilot project.
  - Negotiation with System 12 with regard to the payment for the mobile services (free or at reduced rate).
  - Technical and operational assistance to solve possible interconnectivity problems.
  - Participation in the evaluation and monitoring of the telemedicine service.

- *Ministry of Health of Ukraine/Hospital No. 2 in Kiev*
  - Coordination of all medical aspects concerning specialized assistance during the operational pilot period.
  - Identification of appropriate telemedicine applications.
  - Preparation of application for the operational license.
  - Administrative and logistic support in Ukraine (local transports, storage of equipment/material, etc.)
  - Participation in the evaluation and monitoring of the telemedicine service during the pilot period.

- *Ukrtelecom (national telecom operator)*
  - Participation in the project engineering.
  - Participation and operational assistance with interconnection to PSTN.

- *Ukrspace (national space agency of Ukraine)*
  - Project engineering.
  - Interconnection to PSTN.
  - Interconnection to PSTN.
  - Assistance in the preparation of the application for the operational license.
  - Putting the system into operation.
  - Participation in the evaluation and monitoring of telemedicine services.

- *Ukrainian State Centre of Radio Frequencies*
  - Provision of the operational license (free of charge).
  - Assistance in the frequency allocation and any other associate matter.

Present situation

The project was completed at the beginning of 1998. BHN Association provided free of charge all the required telecommunication equipment, including Inmarsat mini M stations and PCs for telemedicine terminals. All partners participated actively in the installation and the operational tests. A demonstration was given during WTDC-98 in Malta.

Unfortunately, this project is not operational at the moment due to the lack of hard currency in the Ukrainian Hospital No. 2. System 12 (through the local service provider) cannot be paid. This is a common problem in many countries.

By inviting the local telecommunication operator to be a partner in the telemedicine project, the hospitals are not paying the telecommunication fees for the transmission of medical information between them. This is usually considered as a contribution from the local telecommunication operator to the project's budget. What is possible to achieve at a national level, is very difficult – or even impossible – to achieve at an international level.

Contact person

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ITALY: Telemedicine islands project[9]

The selection of this project from Italy is based on the idea of showing what is going on in a developed country. BDT is trying to implement similar clinical applications in developing countries. Of course, it is clear that the quality of the telecommunication infrastructure in a developed country is much higher and it is much easier to find the required bandwidth for different telemedicine services. In general, however, the main goal is the same: to obtain quick and reliable access to medical knowledge.

Introduction and objectives

The islands of Procida and Ischia are well known tourist places in South Italy. During summertime the number of habitants largely increases. To answer the demand for qualified healthcare services in emergencies and in routine activities, a cardiological and radiological video-teleconsulting system, which connects the islands of Procida and Ischia to mainland hospitals (Pozzuoli and Giugliano), has been established. This telemedicine experience allows to connect, 24 hour a day, the main hospitals of Pozzuoli and Giugliano and the island health centres for virtually transferring the professionals who are not present on the islands. This aspect is particularly important for the little island of Procida, which does not have a hospital, but only a very simple and small ambulatory service, which is certainly undersized during summer and unsuited for specialistic controls.

Figure 13 – Territory of the Islands Project

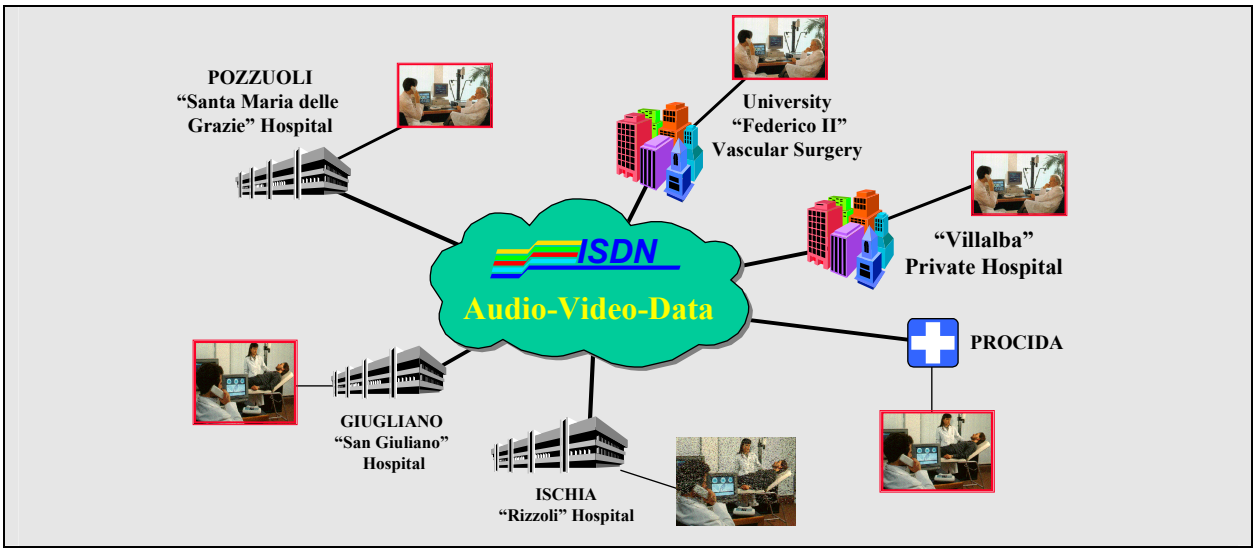
This telemedicine solution aims to provide a prompt and qualified health service on the islands, and to reduce the risks and the costs of patient transportation to the mainland. It offers also the possibility of a transnational interconnection, particularly important for foreigners during the tourist season.

[9] M. Bracale, A. Pepino, M. Cesarelli, P. Bifulco.

Description of the project – technical layout

Each site (Procida, Ischia, Giugliano, Pozzuoli) is equipped with AETHRA telemedicine videoconferencing stations (Telecom Italia approved) connected by an ISDN (3 BRI) network. The system is based on a H.320 standard for videoconferencing. Recently the network has been extended to the Vascular Surgery Dept. at the Policlinic of the University of Naples "Federico II", the private Hospital "Clinica Villalba" and finally to the Electronic Engineering Dept. of the University "Federico II". These two new clinical sites provide expert consultation in the field of vascular application and for patients with implanted pacemakers. Further telecommunication facilities have been installed to allow interoperability with other telemedicine systems based on the same videoconference standard and on the T.120 standard for data exchange and sharing.

Figure 14 – Telemedicine videoconsultation Network



The telemedicine videoconferencing station provides continuing video and audio connections, to permit interaction and consultation between physicians, for a second opinion approach. This system is enriched with remote controlled high-quality videocameras for an interactive patient inspection. Radiological digital scanners are also integrated in the teleconsulting system in order to acquire and transmit radiographs. A computer shared blackboard allows simultaneous interaction on the radiological images. Concerning the tele-cardiological facilities, portable electrocardiograph devices are connected to the telemedicine system via standard telephone lines to transmit ECG signals directly from the house of the patient (Home Care) or from the GP office.

Results

This project is user oriented, and has been designed both for effectively solving the real problems of emergency medicine and also for routinely clinical consultation. This technical solution aims to provide a prompt and qualified health service in the islands, and to reduce the risks and the costs of patient transportation to the mainland. It offers also the possibility of interconnections with foreign health centres. This aspect is particularly important for foreigners during the tourist season, because they could contact medical operators who speak their native language by telemedicine. Furthermore, the local operators could also receive patient clinical history and risk information from the remote health site.

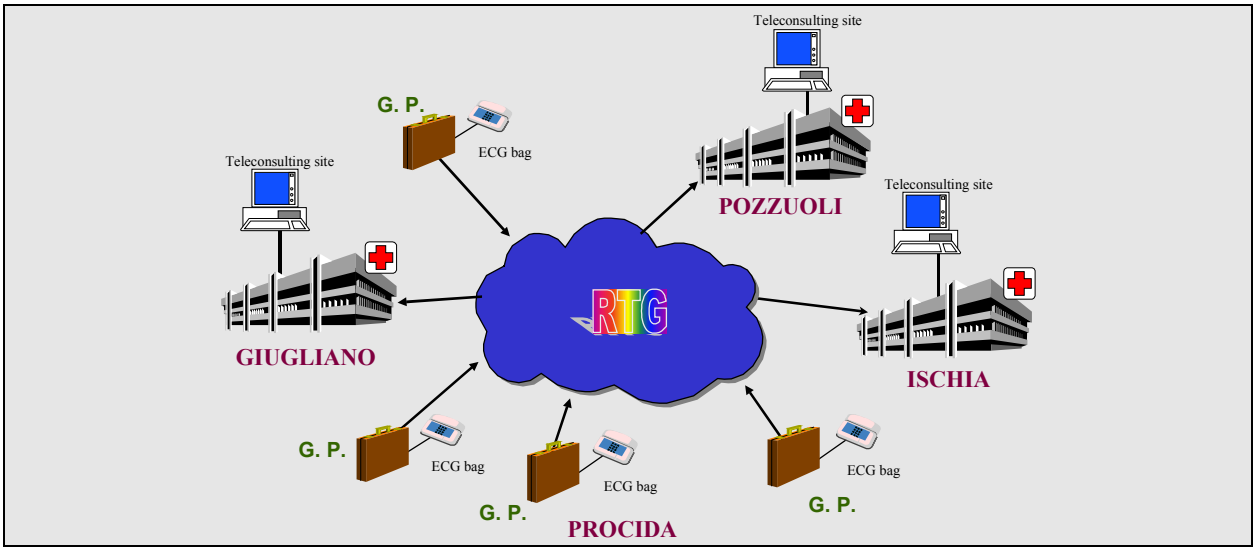
The workstations and the physical network were installed by the Italian Telecom Operator in cooperation with the AETHRA manufacturer under the supervision of the Bioengineering group of the University of Naples "Federico II". The phase of putting into operation was coordinated, from the technical point of view, by the Bioengineering group in the frame of a contract between the Dept. of Electronic Engineering of the University "Federico II" and the "Azienda Sanitaria Locale NA 2". In this framework, the Bioengineering group organized workshops and telematic sessions for continuous education. These activities are still running. Even if the workstations are user friendly, continuous education is necessary, especially where the turnover of the nurses and technical personnel is high. This activity allows to reduce to the minimum the lack of time to learn the correct use of the workstation.

The doctors and the other personnel expressed high interest in the use of the telemedicine workstation for clinical consultation in routine and emergency health activities, and asked for continuous education.

The system is used routinely to connect the islands (Procida and Ischia) to the mainland hospitals to obtain second opinions. The higher rate of connection was observed between Procida and Pozzuoli or Ischia. This is mainly due to the lack of some health professionals in the Procida ambulatory service. The rate of connections during emergency activities is also high between Procida to Pozzuoli due to the required concertation with the Pozzuoli Hospital to efficiently plan the patient transportation to mainland.

The detailed costs of the project are still under evaluation (Technology Assessment activities). However, the cost of a videoteleconsultation is undoubtedly much lower than costs associated to patient transportation for diagnosis. Moreover, the enormous reduction of time required for diagnosis is an invaluable advantage, especially for pathologies like cardiac infraction. In this pathology an early therapeutic approach could enormously increase survival.

Figure 15 – Territorial Telecardiology



Conclusion

The aim of the project is to effectively solve the real problems of emergency medicine and to allow and simplify routine clinical consultations. The telemedicine service is used routinely and daily to connect the island hospital to obtain second opinions during routine clinical activities. The number of connections between the islands and the mainland during health emergency activities is high. The telemedicine service gives an efficient answer to the increased demand of health services associated with the tourist season.

Technology Assessment activities are carried out in the framework of the previous mentioned contract between the Dept. of Electronic Engineering of the University "Federico II" and the "Azienda Sanitaria Locale NA 2". They aim to evaluate and measure the performances of the specific telemedicine solution during its operative work. The preliminary results are promising, but the available data are not yet extensive enough to carry out appropriate statistics. This project represents also a pilot and demonstration site for future applications of telemedicine in emergency.

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PART 3

POTENTIAL PROJECTS

ETHIOPIA: Telemedicine network

Country information

Ethiopia has an area of about one million square kilometers and a population of approximately 61.7 million, of which more than 52 million (85,3%) live in rural areas. The healthcare system in Ethiopia is underdeveloped and able to provide health services to only about half of the population. The Government plans to realize its health development objective through a twenty year health development strategy, with a series of five-year investment programmes, of which the first Health Sector Development Program (HSDP) covers the period 1997/1998-2001/2002.

Objectives

Ten hospitals in the country will be connected via Internet and with the Faculty of Medicine and the Tikur Anbessa Hospital in one telemedicine information network. Each hospital and also the Faculty of Medicine will be equipped with a telemedicine workstation in order to be able to arrange any consultation on dermatology by transmitting colour pictures of the patient's skin. The telemedicine workstations can also be used for any kind of medical training and education.

During the trial period of one year some additional telemedicine services have to be identified and selected. It is recommended to consider the healthcare services listed below:

- Consultation on cardiology with transmission of ECG.
- Teleradiology.
- Pediatrics.

The implementation of the telemedicine project will allow:

- To improve access to speciality care.
- To reduce the cost associated with long distance travel for medical examination and treatment.
- To increase access to continuing medical education and training, and reduce professional isolation among doctors and other health staff located in rural and remote areas.

Partners

In accordance with BDT's strategy to implement any telemedicine project on a partnership basis, a list of partners and their role is presented.

- *Telecommunication Development Bureau (BDT) of ITU*

– Coordination with all partners.

– Financial contribution to the project.

– Telemedicine information support.

– Telemedicine information support.

– Participation in the evaluation and monitoring of the work of the project during the pilot period (one year recommended).

- *Ethiopian National Telemedicine Coordinating Committee*

– Coordination with local partners.

– Mobilization of resources.

– Identification of priorities.

– Organization of telemedicine training.

- *Ethiopian Telecommunications Corporation*

– Participation in the project engineering.

– Participation in the installation of the telemedicine network.

– Connection hospitals identified in the project to the national Internet sever.

– In-kind contribution to the implementation of the project by given the authorization to use every month at least 50 hours of Internet service free of charge during the pilot period of one year.

– Participation in the training for doctors and other staff on the use and maintenance of the telemedicine system.

- *Ethiopian Telecommunications Agency*

– Participation in the project engineering.

– Contribution to the preparation of the telemedicine policy in Ethiopia.

- *Faculty of Medicine, Addis Ababa University*

– Coordination of all medical aspects of the project.

– Identification of appropriate telemedicine application.

– Organization of training on how to use the telemedicine network and how to benefit from the introduction of telemedicine services.

– Preparation of standards/protocols for each telemedicine service introduced in Ethiopia.

– Preparation of proposal to the Ministry of Health on how to regulate and how to manage the telemedicine consultations between hospitals.

- *All hospitals participating in the project and connected via Internet*

– Participation in the installation of telemedicine equipment and workstation.

– Provision of appropriate PC (minimum Pentium II type) to be used for telemedicine workstation.

– Participation in the telemedicine training.

– Identification of the new telemedicine application in accordance with hospital's needs.

- *Economic Commission for Africa*

– In-kind support for the implementation of the project by providing, if necessary, a telemedicine expert service.

– Participation in the evaluation of the results of the project.

– Dissemination of the result of Ethiopian telemedicine project to other African countries.

- *WHO Office in Addis Ababa*

– In-kind or cash support to the implementation of the project by providing, if necessary, medical expert service.

– Dissemination of the results of the Ethiopian telemedicine project to the Ministries of Health of other African countries.
– Participation in the evaluation of the results of the project.

- *UNESCO office in Addis Ababa*

– In-kind or cash support to the implementation of the project.
– Identification of the needs and priorities on how to include the distance education as an important component of the project.
– For educational purposes, using the telemedicine network in Ethiopia.
– Dissemination of the results of the Ethiopian telemedicine project to other African countries.
– Participation in the evaluation of the results of the project.

- *Tokai University School of Medicine/Nakajima Research Laboratory (Japan)*

– Participation in the project engineering covering medical aspects.
– Provision of know-how with regard to the use of VSAT technology for telemedicine services.
– Participation in telemedicine training.
– Participation in the evaluation of the results of the project.

- *E-Health Solutions (Czech Republic)*

– Participation in the project engineering.
– Negotiation with the World Bank/Info*Dev* Programme to obtain a grant for the provision of telemedicine equipment to the project.
– Assistance in telemedicine training.

- *Worldspace Corp. (USA)*

– Participation of Worldspace digital audio and multimedia services in the telemedicine project.
– Free of charge satellite capacity for the duration of the prilot project test.
– Facilitate the integration of Worldspace services and receivers in the overall telemedicine equipment set-up.
– Assistance and training of medical staff.

Implementation

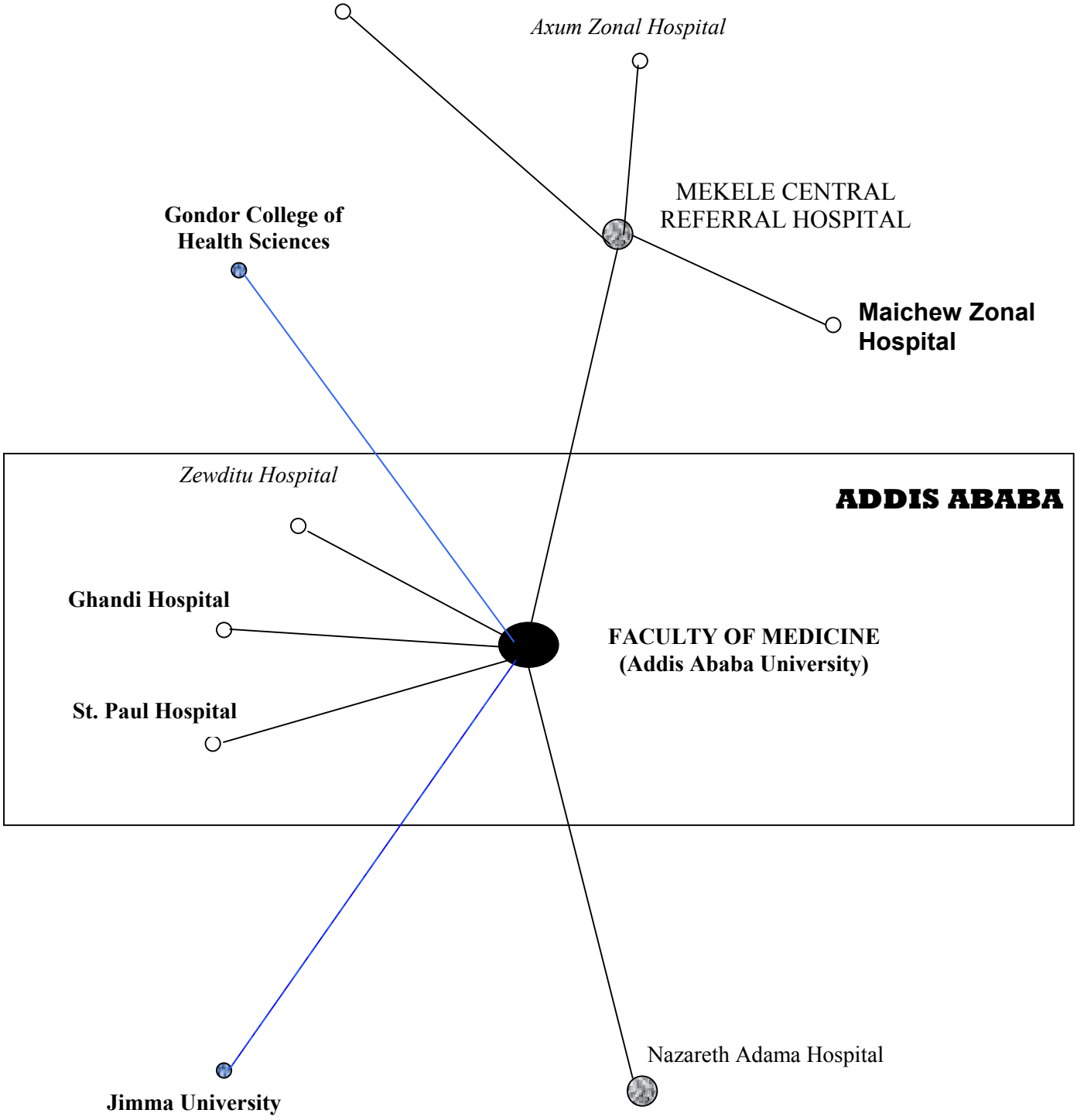
Internet has been selected as the main telecommunication technology to connect hospitals in one telemedicine information network. The Ethiopian Telecommunication Corporation, who is also an Internet service provider in the country, agreed to connect the hospitals to Internet. All hospitals have to provide one PC Pentium-type to be used as the core of the telemedicine workstation in each hospital. The Telecommunication Development Bureau as leader of this project will coordinate the work of all partners and will provide the telemedicine software for teledermatology as well as digital cameras to all hospitals participating in the project. The Faculty of Medicine, Addis Ababa University, has to develop a medical protocol on how to use the telemedicine equipment for teledermatology as the first telemedicine service to be introduced in Ethiopia.

The telemedicine workstation consists of: a PC Pentium II or higher, 64 MB RAM; 4 GB HD; CD 8x+Drive +CD-R Drive; telemedicine software; a modem 56.6 K; a colour paper scanner; a digital camera, and UPS.

Future extension

The extension of the medical information network will depend on the development of Internet in the country. All specialized hospitals will have to be connected to Internet. They should also have access to international telemedicine services to maintain a good professional level of healthcare. The zonal and district hospitals connected to Internet will benefit from support of some specialists in the specialized hospitals on a permanent or *ad-hoc* basis. The primary healthcare units will benefit from the simple use of e-mail by giving them access to the doctor's advice.

TELEMEDICINE PROGRAMME IN ETHIOPIA



LEBANON: Teleconsultation medical network for Ain Wazein Hospital

Introduction

The follow-up meeting of the Regional Development Conference for the Arab States, which took place in Beirut in 1997, selected two countries in the region (Lebanon and Yemen) for a telemedicine pilot project. The Ministry of Posts and Telecommunications of Lebanon recently informed BDT that the Ain Wazein Hospital has been selected for the introduction of telemedicine services. This hospital is situated in the rural area in the south region of the country. It is a referral centre for several small hospitals in the area.

The Ain Wazein Hospital or the Health Establishment of the Druze Community was founded in 1978 as a non-profit association. This was dictated by the urgent need of medical and social service in a wide geographical region comprising the districts of Metn, Aley, Chouf and Iklim, as well as the neighbourhoods of Jezzine and Bekaa. The population of this vast region used to exceed five hundred thousand inhabitants at that time. Several small hospitals were established there during the war, but the needs of the population were greater than these hospitals could offer, a fact which necessitated the regular transfer of all complicated cases to more sophisticated medical centres in Beirut.

The aim of the Association is to provide medical care of high standards. The Ain Wazein Hospital is the only medical center in the region that handles complicated cases which usually require a highly equipped hospital. In order to ensure optimum functioning of this equipment, the administration recruits the best staff among the medical and paramedical community in the region. They are also assisted by specialists coming from different regions in the country.

Objectives

The main goal of the telemedicine pilot project is to improve the quality of healthcare in small hospitals in rural area by providing access to medical specialists in the Ain Wazein Hospital using telemedicine consultations. This will help to reduce the number of unnecessary referrals to the Ain Wazein Hospital. The implementation of the project will also increase access to continuous medical education and training, and reduce professional isolation among doctors and other health staff located in rural areas.

Partners

In accordance with BDT's strategy to implement any telemedicine project on a partnership basis, a list of partners and their role is presented below:

- *Telecommunication Development Bureau (BDT) of ITU*
  - Coordination with all partners.
  - Telemedicine information support.
  - Financial contribution to the project.
  - Leadership in the project engineering.
  - Participation in the organization of telemedicine training.
  - Participation in the evaluation and monitoring of the work of the project during the pilot period (one year recommended).
  - Dissemination of the results of the telemedicine project to other developing countries.

- *Ministry of Posts and Telecommunications*
  - Participation in the project engineering.
  - Study the connection of the hospitals identified in the project to the Ain Wazein Hospital by using two telecommunication technologies (ISDN and Internet).
  - In-kind contribution by giving authorization to use at least 50 hours of telecommunication service every month free of charge during the pilot period of one year.
  - Participation in the installation of the telemedicine network between hospitals identified in the project.
  - Participation in the training of doctors and other staff in the use and maintenance of the telemedicine workstation.

- *Ain Wazein Hospital*
  - Coordination of all medical aspects of the project.
  - Identification of the appropriate telemedicine application.
  - Provision of two PCs (minimum Pentium II type) to be used for telemedicine workstations in the hospital.
  - Participation in the installation of telemedicine equipment and workstations.
  - Participation in the organization of telemedicine training.
  - Preparation of standards/protocols for each telemedicine service introduced between the hospitals.
  - Participation in the evaluation and monitoring of the work of the project during the pilot period.
  - Study the sustainability of the project.

- *All hospitals participating in the project and connected to the Ain Wazein Hospital*
  - Participation in the installation of telemedicine equipment and workstations.
  - Provision of appropriate PCs (minimum Pentium II type) to be used as a telemedicine workstation in each hospital.
  - articipation in the telemedicine training.
  - Identification of the new telemedicine application in accordance with the hospitals' needs.

Implementation strategy

It was proposed to connect five small hospitals located in Hasbaya, Rashaya, Marjeyoun, Metn and Falougha to the Ain Wazein Hospital. The distance between these hospitals and the Ain Wazein Hospital is between 35 and 100 km. All hospitals are connected to the national telephone network. First of all the Ministry of Posts and Telecommunications has to investigate how to connect these hospital by Internet or ISDN. The configuration of a telemedicine workstation depends on the transmission media available between hospitals. It was recommended to start the introduction of telemedicine services with teledermatology. Then the transmission of X-ray and ultrasound images will be added.

UZBEKISTAN: Teleconsultation system for the Republican Centre of Emergency Medicine

Introduction

The Uzbekistan Republic is located in Central Asia. In 1996 the Republic had a population of 23 million inhabitants, the vast majority of which lives in rural areas (61.8%). High birth rates over a prolonged period resulted in a population structure of 41% children under 14 years old and only 6.4% elderly people of over 60 years of age.

In November 1998 the concept for healthcare reforms in Uzbekistan was formulated, the main principle of which being health for all. The guiding objectives to realize are:

- improve the system of emergency services;
- to establish a market for medical and insurance services;
- to establish in Uzbekistan the Institute of General Practitioners;
- to improve the financial base of healthcare by optimizing the budgetary expenditure along with allotting free medical service to some categories of the population.

But the healthcare system faces various problems in the provision of medical service and healthcare, including funds, expertise and resources. A lack of good roads and transportation makes it difficult to provide healthcare in remote and rural areas; problems in the transportation of patients in an adequate manner are often encountered.

It is obvious that telecommunications can provide a solution to some of these problems. Telecommunications will enable medical experts to be accessed by under-served locations. The widespread use of information technology services could allow universal health access. More important, information technology offers solutions for emergency medical assistance, long-distance consultations, administration and logistics, supervision and quality assurance, education and training for healthcare professionals and providers.

The Centre of Emergency Medicine was founded in 1998 as a process of the Uzbek Healthcare System Reforms; it established one of the largest medical centres in Tashkent. The centre consists of:

- ambulance station;
- a sanitary aviation station;
- clinical departments with 760 beds;
- a research and training department;
- twelve regional branches of the centre spread throughout the country.

The medical staff consists of 355 doctors and 587 nurses. The Research and Training Department consists of 125 scientists, including 12 professors and 27 PhDs in medicine. The sanitary aviation staff consists of 91 persons, including 36 paramedics. In 1999 the centre received 33 500 in-patients and 45 000 out-patients.

This centre has to be connected by telemedicine link with the Research Centre of Surgery, which is also located in Tashkent. The latter is an important institution which provides surgery consultations in Uzbekistan. The medical staff consists of 1 150 employees, including 22 professors and 255 PhDs. Consultations are provided to over 40 000 patients every year.

Project configuration

The main goal of the project is to connect the Centre of Emergency Medicine with the Research Centre of Surgery and with all 12 regional branches of the centre. In the beginning, telemedicine transmissions should be based on store-and-forward Internet technology. Later, when the country's telecommunication infrastructure has been upgraded to ISDN, videoconference facilities are also to be implemented.

Partners

- *Telecommunication Development Bureau (BDT)* of ITU
  - Coordination with all partners and relevant local authorities.
  - Telemedicine expert services.
  - Participation in the evaluation and monitoring of the work of the system during the pilot period.
- *BHN Association (Japan)*
  - Participation in project engineering.
  - Financial support to the project on a cost-sharing basis.
  - System setup, commissioning and training services.
  - Participation in the evaluation and monitoring of the work of the system during the trial period.
  - Coordination with other partners from Japan.
- *Agency of Post and Telecommunications (Uzbekistan)*
  - Participation in project engineering.
  - Participation in the installation of the system.
  - Other local support.
  - Contribution in kind by allowing use of the telecommunication infrastructure for medical consultations free of charge during the pilot operating period of one year.
- *Scientific Engineering and Marketing Research Centre (Uzbekistan)*
  - Participation in project engineering.
  - Participation in the installation of the system.
  - Study the possibility of extending the telemedicine system.
  - Mobilize local support to the project among telecommunication operators and manufacturers in Uzbekistan.
- *Uzpak, National Data Network (Uzbekistan)*
  - Participation in project engineering and installation.
  - Maintenance of the telemedicine system during the pilot period of one year, free of charge.
  - Contribution in kind by allowing the use, free of charge, of the data network for medical consultations during the pilot operating period of one year.
- *Ministry of Health (Uzbekistan)*
  - Identification of appropriate telemedicine applications.
  - Administrative support of the project.

- *Centre of Emergency Medicine (Uzbekistan)*
  - Identification of the appropriate configuration of the teleconsultation system to meet medical applications.
  - Administrative and logistic support in Uzbekistan (local transport, storage of equipment/ material, etc.).
  - Customs clearance of all project equipment.
- *Research Centre of Surgery (Uzbekistan)*
  - Identification of the appropriate configuration of the teleconsultation system to meet medical applications.
  - Participation in the administrative and logistical support.
- *Institute of Cybernetics, Academy of Sciences/Laboratory of Medical Informatics*
  - Participation in the preparation of the project.
  - Coordination with Uzbek partners.
  - Coordination with BDT.
  - Participation in the training course for doctors and other staff on the use and maintenance of the teleconsultation system.

WORLD TELECOMMUNICATION DEVELOPMENT CONFERENCE (WTDC-98)

Recommendation 9: Telemedicine

The World Telecommunication Development Conference (Valletta, 1998),

recalling

a) that the World Telecommunication Development Conference (Buenos Aires, March 1994) recommended that ITU study the potential of telemedicine to meet some of the needs of developing countries, and as a result adopted Question 6/2 on health care in developing countries;

b) that the ITU Development Sector has produced a report on "Telemedicine and Developing Countries" which was adopted by ITU-D Study Group 2 in October 1997;

c) that Resolution 7 of the African Regional Telecommunication Development Conference (Abidjan, 1996) calls upon African countries to support any initiatives which will help them gain practical experience in telemedicine and telehealth and that African telecommunication organizations should discuss the utility, logistics and feasibility of telemedicine delivery, especially in remote and rural areas of their country;

d) that Recommendation 5 of the Regional Telecommunication Development Conference for the Arab States (Beirut, 1996) invites all Arab countries to promote collaboration between health care officials and telecommunication operators in order to identify solutions to meet health care needs, especially in remote and rural areas and for those on the move and those who might not otherwise have access to the quality of care available in urban hospitals and to consider initiating one or more telemedicine pilot projects in remote and rural areas;

e) that the first World Telemedicine Symposium for developing countries convened by the Telecommunication Development Bureau in Portugal, 30 June-4 July 1997, recommended that ITU/BDT set aside a specific budgetary allocation from ITU TELECOM surpluses for supporting telemedicine pilot projects, including missions by telemedicine experts to assist developing countries in the formulation of proposals and that ITU-D should continue its studies of telemedicine and, in particular, to identify pilot projects, provide an analysis of project results and help countries to define a policy and strategy towards telemedicine implementation,

considering

a) the potential benefits identified in the report on "Telemedicine and Developing Countries" as well as the recommendations in the report;

b) the new Question on fostering the application of telecommunications in health services in developing countries,

recognizing

a) that, in order to deploy telemedicine applications, it is necessary to bring together multidisciplinary expertise from both the telecommunication and health service communities;

b) that some telemedicine applications may not be sustainable in the short term without some sponsorship but that sustainability is an important objective in the medium term;

c) that the possibility of undertaking telemedicine applications will be enhanced if regulatory barriers are reduced or removed on the equipment and services used,

recommends

1 that the ITU/BDT should take further steps to raise the awareness of decision-makers about telemedicine and how it might be able to help solve some health needs, are one useful method of raising awareness and bringing together representatives from the telecommunication and health sectors being workshops or symposia;

2 that ministries of communications should cooperate with ministries of health and telecommunication operators should collaborate with health service institutions, through one or more pilot projects, with a view to gaining some experience of how telemedicine applications may help meet their health needs, and that they continue to cooperate in considering the need for a telemedicine policy and strategy;

3 that developing countries should seek the advice of the international agencies such as ITU and the World Health Organization if they are interested in the participation in telemedicine projects of foreign partners;

4 that, ITU/BDT, should identify and involve possible partners for sponsoring and analysing the results of pilot projects, the financing mechanisms and technologies used, the services provided and the lessons learned;

5 that ITU/BDT should identify solutions to the sustainability of the application of telecommunication to health services, especially in remote and rural areas of developing countries, in order to demonstrate how telecommunications could optimize the use of limited health services in developing countries,

invites

the international financial institutions and donor agencies to assist in developing telemedicine applications, projects and programmes in developing countries.

DEFINITION OF QUESTION 14/2

FOSTERING THE APPLICATION OF TELECOMMUNICATIONS IN HEALTH CARE

IDENTIFYING AND DOCUMENTING SUCCESS FACTORS FOR IMPLEMENTING TELEMEDICINE

1 Statement of Problem or Situation

The Report on *Telemedicine and Developing Countries*, prepared as an output for Question 6/2, together with the discussions and recommendations of the African Regional Telecom Development Conference, the Regional Telecom Development Conference for the Arab States and the World Telemedicine Symposium for Development Countries, as well as reports on the missions to developing countries by telemedicine experts, all show that developing countries have an overwhelming need for the provision of medical and health care services, especially in areas outside the cities and that telecommunications services could be an economical means of achieving national health policy objectives with regard to improvement and/or extension of medical and health care, especially to non-urban areas.

Implementation of telemedicine requires multidisciplinary collaboration, with the active participation of telecommunication operators and health care professionals. There is a need to bridge the gap between the telecommunication and health-care communities at all levels. National Ministries of Health and Communications also need to work together towards introduction of a telemedicine policy and achievement of universal service where emergency services, health and social information systems are concerned.

2 Question or Issue Proposed for Study

The Study Group shall:

1) Identify telecommunications solutions to promote health care and to meet its needs, especially in remote and rural areas, for those on the move and for those who might not otherwise have access to the quality of care available in urban hospitals.
2) Take further steps to assist in raising the awareness of decision-makers, telecommunication operators, donors and others about telemedicine and how telecommunications might be able to help solve some health-care needs and provide elements to universal service relating to emergency, health and social services. In particular, support a second World Telemedicine Symposium to be held in Latin America in 1998 and a third Symposium to be held in Asia in 1999.
3) Identify telecommunications pilot projects for telemedicine applications appropriate to developing countries; provide an analysis of project results and help countries to define a policy and strategy in regard to the application of telecommunications to support implementation of telemedicine.
4) Establish a database about the different pilot projects and experience in developing countries, what financing mechanisms and technologies have been used, what services have been provided, what the results of the pilot projects have been, what lessons to learn, what mistakes to avoid.
5) Promote development of telecommunications standards for telemedicine applications in conjunction with the ITU-R and ITU-T Sectors in particular.
6) Develop a directory of companies, institutes, service providers which includes telecommunications facilities and technologies used in telemedicine applications, services and software which would be appropriate and cost-effective in the context of meeting the needs of developing countries. The directory should include, as far as possible, a list of donor institutions in this domain.

3 Expected Output

The output expected from this Question will include:

- A report on the proceedings of the proposed Symposia for Latin America and Asia, including conclusions and recommendations. As with the first Telemedicine Symposium for Developing Countries convened by the ITU/BDT in Portugal in July 1997, which was supported by the European Commission, Inmarsat and others, representatives from both the telecommunications and health care sectors would be invited to participate, exchange views and ideas re implementation of telemedicine applications in developing countries.

- A report on pilot projects supported by the ITU/BDT, either in whole or in part, with WHO and other relevant international and national organizations. In some instances, the ITU/BDT and its sector members may be collaborating with other funding institutions such as the UNDP, WHO, World Bank and European Commission. The report would identify the scope of the pilot projects, participants, costs and sources of funding, results achieved, prospects for sustainability, telemed technologies and telecommunications used, etc.

  The report could include recommendations to assist telecom and health care professionals, including relevant government departments, who are considering implementation of telemedicine.

- Development of telecommunications standards for telemedicine applications. Such developmental activity should be coordinated with the ITU-R and -T Sectors, but also in collaboration with other relevant bodies. Such standards should facilitate the maximum interworking between different telemedicine equipment and telecom networks, particularly in the domain of videoconferencing. Further, the work on these standards should also take into account security and privacy in order to guarantee the integrity and confidentiality of patient information.

4 Timing of the Expected Output

The work undertaken by the Study Group can be phased over the next study cycle. Implementation of small-scale pilot projects should take place over the next two or three years.

5 Proposers and Sponsors

Formulation of the proposed Question has been based on the Resolution from the Second African Telecom Development Conference (Abidjan 1996), the Recommendation from the Second Telecom Development Conference for the Arab States (Beirut 1996) and the recommendations emanating from the Report of the first World Telemedicine Symposium for Developing Countries held in Portugal in July 1997.

6 Sources of Input Required in Carrying out the Study

Inputs will be expected from the European Commission, the European Health Telematics Observatory, the World Health Organization, the Midjan Group, telemedicine institutes, etc. Contributors to and contacts already established in preparing the Telemedicine Report will be tapped for contributions to the work of the Study Group and new contacts will be invited.

7 Target Audience

a) Types of target audience

	Developed Countries	Developing Countries	LDCs
Telecom policy makers	*	*	
Telecom regulators	*	*	
Service Providers (operators)	*	*	*
Manufacturers	*		
Ministries of Health	*	*	
International funding bodies	*		
Telemedicine institutes	*	*	

This Question aims at stimulating collaboration between the telecom and telemedicine communities, between developed and developing countries. Essentially, a transfer of know-how from developed to developing countries is expected. However, the experience gained from telecommunications for telemedicine applications in developing countries will also be expected to benefit equipment suppliers and service providers in developed countries, so that they have a better understanding of what is cost-effective in third world markets.

b) Who will use the output

See Sections 3 and 7 a).

c) Proposed Methods for the Implementation of the Results

The outputs of the this Question can be made available via World Wide Web sites (e.g., that of ITU, Midjan Group, etc.), distribution of hard copies to the mailing lists of the ITU and other organizations, availability at Symposia, etc.

8 Proposed Method of Handling this Question or Issue

The outputs of the Question can be prepared by the Study Group in close collaboration with ITU/BDT, taking into account missions by telemedicine experts to developing countries and telemedicine pilot projects. The Study Group should also work closely with, for example, the Midjan Group, which was established as a consequence of the Question 6/2 following the Buenos Aires WTDC, and a similar Asian Telemedicine Collaboration Group, formation of which is under active consideration. The Study Group should invite collaboration with other interested international, regional and national organizations. The Study Group should also establish collaboration with the other ITU sectors in regard to promoting development of relevant standards.

9 Coordination Requirements of the Study

See Section 8 above.

10 Other Relevant Information

The activity for the next Study cycle can build on the Telemedicine Report and other initiatives which resulted from Question 6/2, notably formation of the Midjan Group, telemedicine demonstrations at the African and Arab States Regional Telecom Development Conferences, the World Telemedicine Symposium, telemedicine expert missions to developing countries, and the numerous contacts established world-wide in the last three years.

PRESS RELEASES

Mozambique

ITU/98-1
30 January 1998

ORIGINAL: English

Mozambique unveils leading edge telemedicine facility

Issued simultaneously in Geneva and Maputo – The Prime Minister of Mozambique, H.E Mr. Pascoal Mocumbi, inaugurated today the first telemedicine link of Mozambique and one of the first in Africa. "Telemedicine will end the isolation which has so far existed between health professionals in the country" the Prime Minister told participants. "I urge all partners of this project and in particular Telecomunicações de Moçambique to continue their efforts in finding innovative applications to telecommunications for the benefit of the entire society" he added.

"Telemedicine" refers to the provision of medical services and health care via existing telecommunications-based systems (terrestrial and satellite links). The range of such services, making use of low-cost technology, is very wide, and includes medical consultation, pathology diagnosis, education and emergency services.

The central hospitals of Beira and Maputo will be able to making use of standard low-cost teleradiology equipment which provides support for the exchange and visualisation of images including radiographs as well as for transmitting laboratory results or for communication (verbal or written messages). The project has been carried out by a multidisciplinary group of partners including Telecomunicações de Moçambique and a telemedicine equipment vendor – WDS Technologies of Geneva.

Doctors at the hospital of Beira will now able to refer cases to Maputo for a primary or second opinion. The availability of this new facility will also make it possible to send a medical record of a patient in Beira in order to assess whether hospitalization is required before the transfer of the patient to Maputo, thus minimizing inconveniences and unnecessary costs for patients and for the hospitals. The establishment of a link between the two sites is also expected to be beneficial for clinical and educational purposes.

The project is the first pilot project in Africa to be launched by the Telecommunication Development Bureau (BDT) of the International Telecommunication Union in order to evaluate the potential of information technology to solve some of the developing world most acute health-care problems. It responds to recommendations of the ITU's World and Regional Telecommunication Development Conferences of Buenos Aires, Abidjan and Beirut. It also follows the adoption of a major ITU report presented at the World Symposium on Telemedicine held in Portugal last year entitled *Telemedicine and Developing Countries*.

"Among other things, the Mozambique project is a concrete example of the benefits of collaboration between developed and developing countries. It provides an excellent example of the benefits of close cooperation between telecommunications operators and health care professionals" said BDT Director Ahmed Laouyane on the occasion of the inauguration of the Mozambique project. "Telemedicine will help extend specialist care to those currently without easy access to medical institutions or the specialists they actually need".

Mr Laouyane stressed that a follow-up will be made to assure a sustainable development of the project and to gather some valuable information on how to increase the usability of the telemedicine equipment and service.

The Mozambique project is intended to serve as one of a series of case studies involving the BDT and other partners and as a model for other telemedicine projects to be undertaken by public and private initiatives. The case studies aim at showing the different applications of telecommunication and information technologies for telemedicine and how telemedicine can help overcome some of the serious shortages in health care services in developing countries.

Malta

ITU/98-12
24 March 1998

ORIGINAL: English

Telemedicine link inaugurated today between the islands of Malta and Gozo

Valletta, Malta – Dr Michael Farrugia, Minister of Health, Care of the Elderly and Family Affairs in the Republic of Malta, officially inaugurated today a telemedicine link between St. Luke's Hospital in Malta and the General Hospital in the sister island of Gozo. The inauguration took place at the Mediterranean Conference Centre (MCC) during the World Telecommunication Development Conference organized by the International Telecommunication Union.

Images were relayed live by Maltacom Ltd. from St. Luke's Hospital to the MCC during a real-time telemedicine session with Gozo General Hospital. Specialists at the two hospitals carried on an interactive discussion on clinical cases and exchanged clinical materials (such as X-ray images) over a real-time videoconferencing link.

"Since time immemorial, patients from Gozo have had to cross over to Malta by ferry, or more recently, by helicopter in order to receive the more specialized health services available here", Dr Farrugia said. The journey can be very demanding on persons who are ill, especially in winter time. Now thanks to the videoconferencing link that I am officially inaugurating today, it is possible for doctors in Gozo to carry out a clinical discussion about their patients with specialists in Malta, thus reducing the number of times that the patient needs to cross over to Malta and back", he added. The Minister recalled the strong commitment of Malta in developing telemedicine links and acknowledged the assistance given by all partners. The ITU provided overall project coordination between local and foreign health and telecommunication partners, Telia, the Swedish telecommunication company, made available assistance and guidelines for project evaluation, Maltacom provided the infrastructure and services and MITTS procured and integrated all the hardware, software and network components.

The link which connects Gozo General Hospital to the Maltese Government's comprehensive and integrated information system for all public hospitals and health centres was upgraded from the existing 64 kbit/s to 2 Mbit/s to accommodate real-time video-conferencing and the rapid transfer of large data files on an ongoing basis.

The Malta/Gozo link uses Maltacom's fibre-optic and digital radio transmission network. At Gozo Exchange and Gozo General Hospital high bit-rate digital subscriber line (HDSL) modems are being used, while the internal communication within Gozo hospital, as well as at St. Luke's Hospital, is completely fibre-optic technology. In both hospitals, the telemedicine workstations are connected to the Malta Government Network (MAGNET), the high-bandwidth local area Government network installed and maintained by Malta Information Technology and Training Services Ltd. (MITTS).

Mr Joe Mizzi, Minister without portfolio in the Prime Minister's Office said that the project was a concrete example of the benefits of collaboration between developed and developing countries. "It provides an excellent example of the benefits of close cooperation between telecommunications operators and health care professionals" the Minister said. "Telemedecine will help extend specialist care those currently without easy access to medical institutions or the specialists they actually need" he added. Mr Mizzi urged all partners of the project to continue their efforts in finding innovative applications to telecommunications for the benefit of the entire society.

Speaking at the inauguration, Mr Ahmed Laouyane, Director of the Telecommunication Development Bureau (BDT), described the role of ITU as that of a catalyst. "Telemedicine is a multidisciplinary undertaking, requiring the active participation of different players from both the telecom and healthcare sectors" he said. "Thus, the BDT has been focusing its activity in bringing together the different partners who can make telemedicine a reality", he added.

Mr Laouyane recalled the initiatives taken by the BDT in the area of telemedicine. "The BDT was a founding member of the Midjan Group, an association of professionals from the telecom and health care sectors with the shared aim of stimulating telemedicine projects in developing countries. In July 1997, we organized the first World Telemedicine Symposium in Developing Countries in Portugal. In September, a major report on telemedicine for developing countries was issued to help countries gain better understanding of how such applications can be cost-effectively utilized. We also intend to analyze the results from a number of pilot projects which would serve as case studies for other developing countries interested in the application of telecoms and information technologies to meet some of the health care needs of developing countries" he concluded.

The development of the Malta/Gozo link is part of a telemedicine project started in November at the initiative of the BDT in partnership with Malta's Ministry of Health, Maltacom plc, MITTS Ltd., Telia, and the Midjan Group. Another important component of the project is the development of off-line transfer of paediatric echocardiography images from the Special Care Baby Unit at St. Luke's Hospital to Great Ormond Street Hospital for Sick children in London. The objective is to speed up and facilitate the sending of images for expert assessment and reporting before decisions are taken on the need to transfer children with congenital heart problems from Malta to London for specialized surgery.

Telia's Programme Director of Health Care, Mr Silas Olsson said that Telia Swedtel, in cooperation with ITU, had a two-fold interest in promoting telemedicine in the emerging and developing markets. "We contribute to bridge the knowledge and competence gap between and within markets and to spearhead the change-process in telecommunications operations by the commercial exploitation of IT and Internet systems", Mr Olsson said.

An important feature of both the Malta/Gozo and the Malta/London links is that emphasis has been place on the sustainability of the initiatives. The computer equipment and telecommunications infrastructure will be permanently in place, thus allowing the ongoing use of the links. The uptake of these technologies is yet another step in the development of the health services in Malta, which have had a high reputation in the Mediterranean region for several centuries.

A link between DiabCare Centres in Malta and in Sweden is also planned during the WTDC with two diabetes specialists who will carry out an real time interactive case discussion.

Georgia

ITU/99-8

22 June 1999

ORIGINAL: English

Tbilisi citizens to be provided with 24-hour a day cardiologic medical care

Tbilisi, Republic of Georgia – Georgia will, for the first time, be able to provide patients with heart disease with 24-hour a day medical care following the inauguration, today, of a telemedicine pilot project. The project, to be partly funded with excess revenues generated by the ITU TELECOM exhibitions[10] offers a trans-telephonic electrocardiogram for both diagnostic and emergency services.

Patients will be able to use a state-of-the-art device to record heartbeats whenever needed and transmit the recordings by telephone to a monitoring centre staffed with cardiologists round-the-clock and located at the Guli Cardiac Clinic in Tbilisi.

"We expect pilot projects to serve as test beds for other developing countries interested in using telecommunications to extend and improve the access to health-care services for their population", said Mr Hamadoun Touré, Director of the Telecommunication Development Bureau of the International Telecommunication Union. "It is one of several others which we are implementing in selected developing countries as part of our strategy to use information technology to help health professionals solve some of the most acute health care problems in developing and emerging economies", he added. Recommendation 9 of the Valetta Action Plan adopted by the ITU in 1998 calls for the implementation of pilot projects with a view to helping countries define a telemedicine policy and strategy for an optimized use of limited health services in developing countries.

"It is already the second telemedicine pilot project which has been successfully implemented in Georgia with the assistance of the ITU Telecommunication Development Bureau (BDT)", said Professor T. Todua, Director General of the Institute of Radiology and Interventional Diagnostics. The first project was put into operation in September 1998 when the Institute of Radiology in Tbilisi was connected through Internet to the Diagnostic Imaging Centre in Lausanne, Switzerland for medical second opinion.

Professor T. Melia, Director-General of the Cardiac Clinic expressed his gratitude to the BDT for its role in helping countries to introduce telemedicine services, stressing that time was of essence in heart attack treatments. "By quickly identifying the problem, the patient can be promptly and efficiently treated, thus minimizing hospitalization and associated costs and – in many cases – saving his or her life", Prof. Melia said. Over recent years, the number of heart patients has been steadily increasing and the number of fatalities as a result of heart diseases has reached very high level, many of which because of the time between the first signs of the attack and the medical assistance provided.

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[10] The ITU TELECOM exhibitions and fora are organized on a non-profit basis for the benefit of ITU Members. When excess revenues are derived, a significant part is made available for development projects. The ITU Council – ITU's annual governing body – agreed at its 1997 session to allocate part of these funds for the application of telecommunication technologies in the fields of health care.

Mr Teimuraz Berishvili, formerly Director-General of Georgia Telecom has been a driving force behind the realization of the project which would not have been possible without his untiring efforts and his personal commitment to the use of technologies for the betterment of people.

The Tbilisi project was officially inaugurated by Dr Amiran Gamkrelidze, Deputy Minister of Health. In his statement, Dr Gamkrelidze said that the day was not far off when advanced telecommunication technologies, including Internet and interactive TV, would give doctors the convenience of home visits.

The facilities will also be available to provide related medical care including blood pressure monitoring, asthma control and fetal monitoring.

Partners in the project include the Tbilisi Cardiac Clinic, Telecommunication Company of Georgia, and the Telemedicine Foundation of Russia.

Uganda

ITU/99-8

11 August 2000

ORIGINAL: English

ITU brings telemedicine to Uganda

Kampala – The Minister of State for Health of Uganda, Dr F. Byaruhanga, inaugurated today the country's first Telemedicine Pilot Project between the University Teaching Hospital of Mulago and the Mengo Hospital in downtown Kampala.

In his inauguration address Minister Byaruhanga praised ITU's cooperation in enabling his country to harness the latest information technology for a tangible humanitarian cause which could help save lives. He also urged greater coordination and synergy among development partners and called upon the Uganda's national telemedicine steering committee to work out the institutional framework in which all stakeholders can participate. "The challenge is for the private sector to take keen interest in the new ICT tools", he said.

With public health expenditure reaching a mere US$ 4 per inhabitant and health services heavily burdened by preventable public health disorders, the Ministry of Health adopted an ambitious plan to strengthen health services at all levels.

The Uganda project is the second in Africa involving ITU's Telecommunication Development Bureau (BDT) in innovative public and private sector partnerships. "The project aims at showing how telecommunication and information technologies applications such as telemedicine can help overcome some of the serious shortages in health care services in developing countries", said Hamadoun Touré, Director of ITU's Telecommunication Development Bureau (BDT). "This is yet another very concrete example on how the ITU helps countries keep apace with the revolutionary advances in telecommunication and information technologies in a bid to close the digital divide" he added.

The pilot project is part of a strategy to provide specialist care in surgery, pediatrics, obstetrics, gynecology and internal medicine in regional referral hospitals whose medical teams can only afford one or two specialists. It is estimated that 50% of all 800 doctors are in Kampala while 60% of nurses are in rural areas. With a very high maternal mortality rate ranging from 500 to 2 000 deaths per 100 000 births and infant mortality rate of 97 per 1 000, the need to improve medical delivery and to optimize limited medical resources is a matter of life.

The pilot project also aims at providing access to other specialities currently unavailable such as psychiatrics, anesthetics or ophthalmology.

The project is expected to be further expanded to cover other hospitals in both the capital Kampala and regional hospitals and dispensaries located in rural areas.

Along with the ISDN point-to-point data link between Mulago and Mengo hospitals, a Health Management Information System will be set up to enable medical personnel to share knowledge, experience and information rapidly and efficiently.

"While the project is designed as a pilot activity, full use will be made of its facilities to benefit primarily the practitioners in the two connected hospitals as well as wider community of professionals connected to the project via the Internet" said ITU's Joseph Elotu representing the BDT Director at the inauguration. "For the first time, medical and health care staff will be able to transmit instantaneously large amounts of medical information to a consulting doctor located in a distant hospital or diagnosis centre and access medical information from the Health Management Information System, thus bringing greater efficiency to the practice of medicine in remote areas", he also said.

The telemedicine equipment was provided through the ITU technical assistance programme in partnership with Uganda's Ministry of Health and Uganda Telecom Ltd.

For more information, please contact:

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Liaison statement

On 10 September 1999, during the Second Meeting of ITU-D Study Group 2, the Chairman of Study Group 2 sent a liaison statement[11] to ITU-T Study Group 16 (Multimedia services and systems) reading as follows:

ITU-D Study Group 2 is engaged in studying the above-mentioned Question which requires for its success the availability of relevant Recommendations capable of allowing the instantaneous exchange, and/or wait and proceed, of medical information (this could cover a combination of video, picture, voice, still pictures, etc.).

The ITU-D Study Group 2 would appreciate receiving your comments on the above, as well as enlisting such Recommendations.

In reply, the following liaison statement[12] was received (approved by ITU-T Study Group 16, Geneva, February 2000):

ITU-T SG16 reviewed the liaison statement from ITU-D Study Group 2 regarding the telemedicine application of audiovisual communication at the SG16 meeting in Geneva during 7-18, February 2000.

1 Coding aspects

SG16 has developed and approved H-series Supplement 1 (*Application Profile, Sign Language and Lip-Reading Real-Time Conversation usage of Low Bit Rate Video Communication*), which describes the application profile for sign language and lip-reading applications using audiovisual systems developed by ITU-T SG16, and particularly focused on video quality.

SG16 considers that the supplement may be applicable to the telemedicine application as well. However, SG16 also considers that higher resolution of video with low frame rates is more desirable for the telemedicine application than for sign language and lip-reading application, and that high quality video using high bit rate transmission channel might be necessary. Because of lack of experts specific to health care applications, SG16 asks ITU-D SG2 for providing further advice concerning how audiovisual quality requirements for the telemedicine application differs from those for sign language and lip-reading application.

In response to your specific question regarding instantaneous exchange, there are some key features currently in Recommendation H.263 for providing rapid exchange of visual information. These include the use of Reference Picture Re-sampling to allow rapid transmission of a low resolution video picture followed by the addition of detail to provide a higher resolution video picture, and Progressive Refinement to allow coarse representation of a video picture to be refined to greater fidelity by the addition of further information. These features allow a video coder to provide either fluid motion video for continuously moving scenes or to focus on a particular picture and refine it for close examination after sending a coarse representation for instantaneous exchange.

SG16 appreciates continued collaboration with ITU-D for developing the application of telecommunication in health care.

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[11] See Document 2/130 dated 10 September 1999.

[12] Contact: Mr Gary Sullivan, Microsoft Corp., Redmond, WA 98052 (USA) – Tel. +1 425 7035308 – Fax: +1 425 9367329 – E-mail: *garysull@microsoft.com*

2 Systems aspects

The following table of ITU-T Recommendations lists those that are potentially applicable to your work. Equipment manufactured compliant to the Recommendations listed below provides support for the capabilities identified in your liaison.

Recommendation	Functionality Supported				Physical Transport (Generic name)	Comments
	Voice	Audio	Video	Text/ Data		
H.320 series	X	X	X	X	ISDN Networks	(Note 1)
H.310 series	X	X	X	X	B-ISDN (ATM)	(Note 2)
H.321 series	X	X	X	X	B-ISDN (ATM)	(Note 3)
H.322 series	X	X	X	X	Guaranteed QoS LAN	(Note 4)
H.323 series	X	X	X	X	Packet Networks	(Note 5)
H.324 series	X	X	X	X	PSTN	(Note 6)
V.16	X			X	PSTN	(Note 7)
T.120 series				X	PSTN, Packet Networks	(Note 8)

Note 1: H.320 systems are in use for audio visual conferencing and operate over the ISDN using a recommended minimum of 2 B-channels.

Note 2: H.310 systems are in use for audio visual conferencing with applications in distance learning etc.

Note 3: H.321 systems are in use for audio visual conferencing and support the functionality of H.320 systems on B-ISDN networks.

Note 4: H.322 systems are in use for audio visual conferencing in LANs with guaranteed Quality of Service such as ISLAN-16T

Note 5: H.323 systems are in use for voice communications and audio visual conferencing over packet-based networks which may or may not offer guaranteed Quality of Service, e.g. the Internet.

Note 6: H.324 systems are is use for voice and audio visual conferencing.

Note 7: V.16 is defined for use in transferring electro-cardiogram (EKG) data over the PSTN; however it was published in 1976 and never revised since; it is not known whether V.16 type modems are still used.

Note 8: T.120 is in use for text, data and very high still image transmission over PSTN and packet networks. Additionally this functionality is optionally supported in all H.32x series Recommendations.

ITU-T SG16 wishes to offer it's support on further questions pertaining to matters relating to these technologies.

In case you would have particular requirements for your applications, we could try to take them into account in future recommendations or in our next revision of existing recommendations. We are presently drafting a document for guidance on how to provide such user requirements. It is attached for your information. It contains in its Appendix II an example of a telemedicine application that may not be adapted to your needs but shows how you could describe them.

Attachment: Draft ITU-T Recommendation F.USER (TD 76 (PLEN)).

ITU – Telecommunication Standardization Sector **Temporary Document 76 (PLEN)**

STUDY GROUP 16

Geneva, 7-18 February 2000

Question(s): 1/16

SOURCE : Rapporteur for Question 1/16

TITLE : DRAFT NEW RECOMMENDATION F.USER[13] – GUIDELINE RECOMMENDATION FOR IDENTIFYING MULTIMEDIA SERVICE REQUIREMENTS

PURPOSE: FOR DETERMINATION

This document contains the draft new Recommendation F.USER, Guideline Recommendation for Identifying Multimedia Service Requirements, derived from Sections 1.1 to 1.3 and 2 of the existing Recommendation F.700 (1996 version). It has been revised and is considered stable enough for determination.

[13] This draft recommendation was approved under the World Telecommunication Standardization Assembly Resolution No. 1 procedure on 17 November 2000, and has received number F.701.

ITU-T RECOMMENDATION F.701

Guideline Recommendation for Identifying Multimedia Service Requirements

TABLE OF CONTENTS

ITU-T Recommendation F.701

Guideline Recommendation for identifying multimedia service requirements

1 Scope

This Recommendation provides guidelines for describing user requirements that are to be used as the basis for constructing new multimedia services. These guidelines are primarily intended to support the Multimedia service development methodology described in ITU-T Recommendation F.700. However, they can also be used as the basis for a structured dialogue between End-Users and Service Providers in order to arrive at a responsive service solution when applicable ITU-T service Recommendations are not yet available.

2 Definitions

For the purpose of this ITU-T Recommendation the terms defined in Recommendation F.700 will apply. The definitions of some important terms are reproduced in Appendix I for user convenience.

3 Multimedia service development methodology

A detailed methodology for developing Multimedia services is described in Recommendation F.700. Figure 1 provides an overview of this methodology and shows how end-user requirements are inserted into the service development process through the use of Application Scripts. The construction of these Scripts from End-User requirements is described in the remaining clauses of this Recommendation.

3.1 Application scripts

An application script is a document that describes the essential characteristics of an End-User application so as to facilitate identification and evaluation of the multimedia communication capabilities required to support it. The script, when properly validated, provides the baseline requirements for new multimedia services. The procedure for developing and validating application scripts is described in clause 4.

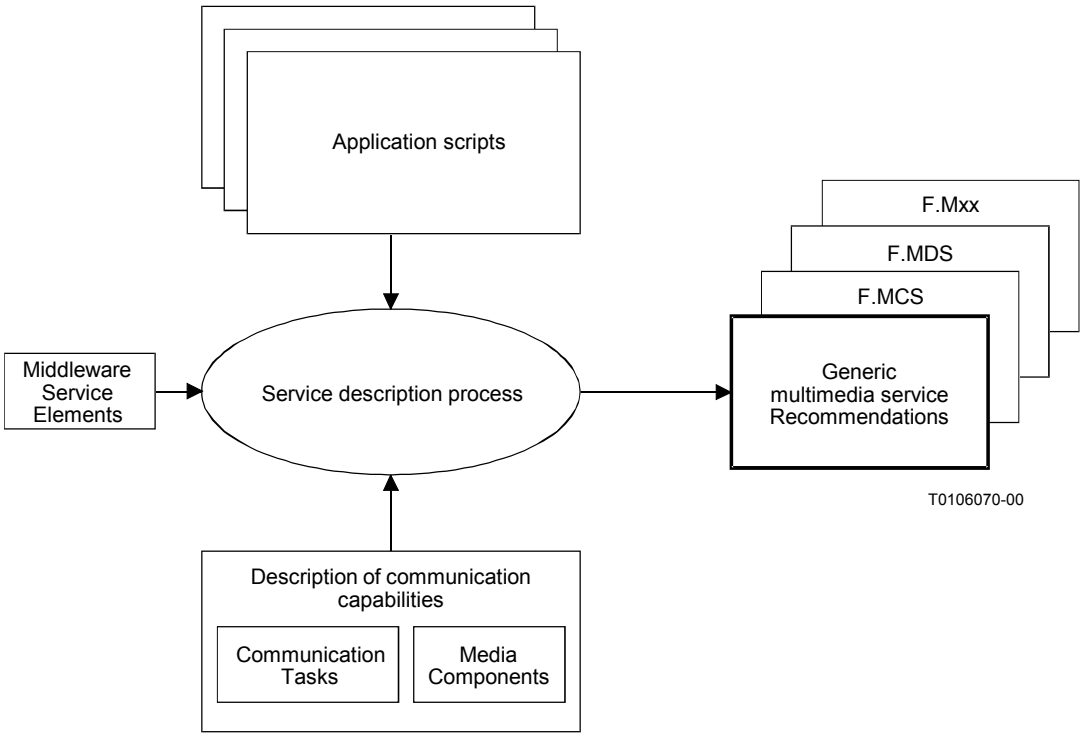
3.2 Communication capabilities

Communication capabilities are the fundamental sets of communication tasks, media components and integration mechanisms required to develop the complex spectrum of multimedia services. The procedure for translating the application script into the required communications capabilities is described in ITU-T Recommendation F.700. Procedures are also identified for launching the development of new communications capabilities when required to more fully support emerging user needs.

3.3 Middleware service elements

The middleware service elements contain all the control features and the processing functions associated with the service. They interact with the various communication capabilities in order to control them or to process the user information.

Figure 1/F.701 – Multimedia service development methodology



3.4 Multimedia service Recommendations

The translation of a particular application script into a description of the required multimedia service can be accomplished directly from the basic communication capabilities by utilizing the procedures specified in ITU-T Recommendation F.700. However, this process can be simplified in many cases by recognizing that a significant number of end-user applications utilize just a few combinations of multimedia communication means. The methodology for describing these generic service architectures in a series of general ITU-T service Recommendations is also described in ITU-T Recommendation F.700.

4 Application Scripts

4.1 Introduction

An application script describes the essential characteristics of an end-user application in a manner designed to facilitate identification and evaluation of the required multimedia communications support capabilities. This is accomplished by first describing the application from the end user's point of view and then translating this description into a form more useful for technical evaluation. The procedures for constructing an application script are described in 4.2 through 4.4.

Ideally, an application selected for the scripting process should represent a broad grouping of individual end-user applications which have the same essential functional characteristics and for which there appears to be a need for the development of a new multimedia service, service arrangement or enhanced service capability.

Differences between specific applications within this broad grouping can be represented by the specific values assigned to a particular requirement attribute. Examples are shown in 4.4. The procedures for validating the results of the scripting process are described in clause 5.

4.2 Prose description

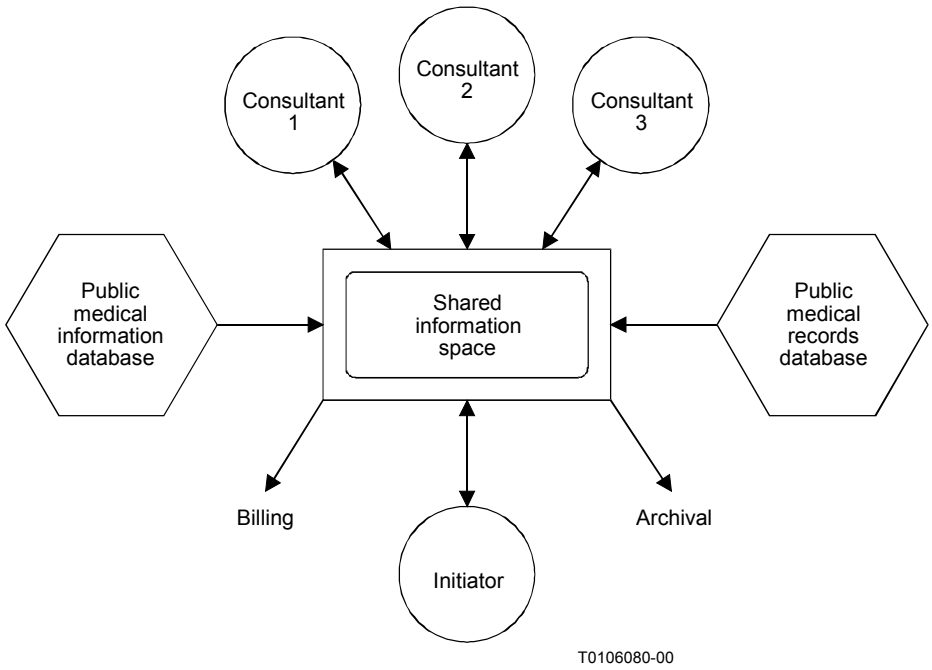
The prose description of an application provides a comprehensive statement of its scope and functional characteristics, together with the user's expectations for the quality of service. This description is written in a language understandable to the end user, who need not be aware of the technical aspects of the underlying service or supporting communications networks.

The prose description may be augmented by an application scenario and a set of implementation notes which further describe the application, highlighting those aspects which might otherwise remain unclear. A sample prose description, with associated application scenario and implementation notes, is provided in Appendix I.

4.3 Functional model of an application

The functional model provides a pictorial representation of the essential functional elements identified in the prose description. This representation is presented from the perspective of the application, rather than from the supporting service or network, and contains only those elements visible to the end user. Figure 2 provides the functional model for the prose description contained in Appendix II.

Figure 2/F.701 – A sample functional model of an application (medical consultation)



The principle characteristics to be depicted in the model are:

- the shared information space in which the interaction takes place;
- the functional role of the major participants;
- the required supporting information resources;
- the type and configuration of the various interactions; and
- the need to interface associated application processes.

While there is no standard symbology for constructing the functional model, care should be taken to select a form of presentation that reflects the essential functional elements of the application in a clear and concise way.

4.4 Application matrix

An application matrix maps user requirements onto technical functionalities. The principles for developing attribute tables are the following:

1) Application matrices are intended to facilitate the mapping of user needs with technical functionalities in an easily understandable form.
2) Application matrices enable the evaluation of service functionalities in a systematic and compact form.
3) Application matrices facilitate assessing the importance of functionalities in regard to user needs.

Table 1 shows as an example a part of an application matrix:

Table 1/F.701 – Application matrix template

User needs	Technical functionalities		
	Differential delay between audio and video	**Image repetition rate**	**Image resolution**
Lip reading (with head view)	< 100 ms	> 20 pictures/s	QCIF (178 × 144 pixels)
Sign language	–	> 20 pictures/s	CIF (358 × 288 pixels)

The following are examples of user needs:

– discussion of a jointly viewed document;
– the need to move around;
– the need to scrutinize fine details of a presented object.

The following are examples of functionalities the applications may require:

– shared viewing space for images;
– cordless communication access;
– high resolution image transfer.

The development of the matrix requires further study.

4.5 Summary

A script may include a prose description, an application scenario, implementation notes and an application matrix. (or several matrices for different environments or different times in the communication) . Some scripts may contain only part of those elememts.

5 Harmonization of Application Scripts with other bodies

Application scripts can be developed by the ITU or by other standards organizations, industry fora, consortia, user groups or individual end users. An application script, before being used as the basis for launching a new service development or evaluation effort by the ITU-T, should be discussed with the end user community if possible or reasonable. This discussion should take place between the relevant study groups and those organizations that have been identified as most representative of relevant end user interests, in accordance with ITU-T policies and procedures (see Recommendation ITU-T A.4).

Appendix I

Definitions

Definitions taken from Recommendation UIT-T F.700.

I.1 application: An Application is a set of activities performed to respond to the needs of the users in a given situation for purposes such as business, education, personal communication or entertainment. It implies software and hardware utilization, could be performed in a fully or partially automatic way and could be accessed locally or remotely. In the last case, it requests use of telecommunication services.

I.2 multimedia {MHEG}: The term multimedia is an adjective which means relative to two or more media; it must be attached to a noun which provides the context. For example, multimedia service or application, multimedia terminal, multimedia network and multimedia presentation.

I.3 multimedia application: A Multimedia Application is an application that requests the handling of two or more representation media (information types) simultaneously, which constitute a common information space. Examples are cooperative document editing, long distance meetings, remote surveillance, medical document remote analysis and teletraining.

I.4 multimedia service: Multimedia services are telecommunication services that handle two or more types of media in a synchronized way from the user's point of view. A multimedia service may involve multiple parties, multiple connections, and the addition or deletion of resources and users within a single communication session.

Appendix II

Multimedia medical consultation

II.1 Prose Description

Medical consultation involves interactive multimedia communications between medical experts located at two or more separate locations. This communication is generally initiated by a doctor desiring to discuss a particular patient's case with subject matter experts and may occur between the doctor and one consultant only, or may require an interactive conference arrangement between the doctor and several consultants simultaneously.

In the course of the consultation, information may also be required from remote databases containing the patient's medical files; from one or more diagnostic test centres in the form of X-rays, sonograms, electrocardiographs or similar medical images; or from a reference library containing technical information, illustrative medical images, or other supporting material required to facilitate the consultation. This material may be textual, aural, graphical or imagery in nature and may be stored in a multimedia format.

Participants in the consultation may be located in an office or medical facility having access to the full range of broadband multimedia telecommunications capabilities; or located in a moving vehicle, on a golf course, or at some other remote location having limited communications access. In order to accommodate all eventualities, provisions for dynamic resource arbitration and allocation, both during "call" initiation and while the "call" is in progress, are required to ensure that the more important aspects of the interaction are fully satisfied.

II.2 Application Scenario

This scenario is provided in two parts to better represent the wide range of communication environments within which a multimedia medical consultation could take place.

II.2.1 Full multimedia support capability

Dr "X" is a world recognized authority on bone structure and is widely consulted by other doctors on a frequent basis. Usually, this consultation takes place in Dr "X"'s office where he has a state-of-the-art multimedia communications terminal with a large high definition video display. A typical consultation might proceed in the following manner:

Stage 1 – Dr "X" is called by Dr "Y" via videophone requesting consultation regarding a patient suffering from multiple fractures of the upper foot resulting from an automobile accident. After briefly covering the nature of the injury, Dr "Y" transmits the patient's examination chart. The full screen video image on Dr "X"'s screen immediately changes to a two-partition representation depicting the patient's chart in the left half and a reduced video image of Dr "Y" in the right half.

Stage 2 – Dr "Y" is on duty in the emergency room of a local hospital and, after discussing the general aspects of the case with Dr "X" in a face-to-face videophone presentation, switches to his handheld remote videophone camera in order to provide Dr "X" with a visual survey of the damaged foot.

Stage 3 – With the visual inspection completed, Dr "X" requests transmission of the X-rays depicting the damaged area taken from different orientations. The two-partition screen presentation is quickly divided into four partitions, one for each of the X-rays to be transmitted.

Stage 4 – After careful scrutiny, Dr "X" selects the partition which gives the best view of the upper ankle area where most of the serious damage appears to have occurred. The partitioned screen is quickly replaced with a full screen, high resolution depiction of the selected image, enabling Dr "X" to make a more detailed inspection of the area of interest.

Stage 5 – Careful examination of the tarsal bone structure indicates considerable damage to the tibialis posterior tendon and associated muscle area, a complicating factor which requires the assistance of a third specialist. With the consent of Dr "Y", Dr "X" initiates a videoconference call to Dr "Z", a specialist in tendon reconstruction.

Stage 6 – After advising Dr "Z" of the nature of the emergency, the three doctors continue discussion of the case. As the videoconference progresses, the patient's examination chart, medical files, X-rays and other reference information are brought into the conference as required, either through the transmission of additional data or recovered from local "memory" if previously transmitted.

Stage 7 – At the end of the conference, Dr "Y" thanks Drs "X" and "Z" for their assistance and terminates the consultation.

II.2.2 Restricted multimedia support capability

A week later, another emergency occurs, this time involving a patient whose foot has been crushed in a logging accident. Dr "Y" again calls Dr "X" for consultation. While Dr "X" is available for consultation, it is his day off and all calls are automatically routed either to his home terminal or his portable terminal, depending upon the doctor's location at any particular point in time. In this case, Dr "X" happens to be on the golf course, accessible from the portable terminal in his golf cart.

In general, the consultation proceeds in a manner similar to that of the previous week. However, due to size limitations placed on the portable terminal and the reduced bandwidth available through the mobile network, service expectations are modified and focused on the more important aspects of the interaction. The less important features are relegated to a nice-to-have but non-essential category. With this in mind, the consultation proceeds in the following manner:

Stage 1 – Dr "Y" initiates a videophone call to Dr "X" to request consultation. Since Dr "X" is now using his portable terminal, he has elected to receive calls in the "voice only" mode. The network, complying with this service request, establishes the initial connection for voice communication only.

Stage 2 – After advising Dr "X" of the circumstances surrounding the emergency, Dr "Y" asks Dr "X" to switch his terminal to videophone operation in order to visually survey the area of injury. Dr "Y", recognizing that Dr "X" is communicating from a portable terminal, bypasses the normal full field view camera on his videophone terminal and activates the handheld remote scanner, holding the camera steady in the vicinity of the injury to compensate for the reduced "motion" response characteristics of Dr "X"'s portable terminal.

Stage 3 – With visual inspection completed, Dr "X" requests transmission of an X-ray for the orientation he feels will best portray the extent of damage. To compensate for the size of the portable video display and the reduced transmission rate, Dr "X" has purchased an enhanced storage feature for his basic portable multimedia terminal in order to capture the considerable amount of data required for high resolution X-rays. In addition, he is willing to accept longer transmission delay in order to obtain the necessary image resolution.

Stage 4 – After careful scrutiny of the damaged area, Dr "X" requests transmission of an additional X-ray which he hopes will depict the damaged area to better advantage. He elects not to choose a split screen presentation due to the small size of the portable video display, but to take advantage of the local data storage and image manipulation features, which allow him to zoom in on areas of particular interest and to change from one locally stored image to the other at near "office" response times.

Stage 5 – Careful examination of the injury again indicates the need for additional consultation with Dr "Z" regarding the extensive damage which has occurred to the tendons in the vicinity of the ankle. With the consent of Dr "Y", Dr "X" places a voice only conference call to Dr "Z".

Stage 6 – After advising Dr "Z" of the nature of the emergency and that he is calling from a mobile terminal, Dr "X" asks Dr "Y" to initiate a three-way videoconference to further discuss the case. In order to make maximum use of the bandwidth available for the more important imagery data, Dr "X" elects to join the videoconference in the AUDIOGRAPHICS-only mode (audio plus still image and graphics). As the videoconference progresses, X-ray and other visual information is brought into the conference as required, either through the transmission of additional data or recovered from local memory if the information had been previously sent.

Stage 7 – At the end of the teleconference, Dr "Y" again thanks both Drs "X" and "Z" for their assistance and terminates the consultation.

II.3 Implementation notes

II.3.1 Related applications

This Application is closely related to *Remote medical diagnostics*, but differs with respect to the time urgency of the interaction, the terminal facilities and transmission resources available, and the principal media of information interchange.

II.3.2 Associated applications

Automated accounting and billing for the consultants' time, and a permanent record of the interaction (*Automatic archival*) are desirable adjuncts to this application.

II.3.3 Security/privacy

The communications associated with this application are privileged in nature and require access to databases containing confidential information protected by privacy laws in most locations.

II.3.4 Service flexibility

There is a need for automated service mechanisms which will allow for:

1) initial "call" establishment at the highest common denominator of service capabilities shared by all participants; and

2) the dynamic and selective modification of service parameters during "call" progress.

II.3.5 Performance trade-offs

The primary media components are *voice* and *imagery*. Resolution requirements for the medical images take precedence over the associated increase in transmission delay. For portable terminal applications, resolution also takes precedence over the area of spatial coverage as long as mechanisms are provided for selecting the boundaries of the area to be viewed.

The consultation may be conducted in either a full-motion video or still-frame audiographic mode of operation, depending upon the terminal and transmission capabilities available to the participants.

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