Survey of Current Efforts and Potentials in Application of Telemedicine in Ethiopia

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Abstract

The health care system of Ethiopia is characterized by low level of health care coverage across the country. According to the latest Health and Health related indicator published by the Ministry of Health (MoH), the health care system can only provide basic services to 61% of the population. Physician to population ratio is one of the lowest in the world, with 1 physician/health officer serving 25,958 people. Since most of the physicians are stationed in the urban areas the above ratio shows a large variation across the regions, which goes to as low as 1 to 72,764 in some rural areas. Delivering proper health care to the rural areas, where more than 80% of the population is living, has been a challenging task. Telemedicine – delivery of health services through the use of ICT – that has met wide success in alleviating such problems in other developing countries is considered a potential solution and forms the focus of this study.

To study the past and current effort on the application of telemedicine in Ethiopia, a survey of government, public and private hospitals was conducted. The survey included stakeholders of the health care system of the country through interviews and questionnaires. The study was conducted as part of an ongoing research entitled: "**design of architecture and implementation issues for a terrestrial and VSAT-based national telemedicine network**". The result of the survey indicated that there have been few attempts to introduce telemedicine in Ethiopia. These efforts were found to be effective in creating awareness on the benefits of telemedicine; but with a limited scope.

The study also investigates interests of the growing number of private hospitals that may have sufficient funds to implement telemedicine systems and identifies the specific area of telemedicine the private hospitals would be interested. The attitudes of medical professionals towards the use of ICT, in particular the use of telemedicine system was also surveyed and presented in this paper.

The study also will identify specific tele-health and telemedicine areas that are very relevant for Ethiopia. Two considerations are possible here. For the national network for the public and government hospitals, the health issues of relevance and immediate importance include prevention, education and treatment for the major killer diseases in the country such as tuberclosis, HIV/AIDS, child-delivery related, etc. For the growing number of private hospitals and clinics that may have sufficient funds and clients willing to pay, the national

1. Introduction

Ethiopia is an East African country, with a land area of approximately 1.1 million square kilometer. Currently the population of Ethiopia is estimated to be about 69.1 million, out of which more than 80% live in the rural areas. The country is subdivided in to 9 national regional states and 2 administrative states.

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The health care system of the country is underdeveloped. According to the latest Health and Health related indicator published by the Ministry of Health (MoH), the health care system can only be able to provide basic services to 61% of the population. There are only 119 hospitals of which 83 are under the ministry and 36 owned by Non Governmental Organizations (NGO), private investors and other government agencies [1]. Physician to population ratio is one of the lowest in the world 1: 25,958[2]. As most the physicians are stationed in the urban areas regional ratios show a large variation. For example in one of the regional states-Harari the above ratio is 1:3179 whereas in Somali regional state the ratio is 1:72,764 [1]. Moreover, more than 60% of the specialists are working in the capital city Addis Ababa.

In most of rural areas traditional practices like early marriage, circumcision, etc result in frequent medical problems and trauma on women and children. Child mortality and maternity problems are severe when compared to the cities. An estimated 60 – 80% of the health problems in the country are due to infectious and communicable diseases and nutrition problems [2].

As a result of poor transportation and other infrastructures in the country, delivery of heath care and educating the people in the rural areas have been challenging tasks. The rural people have to travel long distance to cities to get proper medical care. Their journey is difficult as the land is characterized by mountainous terrain and there is no adequate transportation. Other infrastructures like electric power, clean water, telecommunications etc are unknown to most of the rural people. This in turn worsens the problem of health care delivery to the underserved and un-served remote areas. However uniform health care coverage requires that health care be readily available to all citizens, including those people living in smaller cities and rural areas.

Telemedicine - the use of telecommunication to deliver health care from distance - can be a cost effective solution to fill the gap created by the lack of highly qualified experts in different fields of medicine in rural and remote areas and even in urban areas in Ethiopia. It allows medical personnel at the underserved areas to get specialist support from hospitals in the cities. By doing so, telemedicine can address two of the problems facing the health care system of the country: *inadequate access and uneven resource distribution*. This is particularly important in rural areas that lack the means to get access to proper health care and unable to employ medical personnel. It may also be important in the cities as a means to get access to advanced health care systems and specialist support from physicians living abroad.

2. Method

This preliminary study was conducted as a background work for an ongoing research in title: "**design of architecture and implementation issues for a terrestrial and VSAT based national telemedicine network".** As a result the first thing we had to do was to study current telemedicine effort in Ethiopia. The methods we have used to conduct this study are as follows.

Stakeholders of the health care system in the country such as the Ministry of Health (MoH) and Faculty of Medicine (FoM) were contacted. Concerned officials were interviewed on the current status of telemedicine effort in Ethiopia. Then four members of the National Telemedicine Coordinating Committee (NTCC) were approached and interviewed on what the committee has been doing in relation to telemedicine. The information obtained from these sources was considered enough as far as public and government health institutions are concerned.

To find out where the private sector is in relation to telemedicine, a survey questionnaire was distributed to private hospitals practicing in the capital Addis Ababa. The capital was selected because, there are only 14 private hospitals in the country and 12 of them are in the capital. The survey asked whether the hospitals are using ICT, both in their administrative and clinical practices. It

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[2] Ratio includes 631 health officers

also asked them to express their attitude about the application of telemedicine and given the chance to select specific area of telemedicine. In addition to these, documents form different sources, such as libraries and the Internet were revised.

3. Result

The study showed that there were few attempts to introduce telemedicine in its modern form to Ethiopia. However, none of the efforts could reach to the stage of implementing and utilizing telemedicine technology. The efforts can be categorized according to the owner of specific telemedicine activity.

3.1. Effort by NTCC

Introducing telemedicine to Ethiopia is a cost effective means to improve delivery of health care to the rural areas. It also helps to educate the public on prevention methods. But, it requires creating awareness and working hard on building up of telecommunication infrastructure, to underserved regions. There have been some attempts to introduce telemedicine in Ethiopia.

Efforts to introduce Telemedicine in Ethiopia started around 1997. In June 1997, the Ethiopian Telecommunications Corporation (ETC) recognized Telemedicine as one of its services [3]. During the same time, Faculty of Medicine (FoM) was attempting to create awareness of telemedicine and its benefits to concerned government and non-government organizations in the country, using brochures. This activity was supported by UNECA. In February 1998, a National Telemedicine Coordinating Committee (NTCC) was established with the objectives of organizing Telemedicine effort in Ethiopia. The committee was composed of representatives from three local partners namely: Ministry of Health (MoH), ETC and FoM.

Following ITU's commitment to support telemedicine pilot projects in developing countries in the first World Telemedicine Symposium for Developing Countries [5], NTCC prepared a telemedicine initiative project proposal and submitted it in July 1999. The project proposed to connect ten selected sites (hospitals and medical institutions) to the Internet. The project considers medical consultation among the selected sites as a major objective. ITU accepted the proposal in August 1999, and promised to provide the telemedicine initiative by providing material and expert support. After 11 moths, following the promise, ITU expert arrived to Ethiopia to visit sites selected to be connected in the first phase of the project. The Expert's report, a Project Implementation Document [9], was sent to Ethiopia in April 2001. As it was specified in the document, the project would be implemented in the following three phases [4]:

- **Phase I**: Pilot program, involves connecting ten sites,
- **Phase II**: Expanding the telemedicine network to more hospitals and health institutions in the country,
- **Phase III**: Expanding it further to join International Telemedicine networks.

By the time of writing this thesis, the first phase of the pilot project is expected to be implemented. Testing the system's operation has been scheduled for November 2003 [3]. But as we learned from the ITU's regional representative, here in Addis Ababa, the digital cameras for the ten sites and a server to be installed at the central site have not been purchased yet. The ITU experts are expected to come to Ethiopia to implement the pilot project after the purchase of the necessary equipment.

Different local and international partners supported this pilot project. Each of them is committed to play specific roles for the successful Implementation of Phase I, the pilot program. These partners include from local: MoH, FoM, ETC and Ethiopian Telecommunication Agency (ETA). International partners include: ITU, World Health Organization (WHO), United Nations Economic Commission for Africa (UNECA) and United Nations Education and Science Commission (UNESCO).

The total cost of the project is estimated to be 76,122 USD from which 55,000 USD will be contributed by ITU, in kind, for the purchase of Telemedicine system equipments and expert advice. A two party agreement was signed between ITU and Ministry of Finance and Economic Development (MoFED).

3.1.1. State of the Network

In the pilot project, a telemedicine network is formed by connecting 10 hospitals across the country by providing them with dial up Internet connection. There is an existing LAN in the central site (FoM). The LAN is base on Ethernet technology, which is used to allow students of medical faculty get access to collection of journals, and publication electronically. The other use of the LAN is to share Internet connection. All the connected workstations are in one room (Computer Center). Students and physician have to go to the room when they want to get connected to the Internet or look for some electronic journals. A server in another room stores the publications. This LAN is serving only the faculty, for educational purpose. On the other hand a number of other standalone PCs are used in some of the department offices.

The over all network connection is not documented. The only diagram one can find about the WAN connection is attached in the **Annex I** of the component project document [4]. It shows how the 9 hospitals are connected to the central hospital in a kind of star topology. However, it is the telemedicine application's logical view, which depict that the central site is where all the consulting specialists are stationed.

The conceptual network diagram of the existing telemedicine network, as understood by the researchers is shown in Figure 1 below. All the ten sites will have dialup Internet connection from the sole Internet Service Provider, ETC through the Public Switched Telephone Network (PSTN). Each hospital will be quipped with a digital camera and scanner for dermatology digital image acquisition. The national Gateway at the Sululta satellite ground station connects to Intelsat Indian Ocean and Atlantic Ocean regional satellites [33]. There are no firewall or internetworking devices such as switches involved in the current telemedicine network. The only device used to connect the 10 hospitals is the modems attached to each of the PCs.

3.1.2. Drawbacks of the Current Network

The problem of the current system starts from the very fact that there was no design specific to telemedicine, used in the pilot project. This is because, the objective was to provide Internet service to the selected hospitals to enable doctors, communicate for consultation using e-mails. Providing hospitals with Internet connection cannot be considered as a telemedicine implementation. Some of the drawbacks of the pilot project are:

1. There is no GUI specific to telemedicine. This could be a problem because doctors will be obliged to use commonly available general-purpose email programs to communicate. It will be difficult for doctors to learn and understand the system easily and to distinguish telemedicine communication to the day-to-day emails.
2. There is no patient/physician database design considered in the pilot project. Storing patient data, for future use or physician data to identify the users is not possible if databases are not included in the system.
3. Expansion of the network, as it was planned in the phase-wise implementation plan of the project [3] is not visible, as there is no system design.
4. The project considers the use of e-mail and file attachment. This will be difficult if there would be a need to transfer larger files like medical images and x-ray files.
5. Using e-mail, it would be difficult to structure the information exchange among the doctors. Doctors will be forced to summarize the patient information every time they write referrals and give feedbacks.

6. It would be difficult to secure the patient information and the system as whole unless the PCs connected to the Internet are locked and used only for the purpose of telemedicine services.

Hence there was a need for new telemedicine system design that will have its own GUI, database and uses the existing ICT infrastructure for its network connectivity.
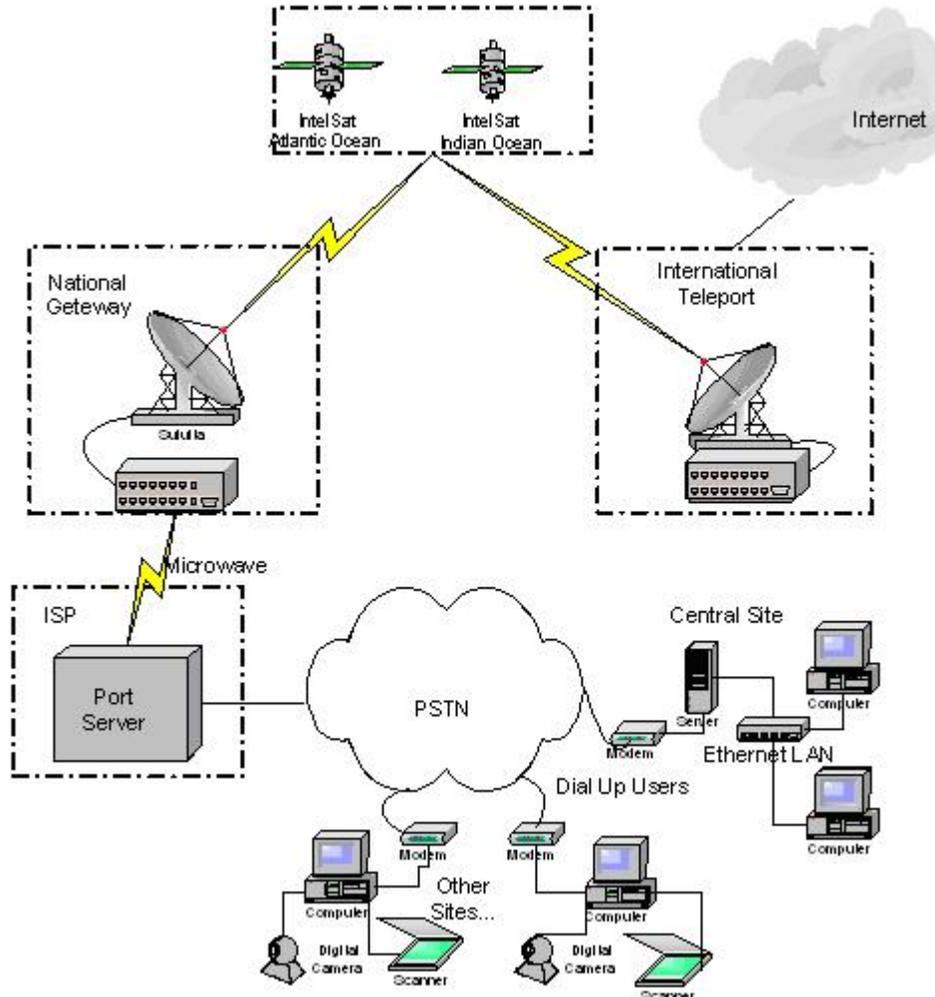

Figure 1: Conceptual network diagram of the pilot project

3.2. Effort by Private Hospitals

The survey of private hospitals ware conducted using a questionnaire and interviews. Using the questionnaire we have tried to investigate the IT/ICT usage in private hospitals. Then we have included questions to find their communication needs, particularly the communication with other hospitals. At the end of the questionnaire we have added questions about their attitude towards the use of telemedicine and choice of specific area of telemedicine.

The questionnaire was distributed to 12 private hospitals, practicing in the capital city Addis Ababa. Eight of the hospitals participated by completing the questionnaires. Out of the 8 participants 2 of them were willing enough to discuss questions with the researcher to give more information in the form of interviews. The next paragraphs and the tables presented the survey result.

3.2.1. ICT Usage in Private Hospitals

All of the 8 participant private hospitals indicated having computers to support their day-to-day activates. Among them half 50% of the hospitals reported having less than 5 computers, whereas the other half indicated having in the range of 5-10 computers, in their respective offices.

Table 1: Availability of computers in private hospitals

Number of computers	No. of Private Hospitals	Percent
None	0	0.00%
Less than 5 computes	4	50.00%
6 to 10 computers	4	50.00%

The hospitals use their computers for a variety of applications. Among the applications, Microsoft Office package the most commonly used to support their Administration and Finance routines. All the hospitals reported that they use their computers for supporting their administrative and finance routines. A mall proportion of the hospitals only 12.50% of them reported to use the computers for maintain Electronic Patient Records (EPR). A significant percent of the hospitals, 87.50% use their computers for recording patient visits at the front desk, which they call Reception - of the hospitals. Our observation also confirmed that, behind the front desk of the hospitals receptionists could be seen using one or two computers.

Table 2: Use of computers in private hospitals

Use of Computers	No. of Private Hospitals	Percent
Administration and Finance Routines	8	100.00%
To Record Patient Visits/Schedules and Appointments	7	87.50%
To Maintain Electronic Patient Record	1	12.50%

The computer systems used in the majority, 62.50% of the hospitals are standalone computers. Only 37.50% of the participants reported that their computers are networked for file or printer sharing. None of the hospitals have networks for database access and sharing Internet connections. We have also observed employees taking files using diskettes from on computer to another for printing. The computers are equipped with Microsoft products, running on of the Ms-Windows version.

Table 3; Computer systems in private hospitals

Type of Computer Systems	No. of Private Hospitals	Percent
Standalone Computers	5	62.50%
Networked for File and Printer sharing	3	37.50%
Networked for Internet Connection	0	0.00%
Networked for Database Access	0	0.00%

Internet connection seems common in the private hospitals. A majority of them, 87.50% reported that they have a dial up Internet connection, provided by the Ethiopian Telecommunications Corporation. Only 12.50% reported not having Internet connection.

Table 4: Internet connection in private hospitals

Internet connection	No. of Private Hospitals	Percent
Have Internet Connection	7	87.50%
Have No Internet Connection	1	12.50%

In those hospitals with Internet connection, the popular application used 85.71% of them used their Internet connection to send and receive E-mail messages. Use of the Internet for web browsing and electronic document searching is reported by 57.14% and 28.57% of the hospitals respectively. Only 14.29% of the participant private hospitals have web presence (have web site).

Used their Internet Connection	No. of Private Hospitals	Percent
For E-mail	6	85.71%
For Web browsing	4	57.14%
For searching electronic Documents	2	28.57%
Have Web site	1	14.29%

Few of the participant hospitals employ IT / ICT staff. 87.50% of them do not have IT / ICT staff employed in the hospitals. Only 12.50% employed 0 to 2 staff with the job titles related to IT / ICT. As we have learned from the additional interviews, these hospitals are also teaching hospitals, which do have nursing college along with the hospitals.

Table 6: Number of IT / ICT staff in the private hospitals

Number of ICT / IT Staff	No. of Private Hospitals	Percent
None	7	87.50%
0 to 2	1	12.50%
2 to 5	0	0.00%

3.2.2. Use of Digital Medical Instruments

More than half of the private hospitals do have one or more medical instruments which are capable of digital data acquisition. Among the digital medical instruments, Possession of Laparoscopy surgery unit is reported by one of the hospitals. CT scan, Endoscopies, Photometers, ECG, EEG and Ultrasound units are reported by 62.50% of the respondents. 42.86% of the hospitals reported not having digital medical instruments.

Table 7: Possession of digital medical instruments

Digital Medical Instruments	No. of Private Hospitals	Percent
Have none	3	37.50%
Have one or more	5	62.50%

3.2.3. Automation

The hospitals were also asked to state if they have any plan of automation, to facilitate their day-to-day activities. Only 12.50% of the hospitals have no interest in automating any of the operations. 87.50% do want to automate some of the operations in their hospitals.

Table 8: Interest to automate activities in the private hospitals

Automation Interest	No. of Private Hospitals	Percent
Interested to automate operations	7	87.50%
Not Interested to automate	1	12.50%

Among the 87.50% of the private hospitals, 42.86% of them want to automate their stock control system, particularly to control their pharmacies along with the finance and admin routines. Automating the front desk, Reception activities and their finance routines are reported by 28.57% of the hospitals. Only 14.29% of them indicated interest in automating their activities in the laboratory, maintenance of patient record and to have general hospital management information system.

Table 9: Systems to automate in private hospitals

Type of system to automate	No. of Private Hospitals	Percent
Stock Control for their pharmacies	3	42.86%
Finance Routines	3	42.86%
Patient Appointment and Schedules	2	28.57%

Laboratory (Clinical Chemistry)	1	14.29%
Patient Record System	1	14.29%
General Hospital Information System	1	14.29%

3.2.4. Communication Needs

To survey the communication needs of the private hospitals they were also asked if they communicate with any hospital in the country or outside the country. All of them reported to have communicated with other hospitals. 37.50% of them reported to have communicated with other hospitals both local and abroad. The same percentage of the hospitals reported to have communicated with local hospitals only. A few percentage, 14.29% of the hospitals reported to have communications with hospitals outside the country only another 12.50% reported to have never communicated with other hospitals.

Table 10: Communication of private hospitals with other hospitals

Communicate with other hospitals	No. of Private Hospitals	Percent
None	1	12.50%
Local only	3	37.50%
Abroad only	1	12.50%
Both Local and Abroad	3	37.50%

Telephone is used by all of the participating hospitals to communicate with other hospitals. Second popular means of communication are postal services and e-mail, which are reported to be used by 71.43% of the hospitals. Web based applications is reported to be used by only 14.29% of the hospitals to communicate with other hospitals.

Table 11: Means of communications used by private hospitals

Means of communication	No. of Private Hospitals	Percent
Telephone	7	100.00%
Postal Services	5	71.43%
E-mail	5	71.43%
Web based application	1	14.29%

The frequency of communication by the private hospitals with other hospitals also varies. More than half of them, 57.14% reported to have communicated with other hospitals between 5-20 times in one month. 28.57% of the hospitals communicated less than 5 times in one month. Only 14.29% reported to have communicated more frequently, more than 20 times in one month with other hospitals.

Table 12: Number of communication by private hospitals with other hospitals

Frequency of Communication in one Month	No. of Private Hospitals	Percent
Less than 5 times	2	28.57%
5 to 20 times	4	57.14%
More than 20 times	1	14.29%

More than half of the hospitals, 57.14% wanted to employ computer networks for their remote communications with other hospitals. The purpose of communication need is reported to be medical consultation, referral and exchange of information by all of these hospitals. 42.86% of the hospitals do not show interest to employ computer networks to communicate with other hospitals.

Table 13: Interest to employ computer networks for remote communications

Computer Networks For remote communication	No. of Private Hospitals	Percent
Interested	4	57.14%
Not Interested	3	42.86%

When asked to give their opinion on a possible nation wide telemedicine network, which connects all regional hospitals and clinics with urban hospitals, 62.50% of them reported that it will be good to deliver health care to remote areas of the country. The same percentage of the hospitals believed that the network would help to improve quality of care in the urban areas as well. 25.00% of the hospitals reported that such a network is too far to be achieved in this country. 12.50% of the hospitals expressed their fear that such a system may bring about complicated issues such as privacy and security.

Table 14: Opinion of private hospitals on a possible nation wide telemedicine network

Opinions on possible Nation-wide TM Network	No. of Private Hospitals	Percent
Good to deliver health care to remote areas	5	62.50%
Good to improve quality of care in urban areas	5	62.50%
Too far to achieve	2	25.00%
May bring complex issues such as privacy	1	12.50%

The majority of the participant hospitals, 75.00% reported that cost of advanced electronic medical instruments and computers inhibit the development of telemedicine in our country. 62.50% of them reported that ICT awareness and lack of computer skill of employees are also among the inhibitors of the development of telemedicine. Budget is reported to be one of the inhibiting factors by 57.14% of the respondents. Medical Ethics, Medico-legal issues and culture were considered as inhibiting factors by 25.00% of the respondents.

Table 15: Inhibiting factors of the development of telemedicine by private hospitals

Factors inhibiting development of TM	No. of Private Hospitals	Percent
Cost of computers and medical instruments	6	75.00%
ICT awareness and skill of employees	5	62.50%
Budget	4	50.00%
Medical Ethics	2	25.00%
Medico Legal Issues	2	25.00%
Culture	2	25.00%

All of the hospitals participated showed interest in joining a nationwide telemedicine network if it can be implemented. 50.00% of them strongly agreed to join, and the other half just agreed.

Table 16: Interest to join a nation wide telemedicine network

Interest to Join Nation Wide TM Network	No. of Private Hospitals	Percent
Strongly Agree	4	50.00%
Agree	4	50.00%
Uncertain	0	0.00%
Disagree	0	0.00%
Strongly disagree	0	0.00%

Considering the development of their own telemedicine system, half of the participant hospitals have chosen not to respond. Among the other half, none of them reported to consider it within one year. 25.00% of the hospitals consider introducing telemedicine systems to their hospitals within the next one to three years. The other half of the hospitals reported to have considered developing their own telemedicine system after three years.

Table 17: Developing telemedicine systems in private hospitals

Consider developing TM Systems	No. of Private Hospitals	Percent
Chosen not to respond	4	50.00%

Within one Year		0	0.00%
In the next 1 to 3 Years		2	25.00%
After 3 years		2	25.00%

Currently none of the participant hospitals indicated having funds for the development of telemedicine. Only 12.50% of them reported that the availability of fund for the development of telemedicine depends on the cost of installing and maintaining such a system.

Table 18: Availability of funds for the development of telemedicine

Have Fund to develop TM System	No. of Private Hospitals	Percent
Yes	0	0.00%
No (Not Now)	7	87.50%
Depends on the cost	1	12.50%

The last question asked to the private hospital was to choose among specific areas of specialization, on which they would be interested to apply telemedicine. A relatively higher percentage, 62.50% of them identified Cardiology as a major interest area. Oncology indicated by 50.00% of the participants and Gynecology / Obstetrics and Endocrinology were chosen by 37.50% of the hospitals. 25.00% reported to be interested by General practice / family practice, Pediatrics, Diabetic patient management, Gastroenterology / Endoscopies, Infectious Disease and Radiology. Among the list of specializations, Dermatology, Pathology and Psychiatry have not been chosen by any of the hospitals. In addition to the list of specializations we have provided the respondents Laparoscopy Surgery, Surgery, Dentistry and Rheumatology were added by 12.50% of the hospitals as areas of interest. The following table shows the list and number of hospitals interested in each of the specializations.

Table 19: Choice of specific areas of telemedicine by private hospitals

Interest on specific area of telemedicine	No. of Private Hospitals	Percent
Cardiology	5	62.50%
Oncology	4	50.00%
Gynecology / Obstetrics	3	37.50%
Endocrinology	3	37.50%
General practice / family practice	2	25.00%
Pediatrics	2	25.00%
Diabetic patient management	2	25.00%
Gastroenterology / Endoscopies	2	25.00%
Infectious Disease	2	25.00%
Radiology	2	25.00%
ENT / Otolaryngology	1	12.50%
Nephrology / urology	1	12.50%
Neurology	1	12.50%
Ophthalmology	1	12.50%
Orthopedics	1	12.50%
Laparoscopy Surgery	1	12.50%
Surgery	1	12.50%
Dentistry	1	12.50%
Rheumatology	1	12.50%

Interest on specific area of telemedicine	No. of Private Hospitals	Percent
Respiratory Medicine	1	12.50%
Dermatology	0	0.00%
Pathology	0	0.00%
Psychiatry	0	0.00%

Before completing the questions, the private hospitals ware asked to express their feelings about the benefits of telemedicine systems. 62.50% of the participants expressed their feelings saying that, they could benefit from the application of telemedicine by:

- Getting up to date information
- Improve quality of services
- Update modes of patient management
- Get access to current development in various specializations
- Assist in the management of controversial cases
- Obtain information on results of research works related to medical discipline
- Exchanging information in a diversified forms (text, image, audio and video)
- Experience sharing
- References

Table 20: Private hospitals feeling on the benefits of telemedicine

Feeling about the benefits of TM	No. of Private Hospitals	Percent
Responded	5	62.50%
Not responded	3	37.50%

3.3. Other Efforts

In addition the efforts of NTCC and private hospitals, there have been some indications of interest to introduce telemedicine in Ethiopia. According to a published document from the Internet, ETC presented papers to international conferences showing interest to introduce this technology to Ethiopia [6].

A newly established ministry, Ministry of Capacity building has a program known as ICT capacity building program. As part the program the ministry plans to introduce ICT is in the health sector of the country. Recently the program has done a survey: "The Ethiopian Baseline Study on the Deployment and Exploitation of ICT, 2003." As part of this study the deployment and exploitation of ICT in the Health sector was surveyed [7]. The study targeted both Teaching and Non-Teaching hospitals, as well as health posts/centers, clinics and pharmacies across the country. Lastly, there are some documents in the Internet that discuss specific cases of telemedicine trial [8], calling support for telemedicine projects [9], and so on.

4. Discussion

As can be seen from the result of this survey, efforts to introduce telemedicine technology have been started 6-7 years ago. Though the development is shown to be slow, the efforts played significant role in creating awareness. It is now known that there are significant potential advantages and benefits from telemedicine in countries like Ethiopia, where about 40% of the population does not get access to basic health care services.

Cost of advanced medical instruments, computers, and telecommunication infrastructure have been some of the inhibiting factors of the development of telemedicine in Ethiopia. Sustaining

telemedicine financially could also be questionable unless the country budgets for the provision of telemedicine as a service. The national government health expenditure per capita has increased form 3.4 to 11.9 in the last 15 years [1]. The recent ICT focused development strategy of the country is also encouraging. The rapidly declining cost in hardware would certainly bring more interest in the utilization of ICT in health sector. However cost of telecommunication will still be challenging in the case of Ethiopia.

More ICT is being exploited in the education and government administration sectors. The ShoolNet VSAT network and the associated Government network [10] are good examples of ICT development in Ethiopia. Developing telemedicine services in line with these developments using their telecommunication infrastructures could be more economical to facilitate provision of medical information and health care to rural areas.

A more planned and coordinated effort is necessary to implement telemedicine application, which will be able to solve the shortage of medical and health care in the country. Coordination among government bodies both in the health care system and telecommunication sector, private hospitals, NGO and educational institutions should be considered. In addition to the local participation support of external donor agencies is necessary in funding telemedicine projects.

5. Conclusion

Like most of the developing countries Ethiopian people suffer form the shortage of health care delivery. The rural people particularly are disadvantaged as a result of underdeveloped health care system as well as other sectors. The country can benefit from the application of telemedicine to solve the problem of health care delivery in a cost effective way.

As reported in this survey, awareness of telemedicine has grown among most of the important stakeholders of the health care system in the country. The telecommunication sector has to continue to subsidize the heath care sector to promote the development of services such as telemedicine, using higher quality network connections.

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10. Official web site of the Ethiopian Telecommunication Corporation: http://www.telecom.net.et.