UTILIZATION OF TELEMEDICINE IN TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA.

MASTER OF SCIENCE IN HEALTH INFORMATICS

ADDIS ABABA UNIVERSITY SCHOOL OF GRAGUATE STUDIES

SCHOOL OF PUBLIC HEALTH AND INFORMATION SCIENCE

BY

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JUNE 2013

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A thesis submitted to the school of graduate studies of Addis Ababa University in partial fulfillment of the requirements for the degree of Masters of Science in health informatics.

BY

BELAY TAMIRU SHITA

Names and signatures of the examining boards

Names	Titles	Signatures	Date
1._____	Chairman	_____	_____
2._____	Advisors	_____	_____
3._____	Advisors	_____	_____
4._____	Examiners	_____	_____
5._____	Examiners	_____	_____

Dedications

I dedicate this thesis manuscript to my beloved parents, TAMIRU SHITA and ENKUAHONECH DESSIE and my wife, EBISTIE TIRUNEH for their motivation, love and affection in the success of my life.

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First of all, I would like to thank Almighty God and his mother Virgin Marry gave me the courage and power to finish this paper.

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Acronyms

AA - Addis Ababa

AAU - Addis Ababa University

AAU-MF- Addis Ababa University Medical Faculty

AOR- Adjusted Odds Ratio

CI - Confidence Interval

COR- Crude Odds Ratio

DICOM- Digital Images Communication in Medicine

EMR- Electronic Medical Record.

Epinfo- Epidemiological information (software)

GP - General Practitioner

ICT - Information Communication Technology

IRB- Internal Review Board

ISDN - Integrated Service Digital Networks

MOE- Ministry of Education

MOH- Ministry of Health

MOIC- Ministry of Information and Communication

PACS - Picture Archiving Communication System

PI- Principal Investigator

POTS - Plain Old Telephone Services

SPSS- Statistical Packages for Social Sciences (Software)

TASH- Tikur Anbessa Specialized Hospital

TM- Telemedicine

WHO- World Health Organization

ABSTRACT

Background: The benefits of telemedicine services are very significant to the society for improving the quality and access of health in the health care delivery system. However, the number of service provision sites is limited, inaccessible and the service is underutilized by the majority of the community due to various factors in Ethiopia.

Objective: The objective of this research is to explore the level of telemedicine utilization, in Tikur Anbessa Specialized Hospital.

Methods: A cross sectional study was conducted in Tikur Anbessa Specialized Hospital from February to April 2013 among 422 health professionals. Quantitative data were collected through self-administered pre-tested questionnaires and complemented by a qualitative data using self interview questions and observation checklist. Quantitative data were initially entered in to EPi-3.5.1 version and exported to SPSS version 16.0 for analysis. Descriptive statistics, COR, AOR and 95% CI were calculated. Logistic regressions were carried out to identify the major predictors' of telemedicine underutilization. Qualitative data were analyzed thematically.

Results: Majority of participants 65% were males and medical specialists were 56.3%. Of the total respondents only 40.6% used telemedicine services and 84.5% of them used the services less than five times a year. Among other factors technology (AOR=9.06 95%CI 3.08, 26.63) and administrative problems (AOR=3.52 95%CI 1.79, 6.95) and legal issues (AOR=2.21 95%CI 1.14, 4.26) were identified the major predictor for telemedicine underutilization. Lack of internet connectivity, system unreliability, system user un- friendly and lack of users' technical assistant were some of the technological barriers reported in both quantitative and qualitative findings.

Conclusion and recommendation: This study revealed that telemedicine services are generally underutilized. Technology and administrative problems; and legal issues were identified as the major factors. Among technological barriers internet connectivity and system reliability are the major problems identified. Knowing and identifying the factors was vital for considering future in depth studies and taking appropriate measures to fix the problems faced in the portfolio.

Key words: -- Telemedicine, Technological barriers, Telemedicine utilization, Tikur Anbessa Specialized Hospital.

CHAPTER-ONE

INTRODUCTION

1.1 Background

One of the greatest challenges facing humankind in the 21st century is to make high-quality health care available to all. Although the vision of WHO is health for all, its realization is difficult, perhaps impossible, because of the burdens imposed on a growing world population by chronic and acute diseases, rising expectations for health, and socioeconomic conditions of the society that increase disparities in health status between and within countries. Traditional way of achieving equitable access to health care is very difficult because the provider and the recipient must be present in the same place at the same time. The advancement of information and communication technologies created opportunities for overcoming the problems by alternative ways of accessing health care services by using telemedicine services (1).

Telemedicine is an alternative way of giving health care services which address the health problems especially in developing countries like Ethiopia because of shortage of health professionals and health care facilities. Tikur Anbessa Specialized Hospital is the largest of all hospitals in Ethiopia and it provides a tertiary level referral treatment. The hospital is administered by AAU and it is also the largest and oldest teaching hospital among others in Ethiopia. Tikur Anbessa Specialized Hospital offers diagnosis and treatment services by different specialty disciplines including telemedicine. Telemedicine unit in TASH is under the radiology department and gives different services such as tele-consultation and tele-education among various applications of telemedicine services (2).

Telemedicine is the use of information communication technology to deliver health care services from one location to another in different approaches (for example store and forward, real-time and remote monitoring) that has the potential to increase the quality and access to health care and to lower patient costs. Telemedicine involves secure transmission of medical data and information, such as biological/physiological measurements, images, audio, video, or any other type of data needed for prevention, diagnosis, and treatment, follow-up and monitoring of patients (3).

Telemedicine services range from individual patients to healthcare systems as a whole from single mobile consultations up to highest surgical procedures and play an important role in providing solutions for health challenges. For instance, telemedicine maximizes the use of existing health care professionals by allowing them to diagnose from distance, monitor and recommend treatment for patients located in remote areas. Telemedicine service in general is one of the promising services in the health care delivery system to achieve sustainable and equitable healthcare services in developing countries by using information and communication technologies to address some of the societal health challenges (4).

1.2 Statement of the Problem

Proper utilization and provision of telemedicine services in health institutions has numerous advantages such as improved access to specialists, increased patient satisfaction with quality of care, improved clinical outcomes and reduce patient costs. However, despite the considerable level of technical maturity of different technologies, the sector is not developed to address the problems of health services in Ethiopia. The number of service provision sites is limited and are inaccessible by the large majority of the community. For example telemedicine services are only found in Tikur Anbessa and Nekempt Hospitals established in collaboration with the Indian super specialty hospitals and the two Ethiopian hospitals by the agreement of African Union and Indian governments in Pan-African networking. The type of telemedicine services found in TASH is tele-education and tele-consultation; the approaches are store and fore ward and real time approaches. However, its completeness and quality is compromised for unknown reasons (5).

Research indicated that there are many factors which result in major decreases in telemedicine adoption and utilization. Some of these factors included knowledge and perception of health professionals, and lack of awareness towards telemedicine technology, legal issues, and financial, administrative, and technological problems. In addition to these major challenges, shortage of telemedicine professionals and poor infrastructures are also commonly faced. Measuring the level of telemedicine utilization, identifying other contributing factors for telemedicine utilization and technological barriers of telemedicine is important because these might be responsible for the failure of many telemedicine projects (6). Even though the

importance of telemedicine services is very significant to the society, technological barriers and other barriers are significant cause of disappointing telemedicine adoption and proper utilization rates (7).

As observed telemedicine unit in TASH for the last two years, the unit didn't provide the appropriate services as users' expected. Given the importance of this sector and the benefits it could provide, the concerned officials, stack holders and users of healthcare services, did not support the implementations and proper utilization of telemedicine services in Ethiopia. The current perceptions and understandings towards telemedicine in Ethiopia are not matured as a result of insufficient data and evidence of the telemedicine utilization problems. Hence, this research measured the level of telemedicine utilization, identified technological barriers for telemedicine and also other contributing factors for underutilization of the service. In this research the following research questions are addressed.

- What are the main determinant factors for telemedicine underutilization in Tikur Anbessa Specialized Hospital?
- What are the main potential technological barriers in Tikur Anbassa Specialized Hospital telemedicine unit?

1.3 Rationale and Significance of the Study

Telemedicine service is in its infant level and underutilized in our country as observed in Tikur Anbessa specialized hospital. The study helped to explore the existing facts on telemedicine services and identified potential barriers of telemedicine utilization in Tikur Anbessa Specialized Hospital. The research findings also contribute informational input for users and stakeholders to make informed decision and to develop future program in the area of telemedicine. Further research trials can also baseline on this cross-sectional study findings. Recommendations given to the hospital community and all intended entities based on the study findings are also relevant.

1.4 Objectives of the study

Here below are listed the general and specific objectives.

1.4.1 General Objective

The main objective of the study was to explore the level of telemedicine service utilization in Tikur Anbessa Specialized Hospital, Addis Ababa University College of health science, Addis Ababa.

1.4.2 Specific Objectives

The specific objectives are:

- To measure the level of utilization of telemedicine services.
- To identify technological barriers in the use of telemedicine applications.
- To assess other contributing factors for telemedicine underutilization.

1.5 Scope of the study

The cross-sectional study included health professionals working in Tikur Anbessa Specialized Hospital. These included medical specialists, medical doctors, nurses, radiologic technologists, laboratory technologists and pharmacists among other professionals on utilization of telemedicine.

1.6 Organization of the study

This thesis has five chapters. The first chapter deals with the introduction, statement of the problem, rationale, objective and scope of the study. The second chapter includes the literature part in the area of telemedicine. The third chapter presents the methodology which discusses the overall procedure of data collection, analysis, and interpretation. Both quantitative and qualitative findings, discussion of the study and strength and limitations are presented in the fourth chapter. Finally the fifth chapter brings to an end of the study with conclusion and recommendations.

CHAPTER-TWO

LITERATURE REVIEW

2.1 Utilization of Telemedicine

Telemedicine is the use of ICT to provide health care services where distance is a critical factor by health care professionals for the exchange of valid information for diagnosis, treatment and prevention of diseases and injuries. A closely associated term is tele-health, which encompasses a broader definition of remote healthcare that includes nonclinical services, such as patient education, disease self-management, and medical training for providers. Telemedicine ranged from simple telephone consultations up to highly complex tele-surgery. It is an established type of technology, used in one form or another for over 40 years with introduction of availability of low cost, high quality computers and high speed internet, more powerful computer technology making real-time audiovisual communication feasible (8).

The perception of using telecommunications in the healthcare industry goes back to the early 1900's by using common technologies like telephone and similar equipments. The use of telemedicine services grew rapidly in the 1990s due to the development of new technology tools to support efficient and quality health care delivery system (8). The implementation of telemedicine services and caring in home by using different technologies from plain old telephone system to broadband were becoming more common due to the growing interest in using home portable technological devices. The interest in telemedicine has grown rapidly in the last decade due to demand for electronic patient monitoring systems remote from the source through technological advancements in the case of tele-monitoring (9).

Currently, telemedicine integrates information technology, computer technology and medical technology. Common applications of telemedicine and tele-health include video conferencing between a patient and health care provider for a consultation or among groups of patients or providers for education, support, and care coordination, transmission of data, such as x-rays, photographs, video, and audio files; remote monitoring of vital signs and other health indicators and internet applications for patient education and disease management. Nowadays, telemedicine programs have become common throughout the world in nearly every specialty area of healthcare such as radiology, dermatology, continuing education, homecare, emergency

care, mental health, rehabilitation, cardiac monitoring, and every medical and surgical specialty (10).

Telemedicine system in Ethiopia provides connectivity to telemedicine setup of super specialty Hospital in India in pan-African networking agreements between African union and Indian governments. Initially telemedicine is planned to provide services of medical consultation and treatment in the areas like cardiology, radiology, dermatology, neurology, pathology, gynecology, general medicine and infectious diseases etc. as per the requirement of Ethiopian authorities by the help of EMR. The medical record/history of the patients can be captured and stored in the DICOM format in the server and sent to the specialist doctors in India, who in turn study and provide diagnosis and treatment during live interactions with the doctor at the patient ends in Ethiopia store and forward like radiology images (11).

A cross sectional study conducted in 2009 on the assessment of telemedicine system in Ethiopia. The result indicated that telemedicine service was underutilized due to the absence of support from health bureau and fear of connectivity cost. In average the total number of sessions attended in both tele-education and tele-consultation sessions by the doctors were thirty one per year (11). Despite this research indicated on the underutilization of telemedicine a prospective study of the types of barriers to adoption and other contributing factors has not been conducted. In addition, more researches are not done in this area when compared with the benefits and the population size of the country. We need data on the factors and technological barriers that hinder the level of telemedicine services utilization.

2.2 Factors Affecting Telemedicine Utilization

Proper utilization of telemedicine has made a real contribution to health care services all over the world to improve the quality and equitable access of health care to the society. The implementation of a telemedicine faces many challenges due to different factors that inhibit telemedicine services delivery. Few of them include cultural barriers, social barriers, and economic barriers, administrative and technical barriers are predominantly affecting the practice of telemedicine services (12).

The most common barriers to the implementation of telemedicine program globally were the perception that the cost of telemedicine is too high. Developing countries more likely encountered resource issues such as high costs, under developed infrastructures and lack of technical expertise in the area of telemedicine. For developed countries legal issues about patient privacy and confidentiality, competing health system priorities and perception of lack of demand are the major ones (13).

A Survey was conducted in United States, Canada and Ireland in 2012 to evaluate the major barriers of telemedicine on users of acute care units from 63 health institutions. 483 individuals participated in the research through email with a response rate of 60.3%. The result indicated that technological, administrative, cultural, financial and regulatory barriers for physician privileges are the principal human barriers to the adoption of telemedicine in emergency and critical care medicine (14).

Particularly in developing countries like Ethiopia, telemedicine has not always delivered the anticipated level of success due to a number of factors. These included lack of reliable and affordable telecommunication services, poor infrastructures, lack of professionals in the field of telemedicine, lack of government awareness, lack of technical training, poor organizational design, user dissatisfaction with low band-width internet connection and unfamiliarity of the system to use without technical assistant are the major ones (15).

Telemedicine is expected to offer significant benefits for developing countries where the majority of the population lives in remote areas with no access to basic healthcare services. But the success of the implementation of telemedicine services depends very much upon knowledge of professionals on telemedicine, their perception and their acceptance of the telemedicine service to be mentioned as the main factors (16).

A cross sectional survey was carried out in Malaysia to assess the knowledge factors and the level of perception of health professionals about telemedicine. 1136 respondents took part in

the research. Of which 32.48% responded and the majority (84%) of respondents mentioned computers are important for internet use and 83% said for software packages and only 31% accept to use computers for telemedicine project. More than 75% of the respondents have no experience of using smart cards, and telemedicine services at all. It showed that the respondents have low inclination towards working in the area of telemedicine project (17).

A cross-sectional descriptive study was conducted on the perception of health professionals in Saudi Arabia hospitals on its benefits and challenges, and their willingness to use telemedicine. Out of 450 health professionals 252 responded which is a response rate of 56%. The result showed that the barrier most commonly perceived by healthcare providers at hospitals not adopting telemedicine was, lack of knowledge (71 %) about the meaning of telemedicine and its applications, types, and benefits, (39.7 %) lack of time to adopt telemedicine and (21 %) lack of importance of telemedicine for adopters, (49 %) lack of sufficient knowledge about other services/benefits of telemedicine, and (29%) difficulty in the application of telemedicine (18).

A cross-sectional study was conducted in Nigeria to assess the knowledge and perception o health professional by using primary and secondary data source in 2007 of the total 200 respondents. The result showed (41.5%) of the respondents had poor knowledge of telemedicine and only (21%) were aware of the country's proposed telemedicine program. (70.5%) accept to use telemedicine services and (69%) recommend its use to others. (67%) believed it should be included in the health system while (57%) thought it should be a special program. (81%) of the respondents were positive on the introduction of telemedicine applications (19).

A qualitative and quantitative case study on factors in the adoption, implementation and sustainability of telemedicine system in Uganda in 2011 carried out in two hospitals that attempted to use telemedicine. 75 respondents from each hospital were selected with 91% response rate. The findings indicated that, lack of knowledge and skills, lack of telemedicine policy and resistances to change by health professionals are identified as major problems (20).

2.3 Technology Involved in Telemedicine and Barriers

Information technology has the potential to improve the quality, safety, and efficiency of health care. It includes hardware, software, medical data, skilled people and internet connection in health care organizations. Diffusion of ICT in health care is generally low but demand will drive to increase the benefits of ICT on health care industry. The extent of ICT and the types of ICT deployed vary by setting and institution. The prevalence of ICT in any setting largely reflects the strength of the drivers and barriers to investment. For many organizations like health care, quality and process improvements are primary drivers and the barriers include the cost and complexity of ICT implementation, which often necessitates significant work process and cultural changes. Certain characteristics of the health care market including payment policies that reward volume rather than quality, and a fragmented delivery system can also pose barriers to ICT adoption (21).

The benefits of ICT in health care are vital to address the problems of health care services. Among the information technologies involved internet has considerable potential on the quality of telemedicine services and as a medium for tele-consultations, monitoring patient condition, and other unforeseen applications in telemedicine. Use of internet for tele-consultations and other telemedicine applications moved these applications into the mainstreaming of other communications used by physicians and other health care providers, decreasing the need for separate facilities, procedures, and telecommunication standards for telemedicine. The internet has become the common standard for transmission of nearly all types of data, including web-based data transfer, audio, and video depending on the bandwidth and switching capacity. As internet capacity grows, telemedicine services improved its acceptance and efficiency to deliver quality services in the health care delivery system (21).

Telemedicine used a number of technologies. Telecommunication technology is necessary to enable communication between two or more sites. POTS and ISDN are sufficient for many telemedicine interactions but they are limited in their ability to support more complex telemedicine applications, such as videoconferencing between more than two sites and transferring medical images at the level of quality needed for accurate diagnoses. Telemedicine system consists of customized medical software for patient demographics and workflow for

tele-consultation services with PACS server and DICOM server. It also work with computer hardware, medical diagnostic instruments which are DICOM compatible and communications link of the telemedicine project connected to the network (22).

Technologies used in telemedicine have ranged from high-band with interactive video to low-bandwidth wireless applied for patient care which involves monitoring of a patient's condition by a healthcare worker located at a healthcare facility which is remote with respect to the location of the patient. Telemedicine applications rely on a high speed internet connection, or broadband which enables information to be transferred with very little delay in receiving or sending. For optimal telemedicine performance, the broadband connection must be of sufficient bandwidth to enable all connection points to send and receive large amounts and complex sets of data quickly, accurately and confidentially. Greater bandwidth enables greater resolution, use of real-time vs. store-forward images, full-motion imaging, and other properties that will expand the technical capacity of telemedicine (23).

A study conducted on assessment of technological barriers of telemedicine in 1999 in USA in three telemedicine projects identified potential barriers of telemedicine utilization rates. The result of the study showed poor quality of audio and video transmission, complexity of the technology used by end users due to lack of end user training, poor patient privacy and confidentiality during telemedicine are the main technology related problems in telemedicine service utilization (24).

In this research it is aimed to measure the level of utilization and identify contributing factors for telemedicine underutilization and potential technological barriers for telemedicine utilization in Tikur Anbessa Specialized Hospital and come up with recent data to supplement the scarce and outdated information on the area of telemedicine. Hence, the research findings had significant importance for relevant stakeholders in the area.

2.4 Conceptual Frame work

Based on literatures reviewed conceptual framework was constructed to show the relationship of factors which affects the proper utilization of telemedicine services in the health care delivery system. The underlined causes for telemedicine utilization are health information system policy, Socio-economic condition and education condition of the country. Technological problem, administrative problem, financial problem, legal issues, lack of awareness, lack of professional knowledge and perception are the intermediate causes for telemedicine utilization. The immediate causes of telemedicine services utilization are system usability problem, system reliability problem, internet connectivity problem and problems on users' technical training to mange telemedicine applications. Figure 2.1 below showed the relationship between factors and outcome variable.

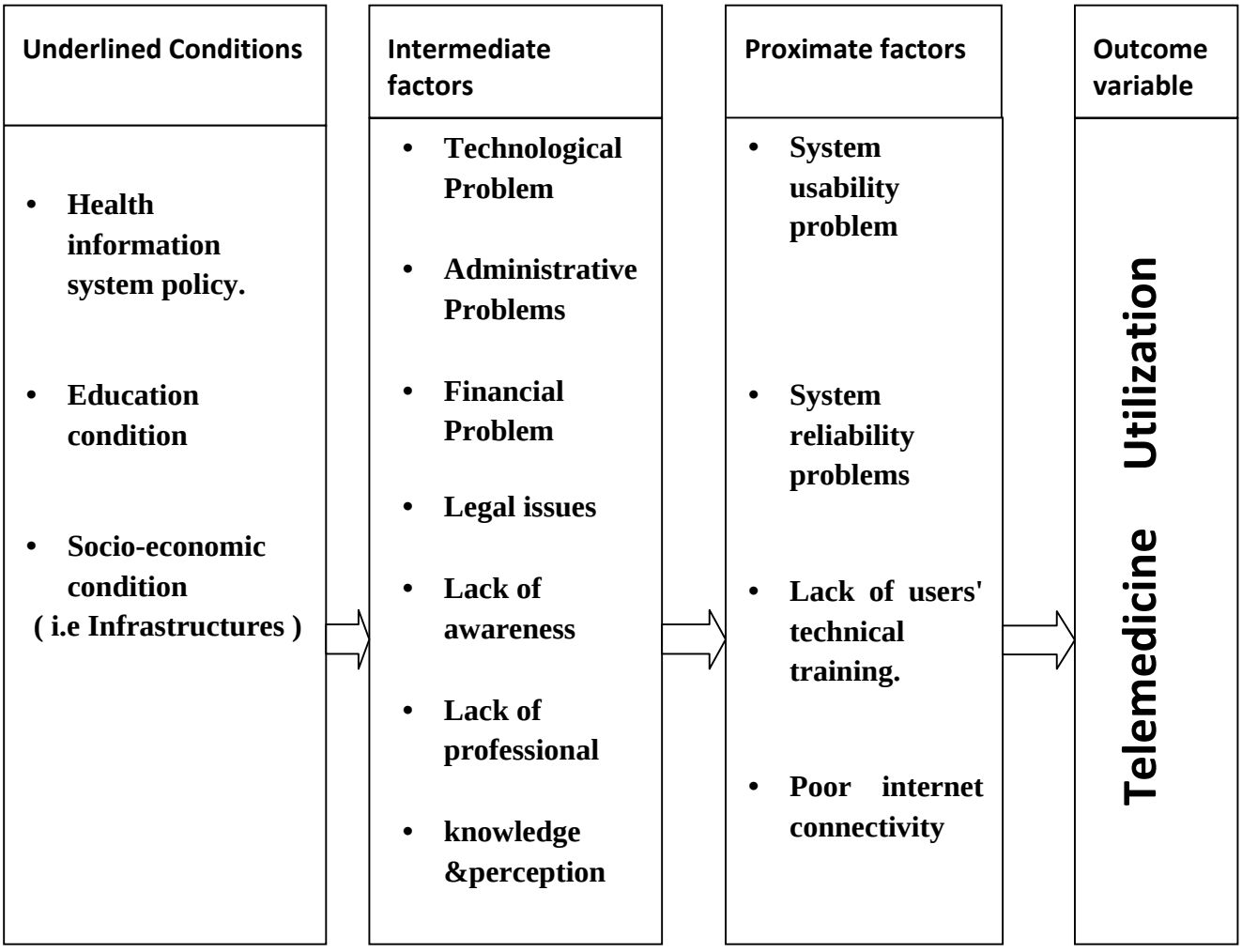

Figure 2. 1: Conceptual framework constructed from review of relevant literatures for telemedicine utilization, and determinant factors, April, 2013.

CHAPTER-THREE

RESEARCH METHODOLOGY

3.1 Study Design

Cross sectional descriptive study design was used to investigate quantitative data through self-administered questionnaires. The qualitative data was collected using semi-structured interview guide questions and observation check list were used for complementing the quantitative data.

3. 2 Research Area and Period

The study was conducted in Addis Ababa city, Tikur Anbessa Specialized Hospital under Addis Ababa University College of health science starting from December 2012 to April 2013.

3.3 Population

Source population of the study included all health professionals working in Tikur Anbessa Specialized Hospital, Addis Ababa University College of health science.

Study populations were medical specialists, medical doctors, nurses, radiologic technologists, laboratory technologists and pharmacy technologists who were randomly selected.

3.4 Inclusion and Exclusion Criteria

Health professionals who were working in Tikur Anbessa Specialized Hospital included in the study.

Administrative staffs and health professionals who were working in Tikur Anbessa Specialized Hospital on annual and sick leave are excluded in the study.

3.5 Sample Size Determination

The sample size was determined by a single population proportion technique using the following assumptions (level of confidence taken to be 95%, CI= critical value of 1.96): a 5% margin of error (d=0.05), 50% proportion of utilization of telemedicine and n= the required sample size. By using the following formula $n= (Z\alpha/2)^2(p\ (1-p)/d^2$ (25).

$$n= (1.96)^2(0.5(1-0.5)/\ (0.05)^2$$

$$=3.8416(0.5*0.5)/0.0025$$

$$=3.8416*0.25/0.0025$$

$$=0.9604/0.0025$$

$$n=384.16$$

n=384, (with 10% non response rate=38.4)

Total sample size =384+38.4=422

n =422

3.6 Sampling Technique

According to the information from human resource department the number of health professionals was medical specialists (912), GPs (22), Nurses (727), Radiologic technologists (43), Laboratory technologist (47) and pharmacy technologists (31). To get a representative sample of study subjects from the hospital, selection was first stratified by profession. Then by considering their level of education and proportion of the population, simple random sampling method was applied and 422 study subjects were obtained. Figure 3.1 below showed schematic presentation of sampling procedures of health professionals in TASH of different disciplines

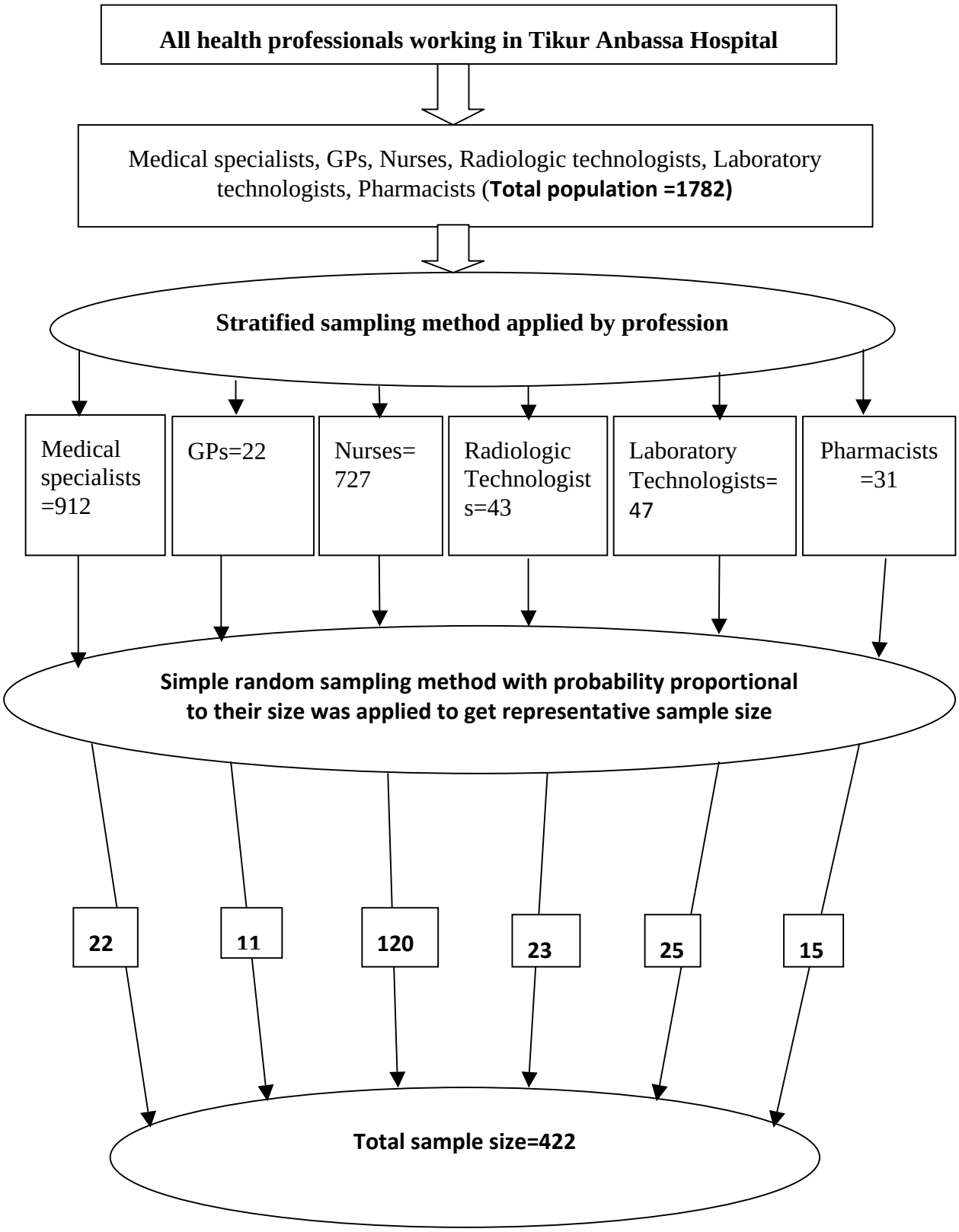

Figure 3.1: Schematic presentation of sampling procedures in TASH, Addis Ababa, Ethiopia, June 2013.

3.7 Data collection Procedures

3.7.1 Quantitative data

The Quantitative Data were used using a pre-coded anonymous self-administered questionnaire. The questionnaire was initially prepared in English and pre-tested before starting the actual data collection outside the study subjects among different health professionals at Minillik II, Yekatit 12 and Zewditu memorial hospitals. Most of the questions were clear and understood by the respondents however, some corrections were made for easy understanding and some questions were removed with similar concepts.

The questionnaire included socio-demographic data, knowledge and perception of telemedicine and other contributing factors for telemedicine utilization, utilization of telemedicine and technological barriers during telemedicine sessions. Two data collection facilitators and one supervisor who are experts from the health care services were trained for two days on the overall procedure of data collection system and the general objectives of the study and supervision process.

Two data collection facilitators were responsible for discussing the purpose of the study, distributing and collecting questionnaires, telling to the informants the importance of honest and sincere response. The health professionals were allowed to fill the questionnaire by themselves. Ensuring completeness of the questionnaire and clarification of question in areas of difficulties was made by the supervisor. 422 questionnaires were distributed from each selected departments for quantitative data depending on the sample size for each profession.

3.7.2 Qualitative data

For qualitative data four key informant interviewees were interviewed through appointment depending on the schedule of the respondents of various positions in the hospital. These included telemedicine department head, medical director, Addis Ababa University dean and telemedicine technical assistant. The interview was done depending on the interview guide questions by the principal investigator. Observation of telemedicine system was also done by the principal investigator to evaluate the technical properties of the system. These included bandwidth, features of the system, ease of use and user friendliness, internet connectivity and data quality. Qualitative data were collected through seven interview guide questions and nine observation checklist questions.

3.8 Variables

3.8.1 Independent Variables

- Socio-demographic data: gender, age, profession, educational level, department and year of experience.
- Factors of telemedicine utilization: knowledge and perception, lack of professionals, lack of awareness, legal issues, financial problem, technological problem and administrative problem.
- Technological barriers:-System reliability, system usability, users technical training (assistant) and internet connectivity problems.

3.8.2 Dependent Variables

- Utilization of telemedicine

3.9 Operational Definitions

Telemedicine-The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities (WHO, 2010).

Telemedicine utilization- is the use of telemedicine services as expected from the users at least once a week in both tele-consultation and tele-education services.

Technological problem- is the overall technology related problem in the implementation and utilization of telemedicine. It includes the hardware, software, and communications link of the telemedicine project with a telecommunications network to input and output devices and connectivity cost.

Administrative problem- is the lack of responsible person to manage telemedicine unit for partnership building, facility upgrades, hiring educating and training of users in the hospital.

Financial problem- is the lack of reimbursement and the capital expenditure for telemedicine technology.

Legal issues-is the absence of an international legal framework to allow health professionals to deliver services in different jurisdictions and countries.

Technological barriers- are the specific problems encountered during telemedicine services application. It includes system reliability, system usability, internet connectivity and users' technical training to meet the clinical needs of the health care.

System reliability- is consistency of telemedicine system in the use of telemedicine services.

System usability- Ease of using telemedicine features without ambiguity (User friendliness).

Perception - understanding telemedicine service in a positive way.

Lack awareness- doesn't know about telemedicine technology.

Lack of professionals- Lack of qualified of personnel in the area of telemedicine.

3.10 Data Quality Assurance

Orientation about the purpose of the study was given to the respondents and pretesting of the questionnaire was done on a 5% sample size with Minillik II, Yekait 12 and Zewditu memorial hospitals its clarity, understandability, completeness and the necessary modification were made on the tool accordingly. The questions were corrected and a final version of the questionnaire was used for the study subjects. Training on how to conduct the data collection and how to use the tools properly was given to data collection facilitators and supervisor for two days.

To ensure data quality, each data collection facilitators checked the questionnaires for completeness. Each questionnaire was reviewed daily by supervisors and the PI to check for completeness and further edition. Frequencies, tabulation & sorting were used for data cleaning to check for missed variables, outliers & inconsistencies. The principal investigator monitored the overall process of the project and data collection. In addition, for getting valid information, triangulation by using the qualitative (key informants' interviews and Observation checklist) was conducted to complement quantitative information found by standard questionnaires.

3.11 Data Management

The collected data was cleaned, coded and fed to [1]Epi Info Version 3.5.3 and analysis was done by using [2]SPSS version 16.0. The data were cleaned for inconsistencies and missing values. Simple frequencies were used to see the overall distribution of the study subject with the variables under study. Odds ratio and 95% CI were used to measure the strength of association between different factors and the outcome variable. Logistic regression was carried to control possible confounders for predictor variables for current telemedicine utilizations. Finally, results were presented in text, tables and graphs, analysis made and communicated to all concerned bodies. The qualitative data were analyzed thematically and the result was presented in text.

[1] Epinfo is software used to enter data and analysis.

[2] SPSS is software used to enter data and analysis.

3.12 Ethical Consideration

Ethical clearance was obtained from Addis Ababa University, School of Public Health and informed consent was obtained from each study subject prior to the interview and data collection process and the purpose of the study was explained to respondents. A code number was given for every participant and no name was used. The results are stated containing only the information for about the total group of the respondents.

The research does not have a short term financial, health care and capacity building benefit to the research participant as an individual or as a group but in the long run it will help the concerned organization and users to have a program consideration and direction and formulation of strategy and design for the improvement of telemedicine services in the country. The research does not have any inhumane treatment of research participants and any physical harm, social discrimination, psychological trauma and economic loss.

3.13 Dissemination of Results

The findings of the study will be disseminated to the stakeholders through the following ways:

1. The thesis will be available in the library of AAU for reference.
2. Feed-back on the research findings will be given to Tikur Anbassa Specialized Hospital.
3. Dissemination of the findings to the relevant stakeholders including Ministry of health, Ministry of information and communication to other relevant institutions working in the area of telemedicine will be done.
4. The researcher will strive to publish findings on journals.

CHAPTER-FOUR

RESULTS AND DISCUSSIONS

This chapter demonstrated the findings of quantitative and qualitative data. All of the variables that were generated from the raw data are summarized. It also presents the quantitative analysis, tables and interpretation of results complemented by qualitative results that specifically address the research objectives.

4.1 QUANTITATIVE & QUALITATIVE RESULTS

4.1.1 Socio Demographic Data

Out of 422 study participants 387(91.8%) responded properly and 30(7.1%) were non responders and 5(1.1%) were missing value or with incomplete results.

In this study the majority of the respondents were males, 254 (65.6%) and 133 (34.4%) were females. The age group of the respondents range from 22-60 years and majority of the respondents were found between 22-34years which is 172(44.5%). Considering the occupational distribution of the respondents in different professions and highest educational level achieved more than half of the respondents, 218(56.3%) were medical specialists. Majority, 118(30.5) of the respondents were form surgery department and while the smallest, 11(2.8%) number of respondent were from pharmacy department. Most of the respondents, 150 (38.8%) have working experience between 0-5 years of and only 27(7%) have working experience above 20 years. Table 4.1 showed the distribution of socio-demographic characteristics of the respondents.

Table 4. 1: Socio-demographic data for respondents (n=387) in TASH, Addis Ababa, Ethiopia, June 2013

Variable	Frequency	Percent (%)
Sex		
Male	254	65.6
Female	133	34.6
Age		
22-34 years	172	44.5
35-37 years	148	38.2
48-60 years	67	17.3
Profession		
Medical specialists	218	56.3
GPs	9	2.3
Nurses	105	27.1
Radiologic technologists	21	5.4
Laboratory technologists	23	5.9
Pharmacist	11	2.8
Educational level		
Medical doctor+	218	56.3
Medical Degree	9	2.3
Masters degree	27	7
Bachelor degree	107	27.6
Diploma	26	6.7
Department		
Surgery	118	30.5
Internal medicine	91	23.5
Gynecology/Obstetrics	55	14.2
Pediatrics	56	14.5
Radiology/Imaging	33	8.5
Laboratory	23	5.9
Pharmacy	11	2.8
Year of experience		
0-5 years	150	38.8
6-10 years	120	31.0
11-15 years	57	14.7
16-20 years	33	8.5
Above 20 years	27	7.0

For qualitative data, out of 4 interviewee participants 2 of them were willing to participate and 2 have refused for interview which is 50% response rate. Of which one was the department head and the other was technical assistant of telemedicine unit interviewed.

4.1.2 Level of Utilization of Telemedicine.

Of the total respondents of health professionals, 230(59.4%) never used telemedicine services in both tele-education and tele-consultation services available in the hospital and 157(40.6%) only participate in the telemedicine sessions rarely. From 157 respondents of using telemedicine services 133(84.7%) were attending telemedicine sessions less than five times a year and all of telemedicine users said telemedicine services are not utilized as users expected.

Among 157 respondents attended telemedicine sessions, almost all 142(90.4%) are not satisfied the telemedicine services in both tele-education and tele-consultation sessions. All respondents said telemedicine services are not meet users' expectation on utilization. Table 4.2 showed users, frequency of attendance, expectations and satisfaction for telemedicine services

Table 4.2 : Frequency distribution (n=387) of utilization of TM services in TASH, Addis Ababa, Ethiopia, June 2013.

Variables	Frequency	Percent (%)
Ever used TM services?		
Yes	157	40.6
No	230	59.4
Of yes, how many TM session attended per year (n=157) in both tele-education & tele-consultation?		
Less than 5 times	133	84.7
6-10 times	21	13.4
11-15 times	3	1.9
TM service utilization meets user's expectation? (n=157)		
Yes	0	0.0
No	157	100.0
Users satisfaction on TM session(n=157)		
Yes	15	9.6
No	142	90.4

As observed from telemedicine unit, telemedicine services have tele-education and tele-consultation sessions. Monthly tele-education sessions schedule was posted with the title of the topics, the name of the experts and the session hours. Tele- consultation session are conducted when the case were identified by the doctors in TASH. The doctor in TASH reported to the head of telemedicine department and communicated to the Indian super specialty doctors to take appointment for consultation but no one attended both sessions during the observation time in one month duration.

As reported from the respondents and observation of telemedicine services in Tikur Anbessa Specialized Hospital, is not meeting the users' expectations. It is underutilized in both tele-education and tele-consultation sessions. In both quantitative and qualitative results telemedicine unit in TASH are not properly delivering the expected services. It indicated that telemedicine services are underutilized based on this study findings.

4.1.2.1 Telemedicine Users of Respondents by Profession

Compared with users and non users of telemedicine, (66.8%) medical specialists, (55.5%) GPs (18.2%) pharmacists, (8.7%) laboratory technologists, (7.6%) nurses and (4.8%) radiologic technologists were users of telemedicine in TASH. This showed that the most common users of telemedicine were medical specialists and GPs and the rest using telemedicine services very rarely. Figure 4.1 showed the comparison of professionals on users and non users of telemedicine.

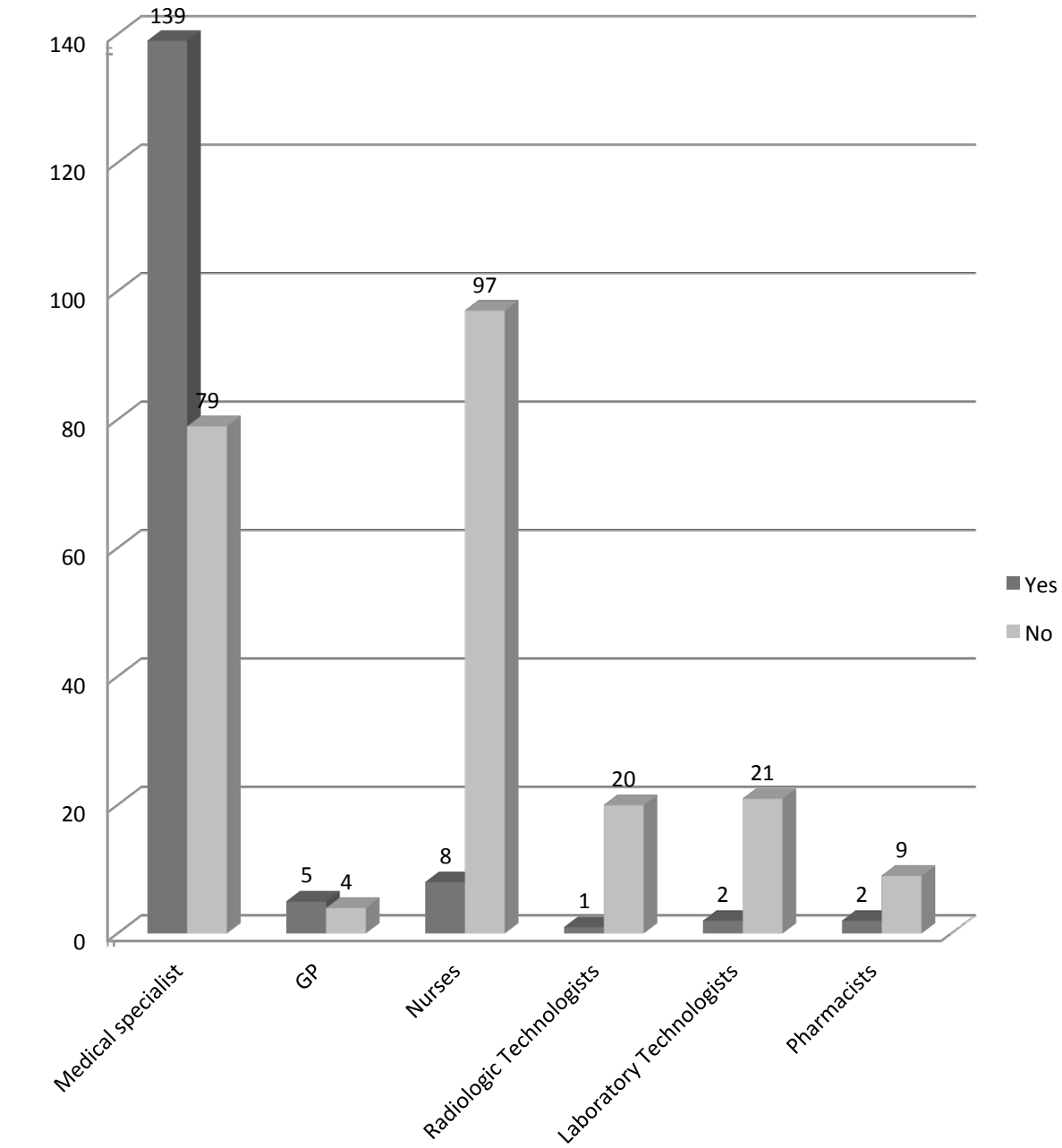

Figure 4.1: Profession versus Telemedicine users of respondents in TASH, Addis Ababa, Ethiopia, June 2013.

4.1.2.2 Respondents' Opinion to Increase Telemedicine Utilization

Among 157 respondents using telemedicine services majority of health professionals suggested that 155(98.7%) improving internet connectivity increases telemedicine service utilization. These showed internet connectivity was the major problem for proper telemedicine services. Table 4.3 showed respondents opinion to increase telemedicine services utilization.

Table 4. 3: Frequency distribution (n=157) of respondents to increase telemedicine utilization in TASH, Addis Ababa, Ethiopia, June 2013.

Variable	Frequency	Percent (%)
Creation of awareness		
Yes	148	94.3
No	9	5.7
Improving Infrastructures		
Yes	146	93.0
No	11	7.0
Providing skilled manpower		
Yes	151	96.2
No	6	3.8
Assuring system reliability		
Yes	151	96.2
No	6	3.8
Making the system user-friendly		
Yes	130	82.8
No	27	17.2
Providing user technical training		
Yes	142	90.4
No	15	9.6
Improving internet connectivity		
Yes	155	98.7
No	2	1.3

As reported from the respondents, to improve telemedicine services in TASH and similar setups, the concerned bodies should prepare a module for health professionals to give telemedicine course as a part of academic discipline and administrative measures should be taken on those who are not participate telemedicine sessions. Telemedicine service should also be owned by AAU-MF and senior specialists and concerned persons should conduct awareness creation for the users and bring sense of ownership. In addition, infrastructures and internet connection should be improved and responsible person should be assigned. This indicated that the findings are similar to the quantitative data.

4.1.3 Technological Barriers of Telemedicine Service

Of the total 157 respondents using telemedicine services in TASH, 153(97.6%) encountered connectivity problems, 152(96.8%) encountered system unreliability problems, 126(80.3%) reported the system is user unfriendly and the rest 111(70.7%) faced problems related to lack of users technical assistant towards telemedicine applications. Table 4.4 showed the distribution of the encountered problems when using telemedicine services (Table: 4).

Table 4.4: Frequency distribution (n=157) of respondents encountered technological barriers during telemedicine session in TASH, Addis Ababa, Ethiopia, June 2013

Variable	Frequency	Percent (%)
System reliability Problem		
Yes	152	96.8
No	5	3.2
System usability problem		
Yes	126	80.3
No	31	19.7
Internet connectivity problem		
Yes	153	97.6
No	4	2.4
Lack of users technical assistant		
Yes	111	70.7
No	46	29.3

As reported from the department, technical problems are mostly encountered during the telemedicine session. Telemedicine system in Tikur Anbessa Specialized Hospital is an old system and had DICOM and PACS incompatibility. The system needs medical images like x-ray to be scanned from the film before sending the images to experts. This showed the system is not user friendly for health professionals because most health professionals are reported to be technophobic to use the system and needs technical assistance. The report insured system reliability problem to transfer digital images directly without scanning the hard copy (i.e. like x-ray films) which led to poor quality medical data (poor resolution) during interpreting the images.

As observed telemedicine system in Tikur Anbessa Specialized Hospital is an old system but the technologies involved are frequently changing. The problems observed in telemedicine system were internet connectivity problem, data quality, system functionality, system reliability and system usability and system upgradability. Internet connectivity problem was the major problem for telemedicine service in TASH. Telemedicine unit has poor data transmission speed or bandwidth problems were observed which led to low internet speed and difficult to transfer and download image related patient data.

Telemedicine system has also system reliability problem due to repeated interruption of internet connection, scratch, and unclear audio and video patient data as observed form the session. The users are not confident on telemedicine system functionality to conduct proper tele-education or tele-consultation session due to internet connectivity problem. As mentioned above telemedicine in TASH is an old system and encountered compatibility problems to the new technology like DICOM and PACS system. The patients' data like x-ray images are first converted in to DICOM format or soft copy form by scanning and loaded to the server computer. The quality of patient data is affected due to this problem.

The health professionals are not familiar this old telemedicine system features which led to system usability problem, system maintainability, upgradability problems. The system is not user-friendly to be managed by health professionals and needs technical training or assistant

which is another problem of proper telemedicine applications. The technological barriers of telemedicine system affect one another and interconnected. This showed that telemedicine services in TASH had directly affected by the overall technological barriers.

These technological barriers revealed the dissatisfaction of health professionals to participate in telemedicine services and the main issues in the underutilization of telemedicine system in Tikur Anbessa Specialized Hospital. The main barrier in telemedicine setup found internet connectivity and system reliability took the lion share among other technological barriers. As observed in the telemedicine session time for one hour tele-education session more than five times connectivity interruption and sometimes complete cancellation of session encountered. In addition, voice and image quality were found to be another problem which led to poor data quality during the transmission of telemedicine services. The speed of internet during image transmission and the format of images were also disappointing facts that were investigated.

Both quantitative and qualitative results indicated that poor internet connectivity and system reliability are the main technological barriers hindered proper telemedicine services in TASH.

4.1.4 Factors Affecting Telemedicine Utilization

4.1.4.1 Knowledge and Perception

Health professionals who know the presence of telemedicine services found in Tikur Anbessa Specialized Hospital are 297(76.7%) but the remaining 23.3% do not know the services. Professionals with the knowledge of other way of investigating patients (Telemedicine) were found to be 337(87.1%). 287(74.2%) of respondents had knowledge of information technologies involved in telemedicine services and only 18(4.7%) took training related to telemedicine. With respect to knowledge of the major services and type of telemedicine approach, only 160(41.3%) and 24 (6.2%) knew the services and approaches found in Tikur Anbessa Hospital respectively.

Perception of health professionals towards the availability of TM services and addressing the quality and access of health care services accounted 305 (78.8%) positive response and the rest 82(21.2%) had no awareness towards telemedicine services. The role of telemedicine in the health care delivery system reported important by 265(68.5%) respondents, 40(10.3%) said

important and mandatory and 82(21.2%) health professionals said telemedicine services are unnecessary and time consuming. This showed that knowledge and perception of health professionals towards telemedicine was positive. Table 4.5 indicated the frequency distribution of health professionals towards knowledge and perception.

Table 4. 5: Knowledge and perception of respondents (n=387) on telemedicine in TASH, Addis Ababa, Ethiopia, June 2013

Variables	Frequency	Percent (%)
Knowledge of TM services found in TASH.		
Yes	297	76.7
No	90	23.3
Knowledge on other way of investigating Patients.		
Yes	337	87.1
No	50	12.9
Knowledge on type of IT used in TM.		
Yes	287	74.2
No	100	25.8
Training related to TM.		
Yes	19	4.9
No	368	95.1
Knowledge on major services found TM unit.		
Yes	160	41.3
No	227	58.7
Knowledge on type of TM approach		
Yes	24	6.2
No	363	93.8
TM availability in health care services.		
Yes	305	78.8
No	82	21.2
TM services for addressing quality and access of health care services.		
Yes	305	78.8
No	82	21.2
The role of TM in health care delivery System.		
Important	265	68.5
Important and mandatory	40	10.3
Unnecessary and time consuming	82	21.2

4.1.4.2 Other Contributing Factors for Telemedicine Utilization

Among reported factors that affected telemedicine services, technology related problems were the major factors that hinder the utilization of TM service strongly 298(77.0%). Lack of professionals, administrative problems and lack of awareness to telemedicine technology had almost similar proportion of respondents 266(68.7%), 251(64.9%) and 244(62.3%) respectively. Finally the least affecting factors are financial and legal issues that accounted 143(37.0%) and 77(19.9%) respectively. Table 4.6 below showed the frequency distribution of respondents and contributing factors towards telemedicine utilization.

Table 4.6 : Frequency distribution of respondents (n=387) factors affecting telemedicine services in TASH, AA, Ethiopia, June 2013

Variables	Frequency	Percent (%)
Lack of professional		
Yes	266	68.7
No	121	31.3
Lack of awareness on TM technology		
Yes	241	62.3
No	146	37.7
Legal issues		
Yes	77	19.9
No	310	80.1
Financial problem		
Yes	143	37.0
No	244	63.0
Technological problem		
Yes	298	77.0
No	89	23.0
Administrative Problem		
Yes	251	64.9
No	136	35.1

4.1.2.3 Factors Determining Telemedicine Underutilization

Bivariate analysis resulted in a number of dependent and explanatory variable associations and cross-tabulation of each independent and dependent variable was done. Socio-demographic data, perception and knowledge of telemedicine were not associated with outcome variable. But independent variables such as legal issues, lack of profession, lack of awareness, financial issues, technological problems and administrative problems were found to have significant associations with the outcome variable.

Technological (COR 17.5 95%CI=6.9-44.3), and administrative problems (COR 7.0 95% CI= 4.1-11.9) lack of telemedicine professionals (COR 5.0 95%CI=2.9-8.5), lack of awareness (COR 3.08 95%CI=1.2-4.8), legal issues (COR 2.85 95%CI=1.70-4.76) and financial issues(COR 2.0 85%CI=1.30-3.01) were found to be predictors of telemedicine underutilization before adjusted odds ratio was done.

Therefore, a multivariate approach was carried out to determine which factors best predicted to inhibit the proper utilization of telemedicine. Technological problems (AOR 9.06 95%CI=3.08-26.63), administrative problems (AOR 3.52 95% CI= 1.79-6.95) and legal issues (AOR 2.21 95%CI=1.14-4.26) were found to be predictors of telemedicine underutilization.

Study participants who responded technological problems are the main factors of telemedicine underutilization were more than nine times of that of who said not. Respondents who said administrative problems are also the main factors of telemedicine underutilization were more than three times that of who said not. Respondents who said legal issues are another factors of telemedicine underutilization were more than two times that of who said no. Table 4.7 below indicated the main predictor variables in COR and AOR with 95%CI of telemedicine underutilization.

Table 4.7: Determinants of the respondents'(n=387) telemedicine underutilization, TASH, Addis Ababa, Ethiopia, June 2013.

	Utilization of telemedicine.					
Variables	**Yes**	**No**	COR	(95%CI)	AOR	(95%CI)
Technological problem						
Yes	152	146	17.5	(6.9,44.3)*	9.06	(3.08,26.63)*
No	5	84		1.0		1.0
Administrative Problem						
Yes	137	114	7.0	(4.1,11.9)*	3.52	(1.79,6.95)*
No	20	116		1.0		1.0
Lack of professional						
Yes	121	120	5.0	(2.9,8.5)*	1.58	(0.643,3.89)
No	36	110		1.0		1.0
Lack of awareness						
Yes	136	130	3.08	(1.2-4.8)*	0.50	(0.23,1.11)
No	21	100		1.0		1.0
Legal issues						
Yes	47	30	2.85	(1.70,4.76)*	2.21	(1.14,4.26)***
No	110	200	1.0		1.0	
Financial Problem						
Yes	73	70	2.0	(1.30,3.01)**	0.67	(0.37,1.18)
No	84	160		1.0		1.0

Note: P < 0.001=* P < 0.01=** P < 0.05=*** References =1

It was reported that telemedicine services are necessary to deliver quality health services, to access expert knowledge any time for appropriate decision and to reduce patient expense and long appointment time. However, the unit is not giving appropriate services due to lack of responsible person, lack of interest of health professionals, lack of telemedicine professionals, connectivity problems during the session, conflict of interest between the TASH specialists and Indian side specialists, inappropriate consultants assigned. It has also problems related to the topics are irrelevant for teaching learning process and different time zone were making telemedicine unit unable to properly function

In addition, poor infrastructures of the country, highly engagement of senior specialists in their private owned clinics rather than participating in the sessions and senior specialists' undermine the capacity of super specialty experts from provider side and the value of telemedicine services. The telemedicine services are dependent on the interest and willingness of Indian experts (provider side interest) is also additional challenge. The main challenges reported in Tikur Anbessa Specialized Hospital telemedicine unit are lack of interest of health professionals towards telemedicine services, lack of responsible person and poor infrastructure of the country.

Quantitative results indicated that technology and administrative problems and legal issues were the most predictors of telemedicine underutilization in TASH. For qualitative results included poor infrastructures, lack of responsible person and lack of interest of senior specialists towards telemedicine were identified as the major contributing factors for telemedicine underutilization. This showed both quantitative and qualitative findings were similar except legal issues.

4.2 Discussions

The current study showed that telemedicine services in Tikur Anbessa Specialized Hospital is underutilized compared to the study conducted in the same unit in 2009. In the previous study both tele-education and tele-consultation sessions attended by health professionals were in average thirty one sessions but compared to the current study which is less than five times a year. This indicated that in the current study the number of sessions in both tele-educations and tele-consultations decreases more than fivefold of the previous study.

In this study perception of health professionals towards telemedicine (78.8%) had positive response and (68.5%) respondents do have good knowledge about telemedicine benefits. The study conducted on the perception of health professionals on its benefits and challenges, and their willingness to use telemedicine in Saudi Arabia hospitals in 2012 showed that the most common barrier perceived by healthcare providers at hospitals are lack of knowledge (71 %) about telemedicine benefits and(39.7%) lack of time to adopt telemedicine.

Another study was conducted to assess knowledge factors and level of perception of health professionals about telemedicine in Malaysia in 2010 found to be low knowledge and perception towards telemedicine. But perception and knowledge of health professionals for the use and importance of telemedicine application in current study were different from both studies which was higher in the current study. Therefore, Perception and knowledge of health professionals are not the main factor for telemedicine service underutilization in the current study but the study in Saudi Arabia and Malaysia knowledge and perception of health professionals were found to be the main factors of telemedicine underutilization.

Among reported factors in the current study that affected telemedicine services, technological problems, administrative problems and legal issues were found to be major factors for telemedicine underutilization. A survey was conducted in United States, Canada and Ireland in 2012 to evaluate the major barriers of telemedicine on users of acute care units were indicated that technological, administrative, cultural, financial and regulatory barriers for physician privileges are the principal human barriers to adoption of telemedicine in emergency and

critical care medicine. This showed that the major factors that hinder telemedicine services in both studies were the same except cultural barriers but the significances were different.

A study conducted on assessment of technological barriers of telemedicine in 1999 in USA identified potential barriers of telemedicine utilization rates. The result of the study indicated that poor quality of audio and video transmission, complexity of the technology used by end users due to lack of end user training, poor patient privacy and confidentiality during telemedicine were the main technological barriers in telemedicine underutilization. In the current study the findings of technological barriers were poor internet connectivity, system unreliability, DICOM and PACS incompatibility, system user unfriendly and lack of users' technical training. This showed that the results of the current study are match with the previous ones in addition to poor internet connectivity, system unreliability and DICOM and PACS incompatibility problems encountered in this study.

4.3 Strength and Limitation of the Study

The research has the following limitations and strength.

Strength

- Both qualitative and quantitative data were used to triangulate the findings.

Limitations of the study

The research has the following limitations:

- Most of the respondents were not aware about telemedicine technology and 50% of the respondents in interview refused to participate. This has made the result less comprehensive.
- Few inquired to have information first about the subject matter before they answered the questions. This may result in respondent bias.

CHAPTER- FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Cross-sectional study was conducted to explore the level of telemedicine utilization through primary data source i.e. self administered questionnaire, interview questions and observation checklist for health professionals working in TASH from February to April 2013. The results revealed that the utilization level of telemedicine services in is found to be very low in average less than five times a year. The main technological barriers during telemedicine service were found to be internet connectivity and system unreliability. The main determinant factors that affect proper utilization of telemedicine services in TASH included technological Problems, administrative problems and legal issues.

5.2 Recommendations

Considering the importance of this sector and the benefits it could provide, the government, the concerned officials and users of healthcare services, should support the implementations and proper utilization of telemedicine services in TASH. Based on the findings of the current study and reviewing relevant literatures the following guide line is recomended for better telemedicine services in TASH.

- There is a need to develop a framework for designing and implementing sustainable telemedicine information systems in Ethiopia based on the users requirements.
- MOIC and AAU should struggle to change the existing old telemedicine system to improve the quality and efficiency of telemedicine service.
- The MOH in collaboration with MOE should prepare a module for health professionals about TM and should be integrated as part of academic discipline and should take administrative measures on those who are not participating in telemedicine services/sessions regularly.
- MOH should develop telemedicine application strategy and legal frame work to integrate with the current referral and consultation system.
- Structured and regular awareness creation training towards telemedicine technology should be given to the users to change their attitude and familiarize them with the system and to bring sense of ownership and trust on telemedicine system.

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ANNEXES

Annex I-Participant Information Sheet

Title of the research: - Utilization of telemedicine in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, June 2013.

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Introduction: World health organization declared to address quality health services for all but for various reasons it is not undergone as expected. To address these hot issue the implementation and proper utilization telemedicine is significant and one of the best tool to improve the quality and access of health care service in the health care delivery system.

Purpose: The Objective of this research is to explore the level of utilization, identify other contributing factors and identify technological barriers of telemedicine. This research undertaking is a post graduate Masters of health informatics partial fulfillment of the master of sciences.

Procedure and Participation: The method of the research is a descriptive cross sectional study through self administered questionnaire and qualitative data by interview and observation checklist. You are asked to participate in this research because the trustful information which you will provide is important for the understanding of the proposed subject matter. Moreover, your particular participation is affirmed by the sampling frame through the procedure of probability sampling technique which provides equal chance of selection. You will be asked about your socio-demography, knowledge and perception on telemedicine, other contributing factors of telemedicine utilization and technological barriers of telemedicine.

Confidentiality: to establish secured safeguards of the confidentiality of research data, the PI will use codes during data collection period instead of using names. The original data will be locked in cabinets until the data analysis carryout and no person shall access except the PI and the advisor for data checking and cleaning purpose. The use of information for any purpose other than that to which participants consented is unethical to the participants. The information

you provide is not disclosed in the way it identified your personal characteristics and privacy. After the research defense and final work is approved by AAU academic commission, the original questionnaire hard copy will be incinerated in secure manner.

Benefit: The research does not have a short term financial, health care and capacity building benefit to the research participant as an individual or as a group but in the long run it will help the concerned organization and policy makers to have a policy consideration and direction and formulation of strategy and design of telemedicine services program based on the recommendations and the findings. Moreover the research work will help as a base line data in the field.

Risk: The proposed research does not have any inhumane treatment of research participants and any physical harm, social discrimination, psychological trauma and economic loss.

Inducement, incentive and Compensation: This study process has no any form of inducement, coercion and the study does not bring any risks that incur compensation.

Results Dissemination: The researcher is responsible for dissemination of findings moreover fully accountable to provide feedback to hospital administration, to the policy makers and other concerned bodies. Maximum effort will be done to publish the finding in scientific reputable journal.

Freedom to withdraw: If you want to participant in the study, you have full right to with draw from the study any time you wish. This would have no effect at all on your health benefit or other administrative effect that you get from the organization as routine moreover nobody will enforce you to explain the reason of withdrawal.

Person to Contact: The participant has the right to ask information that is not clear about the research context and content before and or during the research work. You can contact the principal investigator and his advisor. Moreover this research undergone ethical reviewed and approved by Addis Ababa University College of Health Sciences IRB. The main task of this board is to make sure that the ethical principles is adhered or not and the research participants are protected from harm.

If you want more information and check about this project you can contact the principal investigator o advisors by the above address mentioned.

Annex II- Informed Consent Form

Title of the Research: - Utilization of Telemedicine in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, June 2013.

Prinicipal Investigator: Belay Tamiru Tel: 0911866017 (Mobile)

Advisors: AberaKume (MD,PhD), Mobile: 0911882912

Solomon Teferra (PhD) , Tel:+251-911-242544 (Mobil)

I have been well aware of that this research undertaking is a post graduate degree partial fulfillment of research thesis in health informatics program which is fully supported and coordinated by AAU School of Public Health and information science. I have been fully informed in the language I understand about the research project objectives that are to measure the level of utilization and technological barriers of telemedicine.

I have been informed that all the information I shall provide to the investigator will be kept confidential. I understood that the research has no any risk and no harm. I also knew that I have the right to withhold information, skip questions to answer or to withdraw from the study any time I have acquainted nobody will impose me to explain the reason of withdrawal. It is also enlighten there would have no effect at all in my health benefit or other administrative effect.

I have assured that the right to ask information that is not clear about the research before and or during the research work.

I have read this form, or it has been read to me in the language I comprehend and understood the condition stated above, therefore, I am willing and confirm my participation by signing the consent.

Name of the participant _____Signature_____

Agreed to participate in the study: Yes ☐ No ☐

Thank you!

Annex III. Questionnaires

Part I: - Self administered questionnaire for health professionals working in Tikur Anbessa Specialized Hospital.

1:- Socio-demographic data

SN	Questions	Response options	Code	Skip
101	Sex	1. Male 2. Female		
102	Age	_____yrs		
103	Profession	1. Medical specialist 2. GP 3. Nurse 4. Radiologic technologist 5. Laboratory technologist 6. Pharmacist		
104	Highest educational level achieved	1. Medical Degree + 2. Medical Degree 3. Masters degree 4. Bachelor degree 5. Diploma		
105	Department	1. Surgery 2. Internal medicine 3. Radiology 4. Pediatrics 5. Gynecology/obstetrics 6. Laboratory 7. Pharmacy		

106	Year of experiences	1. 0-5 years 2. 6-10 years 3. 11-15 years 4. 16-20 years 5. Above 20 years		

2:-Knowledge and perception of respondents and other contributing factors on telemedicine utilization

SN	Questions	Response options	Code	Skip
201	Do you Know any other way of investigating patients other than face to face patient-doctor interaction?	1. Yes 2. No		
202	Do you know telemedicine services found in Tikur Anbessa Specialized Hospital (located at 1st floor)?	1. Yes 2. No		
203	Do you have any training related to telemedicine?	1. Yes **2.** No		
204	Do you think that telemedicine services can help to address the quality and access of health care services in the health care delivery system?	1. Yes 2. No		
205	In your opinion, should telemedicine be made available in all health care units?	1. Yes 2. No		
206	What is your opinion on the role of telemedicine in the health care delivery system?	1. Important 2. Important and mandatory 3. Unnecessary and		

		time consuming		
207	Do you know the type of information technology used in telemedicine system?	1. Yes 2. No		If no, go to Q209
208	If yes, what are the components of information technology involved in telemedicine unit?	1. Hardware 2. Software 3. People 4. Medical data. 5. Internet connections		
209	Do you know the major services available in Tikur Anbessa Specialized Hospital telemedicine unit?	1. Yes 2. No		If no go to Q211
210	If yes, what are the major services available in Tikur Anbessa Specialized Hospital telemedicine unit?	1. Tele-education 2. Tele-consultation 3. Both		
211	Do you know the different types of telemedicine approach?	1. Yes 2. No		If no, go toQ213
212	If yes, what type of telemedicine approach do you know?	1. Store and forward 2. Real time 3. Both		
213	Do you know any factors that affect telemedicine services in TASH?	1. Yes 2. No		If no, go to 301

214	If yes, In your opinion, what are the factors that inhibit telemedicine services in Tikur Anbessa Specialized Hospital? You can choose more than one answer.	1. Lack of professionals 2. Lack of awareness 3. Legal issues 4. Financial Problem 5. Technological problem 6. Administrative problem		

3- Level of utilization of telemedicine and technological barriers in Tikur Anbessa Specialized Hospital.

SN	Questions	Response options	Code	skip
301	Have you ever used telemedicine services at BLH (located in 1st floor)	1. Yes 2. No		If no stop answering
302	Do you know the schedule of telemedicine session?	1. Yes 2. No		
303	How many sessions of telemedicine do you attend so far per year?	1. Less than 5 times. 2. 5-10 times. 3. 11-20 times 4. More than 20 times.		
304	Which telemedicine session did you attend so far?	1. Tele-education 2. Tele-consultation 3. Both		
305	Are you satisfied in the telemedicine sessions that you attend?	1. Yes 2. No		
306	Is there technology related problems encountered during the telemedicine sessions?	1. Yes 2. No		If no, go to Q308

307	If yes, what are the problems remembered in telemedicine session? You can choose more than one answer.	1. System reliability issues 2. System usability issues 3. Lack of internet connectivity 4. Lack of technical assistant.		
308	In your opinion, does telemedicine services utilized as you expect in Tikur Anbessa Specialized Hospital?	1. Yes 2. No		
309	Do you think telemedicine session needs improvement in TASH?	1. Yes 2. No		If no, stop answering.
310	If yes, which improvement do you suggest? You can choose more than one answer.	1. Create awareness on telemedicine 2. By improving Infrastructures 3. By providing skilled manpower 4. Assuring system reliability 5. By making the system user friendly 6. By giving users technical training 7. By improving internet connection		

Part II-Semi-structured interview questions guides for respondents.

1. What is your name and position?
2. Which types of telemedicine services are delivered and the schedule of the services in Tikur Anbessa Specialized Hospital telemedicine unit? Please describe?
3. Do you think telemedicine is necessary in Tikur Anbessa Specialized Hospital? If the answer is yes or no, why?
4. Do you think that telemedicine unit in Tikur Anbessa Specialized Hospital give appropriate services? If no, why?
5. Do you know any technology related problems encountered in telemedicine unit at Tikur Anbessa Specialized Hospital? If yes, Please specify?
6. What are the main challenges (factors) in telemedicine services found in Tikur Anbessa Specialized Hospital that you encountered?
7. What is your opinion to improve telemedicine unit found in Tikur Anbessa Specialized hospital?

Part III- Observation checklist to evaluate technical properties of telemedicine in TASH.

SN	Questions	Options	Remark
1.	Does telemedicine setup looks like user friendly (usable)?	1. Yes 2. No	
2.	Does telemedicine system works properly (Does the system reliable)?	1.Yes 2.No	
4.	Does telemedicine features functional?	1.Yes 2.No	
5.	Does telemedicine system have good data quality?	1. Yes 2. No	
6.	Does telemedicine system have good connectivity, speed and bandwidth?	1.Yes 2.No	
7.	Does telemedicine department have technical assistant?	1.Yes 2.No	
8.	Does telemedicine system upgradable or maintainable?	1.Yes 2.No	
9.	Does telemedicine system DICOM and PACS compatible?	1.Yes 2.No	

Declaration

I the undersigned, declare that this thesis is my original work and has never been presented in this or any other university, and that all resources and materials used in here, have been duly acknowledged.

Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. I further declare that I observed the guidelines for scientific work in the quotation of all unprinted sources, printed literatures, phrases and concepts taken either word for word or according to meaning from the internet and that I referenced all sources accordingly. In all other instances, however, permission must be obtained from the author.

Name: Belay Tamiru Shita

Place: Addis Ababa University, Ethiopia

Date of Submission_____

Signature_____

This thesis has been submitted for examination with our approval as university advisors.

Name of advisor_____ Name of advisor _____

Signature_____ Signature _____

Date_____ Date _____