

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**ASSESSING FACTORS THAT AFFECT THE IMPLEMENTATION
OF ELECTRONIC MEDICAL RECORD (EMR) SYSTEM IN
GOVERNMENT OWNED HOSPITALS IN ADDIS ABABA**

**By
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**A Thesis Submitted To The School Of Graduate Studies Of Addis
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Degree Masters in Health Informatics**

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TABLE OF CONTENTS	Pages
Acknowledgments.....	III
Table of contents.....	IV
List of Tables	VI
List of Figures	VI
List of Abbreviation	VII
Abstract	VIII
1 Introduction.....	1
1.1 Background.....	1
1.2 Statement of the Problem.....	4
1.3 Rationale for the Study	6
1.4 Scope of the study.....	7
1.5 Organization of the Study	7
2 Literature Review.....	8
2.1 What is an Electronic Medical Record?.....	8
2.2 Functions of an EMR.....	9
2.2.1 Patient Charting	9
2.2.2 Order Communication Systems	9
2.2.3 Clinical Decision-Making Support Systems.....	9
2.2.4 Document/Image Management.....	10
2.2.5 Patient Portal.....	10
2.2.6 Statistics and Reporting	10
2.3 Paper Based Medical Records	10
2.4 Advantages of Electronic Medical Records.....	12
2.5 Disadvantages of Electronic Medical Records	14
2.6 Factors that affect implementation of EMR.....	16
2.6.1 Management (leadership) Commitment and support.....	16
2.6.2 Resistance to change	17
2.6.3 Employee participation	17
2.6.4 Workflow Redesign	18
2.6.5 Appropriate Technology	18
2.6.6 Availability of Trained Manpower	19
2.6.7 Availability of Adequate Budget for EMR Implementation.....	20
3 Objective of the study	22
4 Methodology	23
4.1 Study area.....	23
4.2 Study Design.....	23
4.3 Study population	23
4.4 Sample size	24
4.4.1 Questionnaire	24
4.4.2 Interview	25
4.5 Sampling procedures.....	25
4.6 Data Collection Technique	26
4.7 Data Analysis Procedure.....	27
4.8 Data Quality Management	27
4.9 Ethical Considerations	28

5	Result	29
5.1	Questionnaire	29
5.1.1	Description of study population.....	29
5.1.2	Attitude of respondents towards EMR.....	31
5.1.3	Perceived barriers to EMR implementation.....	35
5.1.4	Factors that affect users support for EMR implementation	37
5.1.5	Comparison of management commitment between government and non-government hospitals	39
5.2	Interview	40
5.2.1	Current medical record keeping system.....	40
5.2.2	The current medical record keeping system efficiency	40
5.2.3	Plan to implement EMR.....	41
5.2.4	Availability of trained manpower	42
5.2.5	Availability of budget for EMR	42
5.2.6	Availability of EMR suppliers	42
5.2.7	Existence of resistance to EMR implementation	43
5.2.8	Factors affecting EMR implementation.....	43
5.2.9	To mitigate factors that affect EMR implementation	44
6	Discussion.....	45
7	Conclusion and Recommendations.....	49
7.1	Conclusion	49
7.2	Recommendations.....	51
	Reference	52
	Appendixes	57

LIST OF TABLES	Pages
Table 1. Characteristics of the respondents, Addis Ababa hospitals, May 2010.....	30
Table 2. Attitude of respondents towards EMR, Addis Ababa hospitals, May. 2010.....	33
Table 3. Perceived barriers to EMR implementation, Addis Ababa hospitals, May. 2010.....	36
Table 4: Relation/Association between different variables and EMR implementation support, Addis Ababa hospitals, May 2010.....	37
Table 5. Relation/Association between Management commitment with type of organization, Addis Ababa hospitals, May 2010.....	39

LIST OF FIGURES	Pages
Figure1. Conceptual Framework of factors that affect EMR implementation.....	21
Figure2. Pictorial representation of sampling procedures.....	26

LIST OF ABBREVIATIONS

AARHB-Addis Ababa Regional Health Bureau

CDOs - Care Delivery Organizations

CI- Confidence Interval

CPOE - Computerized Physician Order Entry

EMR- Electronic Medical Record

FMOH – Federal Ministry of Health

HEP – Health Extension Program

HL7- Health Level 7

HSDP - Health Sector Development Programs

IT- Information Technology

MDGs - Millennium Development Goals

MRI's - Magnetic resonance imaging

OR - Odds Ratio

PASDEP - Plan for Accelerated and Sustained Development to End Poverty

SNNPR - Southern Nations Nationalities and People Region

ABSTRACT

Background: To provide health services for the increasing Ethiopian population the government has increased the number of health facilities. To offer efficient and effective health services, however, patients' medical record keeping or management system is very important. In line with this, some developed countries have undertaken the transition to Electronic Medical Records (EMR) system. Despite this fact, however, Ethiopia has not gone far in this aspect, and most hospitals are still documenting on paper based medical records, which is time consuming and sometimes even difficult to find. As a result, there is time when physicians are treating patients without having patients' background information of their past medical treatments. Therefore, it is very important and timely to look into why our hospitals are not using Electronic Medical Records (EMR).

Objective: The general objective of the study was to assess factors that affect implementation of EMR in government owned hospitals in Addis Ababa.

Methods: A cross-sectional study design were used and health professionals and key informants in ten government owned hospitals and the only two nongovernmental hospitals that have fully implemented EMR, were assessed using questionnaire and interview on issues of health professionals attitude, budget, trained manpower, management commitment, availability of technology and other related to EMR implementation. A Simple random sampling technique was used to select health professionals, depending on the population sizes of their hospitals and all key informants were selected purposively. Accordingly, a total of 399 health professionals and 12 key informants from each hospital have participated in the study. Data analysis was done using chi-square test, mean, t-test and odds ratio. EPI-INFO version 3.3 and SPSS version 11.0 was used to enter, clean, and analyze the data.

Results - The majority 328 (92.1%) of health professionals in government hospitals support implementation of EMR in their hospitals. Among the variables analyzed, respondents' age, sex, occupation, education status, having computer training, experience, type of organization and level of communication between employees and management were not found to significantly ($p>0.05$) affect health professionals attitude

to support EMR implementation. Among government hospitals selected for this study only one hospital is in testing stage to implement EMR, while the remaining nine hospitals have not implemented EMR. Among the factors analyzed, except lack of budget, all were not found to significantly affect the implementation of EMR.

Conclusions - From the findings of the study it is concluded that except lack of budget, other factors like employees' attitude, management commitment, technology and lack of trained manpower were not found to be significant factor to affect the implementation of EMR in government hospitals. If budget is secured it is possible to implement EMR in government hospitals.

Recommendations - Based on the findings of the study providing sufficient budget to EMR implementation, hospitals to generate income, financial subsidy or donating to implement EMR, strengthening the existing programs on EMR implementation, effective trainings and discussions with users and supporting domestic EMR software suppliers are recommended.

1 Introduction

1.1 Background

Ethiopia is a Federal Democratic Republic composed of 9 National Regional States (namely Tigray, Afar, Amhara, Oromia, Somali, Benishangule-Gumuz, Southern Nations Nationalities and People Region (SNNPR), Gambella and Harari) and two administrative states (Addis Ababa city administration and Dire Dawa City council). The land area of Ethiopia is estimated at about 1.1 million square kilometer and the current population is approximately 79 million, of which more than 84 percent live in rural areas (1).

According to the 2007/08 Health and Health Related Indicators publication by FMOH, the capital city, Addis Ababa has an estimated total population of 3,147,000 consisting of 1,511,000 men and 1,636,000 women. With an estimated area of 530.14 square kilometers or 204.69 square miles, this chartered city has a density of 5,607.96 people per square kilometer and has 43 Hospitals, 28 Health Centers and 442 private clinics (1).

Many have stated that, Ethiopia has one of the worst health status in the world. The Ethiopian health care delivery system has historically been unable to respond qualitatively to the health needs of the people. It has been highly centralized and services are delivered in a fragmented way with a reliance on vertical programs and there is little collaboration between public and private sectors. At the centre of the problem is the backward socio- economic development resulting in one of the lowest standard of living, poor environmental conditions and low level of social services. The other cause of health problem in Ethiopia can also be attributed to the isolation of large segment of society from the modern health facilities. Furthermore, wide spread of illiteracy prevents the dissemination of information on modern health practices. A shortage of trained personnel and insufficient funding also hampers the equitable distribution of health services. Above all, most sounding health institutions are concentrated in urban centers. As the majority of the population resides in the rural areas and has little access to any type of modern health institution, it is estimated that about 75 percent of the population suffers from some type of communicable disease and malnutrition, which are potentially preventable (2, 3).

In response to the country's health problem, the Ethiopian Government has formulated a series of Health Sector Development Programs (HSDP I, II and III 1997-2010) in line with the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) and to achieve the health-related Millennium Development Goals (MDGs). Under this program, the government has introduced "Accelerated Expansion of Primary Health Care Coverage" and the Health Extension Program (HEP). These health programs focus mainly on providing quality preventive and selected curative health care services in an accessible and equitable manner to reach all segments of the population, with special attention to mothers and children (4).

The use of modern information technologies, such as the availability of powerful computers and continuously developing software, new high-speed networks and inexpensive massive storage, along with the remarkable growth of the Internet and Intranets, have led to an increase in the amount and availability of health information (5) and there by efficiency of health services.

The use of paper based medical record system had made the practitioners not be fully informed about patients' present and previous health status and treatment. Practicing healthcare in this manner with lack of information had become a habit (5). To alleviate such problems, Electronic medical records systems (EMR) are starting to be used in hospitals throughout developed countries.

EMR systems represent a departure from traditional paper records keeping in that they include patient demographics, medical histories, and all records of patient treatment stored in a computerized format. When coupled with networked systems and the Internet, the EMR platform offers increased versatility in terms of transferability of information, greater communication among doctors, and improvements in quality of care, just to name a few advantages (6). In this regard many developed countries like USA, Canada, Norway, have already started to use EMR and significantly improve the provision of health care services.

All the organizations that are developing or planning to develop EMRs share broad common goals, such as improving the quality and safety of care, reduction of costs and unnecessary labor, improving decision making at the point of care, and creating stronger physician partnerships (7).

Like other countries Ethiopia should also use EMR to deliver quality health care services and solve problems related to lack of getting appropriate patients' information particularly in areas such as Addis Ababa, where the density of population and hospitals are large.

1.2 Statement of the Problem

Currently most hospitals in Addis Ababa use paper based medical records that usually decrease the productivity of health professionals, since paper based records are sometimes lost and difficult to retrieve patient information, important information may not be written on them, or the handwriting of health professionals may not be readable. Paper based records may also negatively influence the quality of care provided to the patient. Sometimes physicians have to deal with information regarding their patients' medications or preventive services in the form of lists or registries. The information in the registries may be sometimes duplicated and even contradictory in different lists or registries, so that the physicians may not keep track of some patients' problems and the quality of care may suffer.

Beside this, a lengthy waiting time to get service is another factor for inefficiency. According to the 2006 Country Status Report on Health and Poverty, Document of the World Bank, one of the main reasons for dissatisfaction with the quality of care in public health care service is the lengthy waiting time. The waiting time between arrival and being seen is very high, averaging 7 hours at government hospital outpatient departments, 6.2 hours at NGO hospitals, and 2.7 hours in other private hospitals (8).

In providing health services, basic information must be available for all doctors and other professionals who need it and utilize it in proper manner. Furthermore, consistency and timeliness of data is important to improve the health management information system (HMIS) and to deliver quality health services.

In addition, there is great need for a digital record to allow capture of patient data that can then be processed and mined for insights into better treatment for patients. The electronic medical record (EMR) is the tool that promises to provide the platform from which new functionality and new services can be provided for patients (9).

Therefore, it is important to change the old way of patient medical record, which lacks appropriate information, time and space consuming into the modern one, electronic medical record.

Despite these facts, there were no documented studies that look into this issue, particularly in Addis Ababa. Therefore, it is important to identify those factors that affect implementation of EMR in government owned hospitals in Addis Ababa.

1.3 Rationale for the Study

The government is the main health care provider and it runs a majority of health facilities, and these numbers have increased significantly over recent years. Nowadays, 59 percent of hospitals, 98.5 percent of health centers and all of the health posts are run by the government (1, 4).

The majority of the Ethiopian population still depends on government hospitals for their healthcare (10). Currently 44 percent of the population is under the age 15. This population structure connotes rapid exponential population growth in the future. If population growth does not decline in the coming years it is expected that the population of Ethiopia will double in about 25 years (11). As the population increased over the years managing such number of populations' health profile in paper based records will be difficult. Therefore, it is important to improve the efficiency of service provision to a lot of people coming to the hospitals and other health care institutions.

Since, paper based medical records are bulky and awkward to use, some healthcare organizations in developed countries have undertaken the transition from a traditional paper system to an electronic medical records (EMR) system. Research in this field has shown that EMR systems can improve the quality of care provided, accuracy of patient information, and overall safety of patients through reduced medical mistakes (6, 12).

Therefore, it is important and timely to assess factors that affect implementation of EMR in health care organization in general and for this particular purpose in government hospitals in Addis Ababa. Thus, as the result of this study policy makers, health sector planners and health care organizations will have basic information about factors affecting implementation of EMR. Furthermore, awareness of the problems may also help to create conducive environment in all aspects to implement EMR. Finally, the information gained from this study may answer some of the questions that have posed concerning the implementation of EMR in the context of our country. It is hoped also that the study will stimulate researchers for further investigation.

1.4 Scope of the study

This study is limited to assess factors affecting implementation of EMR in ten government owned hospitals that are administered under Federal Ministry of Health (FMoH), Addis Ababa Health Bureau (AAHB), Addis Ababa University and two non-government hospitals that have implemented EMR. It did not include hospitals that are administered by federal police and defence as well as that did not implemented EMR. Furthermore, other healthcare organizations such as health centers, health posts and the like were not included. This is not to overlook the importance of their health care services, but since it will not be easy to undertake such a huge task within the time span available for the researcher.

1.5 Organization of the Study

This study is presented in seven chapters. The first chapter gives a general background of the study, statement of the problem, and rationale for the study. Chapter 2 deals with the review of the literature on definition of EMR, advantage and disadvantages of EMR, and factors that affect implementation of EMR and Chapter 3 describes study objective. Chapter 4 specifies the methodology used for the study, while Chapter 5 reports results of the study, and Chapter 6 provides discussions. Finally, the last chapter, Chapter 7 presents conclusions and recommendations based on the findings of the study.

2 Literature Review

2.1 What is an Electronic Medical Record?

Different authors define EMR in different ways, some define it as a medical record in digital format that provides all relevant information about a patient in one single location, while others define it as a system that represents a departure from traditional paper records keeping of patient demographics, medical histories, and all records of patient treatment stored in a computerized format (6, 13).

According to Jerome, one of the health care experts, EMR is a computer based information system that integrates patients-specific information from diverse sources and tracks that information overtime to facilitate clinical management and information retrieval, analysis and reporting. And Morgan defines EMR as a confined medical record offering little integration with other system and is much restricted in its scope. Other researchers refer EMR as a patient medical record from various sources related to patient treatment, diagnosis, laboratory test, history, prescription and allergies that can be accessed from various sites within the organization with the protection of security, patient privacy and confidentiality (14).

In short EMRs are computerized legal clinical records created in care delivery organizations (CDOs), such as hospitals and physician offices (15), and it is a new technology which is currently receiving increased attention in health sectors.

The idea of incorporating a patient's entire medical history into one accessible, electronic file was came up back in the 1960s and this patient record format is named "electronic medical record," or an EMR. Later on in 1972, the first medical records system was developed (9, 16).

Nowadays, most developed countries like Canada, have already implemented EMR technologies in large clinics (9). Similarly, Many Norwegian hospitals that have implemented EMR system have proceeded to withdraw the paper-based medical record from clinical workflow (17). And in USA the Obama administration has called for

providing EMR throughout the country before the year 2014, and the 2009 economic stimulus bill contains significant funding (nearly \$20 billion) to promote this effort (18).

2.2 Functions of an EMR

The functions of EMRs are not always clear because of the existence of different views of professionals. Different authors stated a list of six key functions of EMR system. The minimum set of functions of EMR is stated below (19).

2.2.1 Patient Charting

This function documents the patient's visit by providing templates or forms for inputting patient visit information such as vitals, complaints, history and present illness, review of systems, physical exam, etc. In most systems this is done via drop-down list, check-box, option buttons, hand-writing recognition and/or voice recognition.

2.2.2 Order Communication Systems

This function communicates with external systems such as laboratories, pharmacies, Imaging Centers and Hospitals. This function assists the physician in sending out laboratory requests, prescriptions, imaging requests and submitting visit charges and diagnosis codes to the back office/billing system, often referred to as Computerized Physician Order Entry (CPOE)

2.2.3 Clinical Decision-Making Support Systems

This function helps physicians in their decision-making by automatically providing recommendations, reminders and alerts to the provider. These recommendations are based on the information that the physician enters regarding the patient and matches that against a database and the patient's health maintenance profile. This function also assists the doctor with coding and diagnosis.

2.2.4 Document/Image Management

This function provides offices with a way to manage the flow of paper coming into their office, i.e. patient intake forms, referring physician letters, faxes, laboratory reports, etc. and provides physicians with a way to manage images such as x-rays, magnetic resonance imaging (MRI's), ultrasound and, in some programs, audio/video clips.

2.2.5 Patient Portal

This function enables patients to access their health record from any computer in the world with a secure internet connection, granted they provide a username and password. Automated features include appointment scheduling, Rx refill requests, record access, electronic intake forms and outcome assessments and patient education. This can also be used for provider-to-provider communication where patients can grant access rights to their electronic medical record.

2.2.6 Statistics and Reporting

This function allows providers to create reports from their database for statistical purposes. This feature becomes especially helpful in the event of drug recalls, health maintenance reminders and disease management.

2.3 Paper Based Medical Records

Traditionally, patient records have been stored in paper files, and it is still used due to its familiarity to users and portability. There is also a sense of ownership of paper records, due to being only one copy. This increases the sense of their security (20), although it will be noted below that this may be a false sense of security. Nonetheless, there are many problems with paper-based medical records

Compared to electronic medical records paper based medical records have the following limitations. The first one is, paper based medical records have a negative impact on optimization of information management in healthcare and as a consequence reduce productivity and quality of care provided to the patients. Productivity may decrease,

because paper records are often unavailable, important information may not be written on them, or the handwriting of a health professional may not be readable. Sometimes physicians have to deal with information regarding their patients' medications or preventive services in the form of lists or registries. The information in the registries may be sometimes duplicated and even contradictory in different lists or registries. In such cases physicians may not keep track of some patients' problems and as a result the quality of care may suffer (5).

Another problem is that the record can only be used in one place at one time. This is a problem for patients with complex medical problems, who interact with numerous specialists, nurses, physical therapists, etc (20, 21). As a result, physicians are urged to treat patient without having adequate information about them. In line with this a study conducted by the research firm (Harris Interactive) has uncovered several major causes for medical errors. The most common error this study found involved multiple physicians treating the same patient without having access to all the patient's records. Typical of these scenarios are treating patients referring to different places with incomplete records stored in different locations (6).

Furthermore, paper files consume space and significantly delaying access to efficient care and information retrieval are the most common problems (21). This is evidenced by the fact that clinics and hospitals using paper files are stacked as far as the eye can see. Beyond the physical challenge of handling that volume of paper, reliance on paper files and charts often means that, the amount and quality of time spent with patients is diminished. Doctors often have to flip through multiple pages of barely legible charts, trying to find a particular piece of information, which may be incomplete or missing entirely (16).

A final problem with the paper-based record is security and confidentiality. Although ascribed as a problem of the EMR, there are attributes of the paper record that increase its vulnerability to access by unauthorized individuals (20).

2.4 Advantages of Electronic Medical Records

The advantages of an Electronic Medical Record (EMR), as compared to a paper-based record, are well documented in literature. In an effort to optimize the efficiency of health care service provision, use of EMR is vital to reduce limitations observed in paper based medical records. EMR has the potential to become the core electronic information and communication system in the health care sector. With the assumption that EMR systems can improve both the quality and the effectiveness of healthcare delivery, numerous governments and healthcare organizations have invested in development and deployment of EMR systems (17). With the growing demand for digital information in health care, the electronic medical record (EMR) represents the foundation of health information technology (22).

One of the most important advantages of EMRs is the accessibility of information. Searching and accessing medical information in EMRs becomes easier, simplified and less time spending, since records can be searched and displayed by different parameters, as chronologically, by group of indicators, by problem, by provider etc. Laboratory data can be displayed in text form, in tables or graphically that is more convenient to interpret. The quality of information is also improved without the limitations such as missing pieces of data or handwriting legibility. The EMR databases could be accessed by authorized users through Internet or other telecommunication systems, so that physicians can be able to see or add their records at the hospital, at home, or even while traveling(5).

EMRs can also increase the healthcare efficiency by providing aggregated, regional and national data and improving co-operation between health professionals, since the EMR software permits the possibility to multiple physicians to easily access the same patient's record for purposes of consultation or cross-coverage (5, 23). EMR systems can greatly aid physicians in managing chronically ill patients by tracking the frequency of preventive services, reminding physicians to offer needed tests during patient visits, and by ensuring that critical, disease-specific results are consistently recorded on each visit.

Electronic records could easily offer diverse type of data in the form of selected variables for quality assurance and quality improvement or for research activities. Quality assessment and improvement activities are greatly eased, since practice-level process and outcome data on clinical variables are readily accessible (5).

EMRs can also support for medical decision making. For instance, if critical laboratory values fall outside of a normal range, they can immediately be flagged for further inspection. Furthermore, patients' with complex medical conditions or instances where a patient sees multiple care providers it is difficult for both patients and physicians to recall medication, allergy and problem documentation. A single repository of such information combined with decision support from the simple (drug interaction flags) to the complex (prescribing recommendations) could easily highlight. Unsafe drug-drug or drug-allergy interactions could be identified as soon as the physician selects a medication on an electronic prescription pad (form), or have better clinical decision support (13, 24, 25, 26).

With regard to patient satisfaction, a survey conducted at a family medicine clinic located in Upper-Midwestern town demonstrated that patients were comfortable with the use of EMR, and they also thought EMR had a positive effect on the quality of care they received (27). Likewise, different studies have shown that users have positive attitude towards EMR use. A study conducted in primary healthcare centers in Kuwait that evaluates users satisfaction of the newly implemented EMR system found that a large majority of the respondents considered the system to be flexible (83%), easy (89%), and satisfying (81%) (28). Another study also showed that, clinicians find the EMR easy to use and are generally satisfied with the impact on their work (29). Some physicians who used EMR have said that they are able to see more patients after implementing an EMR (9). Another study in Primary Care Respondents clearly indicated that EMR improved the speed with which they could accomplish many tasks (18).

The entire system of EMR is password driven to ensure security and the integrity of medical records. Care networks can define restrictions of all users based on specific categories of information. Access to patient information will be granted on a "need to

know” basis. Users will be authorized to view only the information necessary to do their job (30). In addition, the systems automatically collect data on the screens viewed or printed by a particular employee, allowing for traceability and flagging questionable activity. So, although some patients may have concerns about their information being made available electronically, the systems on the market have already taken steps to minimize any security problems (13).

Furthermore, EMR is not only important to physicians, but also for management processes. Because the quality improvements made possible through EMR systems will ultimately translate into cost savings (6, 14, 25). EMRs could generate information reports for administrative, monitoring and evaluation purposes (5). Administrative benefits include easier in creating reports, organizing and locating clinical information, managing plan care, enhancing claiming and ordering processes, reducing the time for billing processes and providing better customer service. EMR can contribute knowledge to improve long term planning for healthcare organizations and resource allocation (14, 25).

In general, EMR decreases diagnosis time, quicker workflow, automated discharge instructions, reduction of cost and improved efficiency, improved overall quality of care, good relationships with their patients, improved patient safety, faster access to patient data, and efficient financial systems (13, 14, 31, 32, 33).

2.5 Disadvantages of Electronic Medical Records

The majority of case studies from a broad spectrum of practices describe the successful application of EMR systems. However, alongside these new opportunities, an EMR system, also introduces more complexity into an already complex healthcare system particularly to the privacy and safety of health information (6). Some sustain that once the medical information is stored electronically it can be easily shared with many parties. Electronic systems allow access to data from many locations, increasing the likelihood of a security breach. They can also give individuals access to much more data than was previously possible, increasing the damage caused by system misuse. Personal health

information is often highly sensitive, and it is therefore difficult to repair the damage caused by a breach of privacy. All these risks can be mitigated, but there is little doubt that EMR systems will create (5, 34).

Some health care providers argued that the initial capital investment in applying EMR in the organization is very high, implementing EMR system can have a costs involved in maintenance, training of health care professionals and upgrading the system (5, 14, 35). EMR technology is still unaffordable for most hospitals, group practices, and for solo-practitioners. Furthermore, every healthcare institution and physician is argue that, after taking on the sunk costs of acquiring EMR technology, there is no guarantee that a newer version will not replace the previous model very soon. Additionally, the amount of money a healthcare institution spends on EMR technology in order to improve healthcare is money that the institution will not have to acquire other resources to provide healthcare (36).

Another concern related to implementation of EMRs is the possibility that physicians will spend more time with computers than with their patients (5, 14). In some cases, EMR software is becoming so complex that it is difficult to tell in advance what the system will do in a given situation. Furthermore, clinicians are initially slower after EMR implementation (35).

In addition to these, computer error can occur for several reasons, namely hardware failure, network failure and any problem with EMR. Any breakdown of the EMR system has to await the arrival of the specialist technicians and during that time the user reverts to the paper-based system. This generates frustration and disappointment with EMR (28).

A study conducted in Mexico public hospitals, physicians who participated in this study indicated that the EMR systems are very complex and difficult to learn, and this affects their attitude towards using the EMR systems. The participants also mentioned that, it usually takes too much time to enter data in real time (37).

2.6 Factors that affect implementation of EMR

2.6.1 Management (leadership) Commitment and support

A successful implementation of EMR depends much on commitment and support from the top (leadership) and is one of the most dominant factors. Lack of support from clinical or administrative leadership may lead to dissatisfaction with implementation of EMR systems. Without real commitment from the top can easily doom an EMR effort. Commitment of top management helps to ensure adequate resource allocation, supports redesign effort and facilitates implementation steps (5, 7, 21, 38).

In addition, switching from traditional record keeping to electronic records affects everyone. Therefore, all staff must know why it is being done and how it will impact their job and where they will fit into the new workflow (13, 39). Thus, implementation of EMR system will require frequent communication between management and employees. This direct interaction will help to create positive perceptions about EMR. Therefore, management should pay careful attention not only to crafting fair procedures and policies, but also to communicate with the employees (6, 39).

A study conducted in a private family clinic in the Northeastern United States found that inadequate communication among members developed divergent understandings of why the clinic adopted the EMR and what purposes it should serve. Communication patterns and decision-making processes also affected the organization's ability to recognize and address serious differences in understanding regarding the purpose of the EMR (40).

Furthermore, at the outset of EMR implementation, it is important to define the role and responsibilities of the managers, in selecting the right people for these important roles, and the EMR implementation unit. The successful manager should be able to plan, motivate, evaluate, solve conflicts, negotiate with external contacts, coordinate, integrate and enhance internal communication (38).

2.6.2 Resistance to change

Prior to implementing and installing an EMR, the organization's state of readiness for the EMR implementation must be analyzed. The organization must be prepared for change by identifying core values, understanding broader organizational context and stakeholder concerns, understanding end-user needs, creating a vision and compelling need for change, and being sensitive and responsive to organizational stress resulting from change. People tend to resist change, especially if they're intimidated by the new technology. Thus, addressing the obstacles and barriers, which prevent buy-in and developing solutions to these potential problems can facilitate the success of change management. In an organization there always exists some level of resistance to change. As long as the forces resisting change are greater or equal to those supporting change, the organization remains inert and unchanging. Therefore, if an organization is to experience successful change, its' managers must reduce the forces representing resistance to change and/or increase the forces driving the change effort (6, 31, 38).

2.6.3 Employee participation and attitude

Moving from paper-based records to EMR requires wide commitment, active participation, and considerable time and effort from all staff (41, 42). Lack of EMR acceptance by physicians and nurses are one of the main factors of failure to implement it. Many studies have pointed out that it is necessary to have support and buy-in from all partners and staff before trying to implement new technology (39). Their support and commitment is vital for successes. Likewise an active participation of physicians, nurses and concerned body's involvement during decision making to implement EMR can facilitate the acceptance of the new system. In general, employees' participation and input in the change process can increase performance and commitment as well as reduce resistance to change (6, 38). And user satisfaction and respond with an EMR plays a decisive role in its subsequent use (18, 28).

Another important barrier is employee attitudes toward EMR. Employees may conceive that EMRs will not improve the quality of care, that they are just one big mess, that they

will take too long to learn, or that they will just get in the way. There are many who believe there is nothing wrong with their current system and see no reason to switch to EMR (13).

2.6.4 Workflow Redesign

Moving from paper-based records to EMR also requires workflow change. Critical to successful implementation is the fit of staff and physician workflow to that of the EMR functional and usability design or flexibility. Understanding of the patient care process or workflow will be crucial in the successful transition to EMR. That is, the fit of clinical workflow to EMR execution of the same task is critical. If the fit of work flow is poor, implementation can fail (38, 41).

2.6.5 Appropriate Technology

2.6.5.1 Software Selection

Once the organization decides to move to an EMR, one of the most critical steps in the pre-implementation phase is choosing software carefully. Thus, to increase the chance of success, management with technical advice and guidance must choose software that most closely fits its requirements, including hardware, databases, and operating systems. Many factors that would be considered here will include cost, user friendliness, information integration capacity, and supplier issues. A well defined software selection process increases the success of implementation (38, 39).

In addition, since the EMR marketplace is volatile, supplier stability is a major concern and choosing an EMR supplier means embarking on a long-term arrangement that have significant financial implications (26, 39).

2.6.5.2 Data pre-Load & integration

Data pre-load and integration are inseparable points of EMR implementation. Pre-load data and integration is becoming increasingly possible, however it requires additional

effort and time. Most important factors here are standardization, interoperability between different systems, and fits of workflows between EMR and other systems (9, 38).

2.6.5.3 Technology Usability

In order for EMR to succeed, it is vital that users be able to easily and accurately retrieve, seek, gather, encode, transform, organize, and manipulate pertinent information to accomplish desired tasks (43). If EMR do not adapt to common tasks, too complex to use or understand, not user friendly, and do not meet their expectation or in general if it not well functioning system, it will be ignored and even sabotaged (31, 44). The ability of physicians to use the new system may also influence their satisfaction towards EMRs (5, 38). Therefore, it is important to design systems that are easy to use, understandable and have good instructions.

2.6.6 Availability of Trained Manpower

Any successful implementation of any new technology requires a strong trained manpower. Trained and skilled manpower should be available throughout the implementation phase to detect, solve and follow-up on problems that arise during and after implementation. The professional should have good skills and be responsive to improvements and/or modifications that are identified by clinicians or primary users. Continuous supplier support is also essential during the initial start-up phase (38, 39, 45).

Likewise, proper EMR training programs are key factors for smooth transition to a paperless patient care system. When training people to use the system, physicians and office staff will need different, tailored training programs, since one size does not fit all (5, 38, 39, 44). With this regard studies suggest that, training physicians, nurses, and other healthcare staff in the efficient use of computers is an important step in the implementation of EMR system (27, 28).

2.6.7 Availability of Adequate Budget for EMR Implementation

Financial cost of EMR technology cited as the primary impediment to adoption (42, 46, 47). The major barriers to widespread EMR implementation are cost both direct and indirect (9, 36). Along with the high cost of the hardware and software, there are also costs associated with training physicians and staff, maintenance and upgrading the system (13, 14). EMR systems are constantly changing, since application software, operating systems, hardware, technology, and medical knowledge about diagnosis and treatment are constantly changing. In addition, since information systems and capabilities are constantly changing, ongoing and continued evaluation, education, and training are necessary to optimize clinician efficiency and effectiveness (35). Therefore, implementing an EMR without sufficient budget will be very difficult.

The general conceptual framework of this study will analyze the variables that are likely to influence implementation and use of EMR. The framework does not provide a comprehensive list of factors that enter into detailed variables. Its primary concern is to depict the major factors that influence implementation of EMR. The general conceptual framework of this study is depicted as follows.

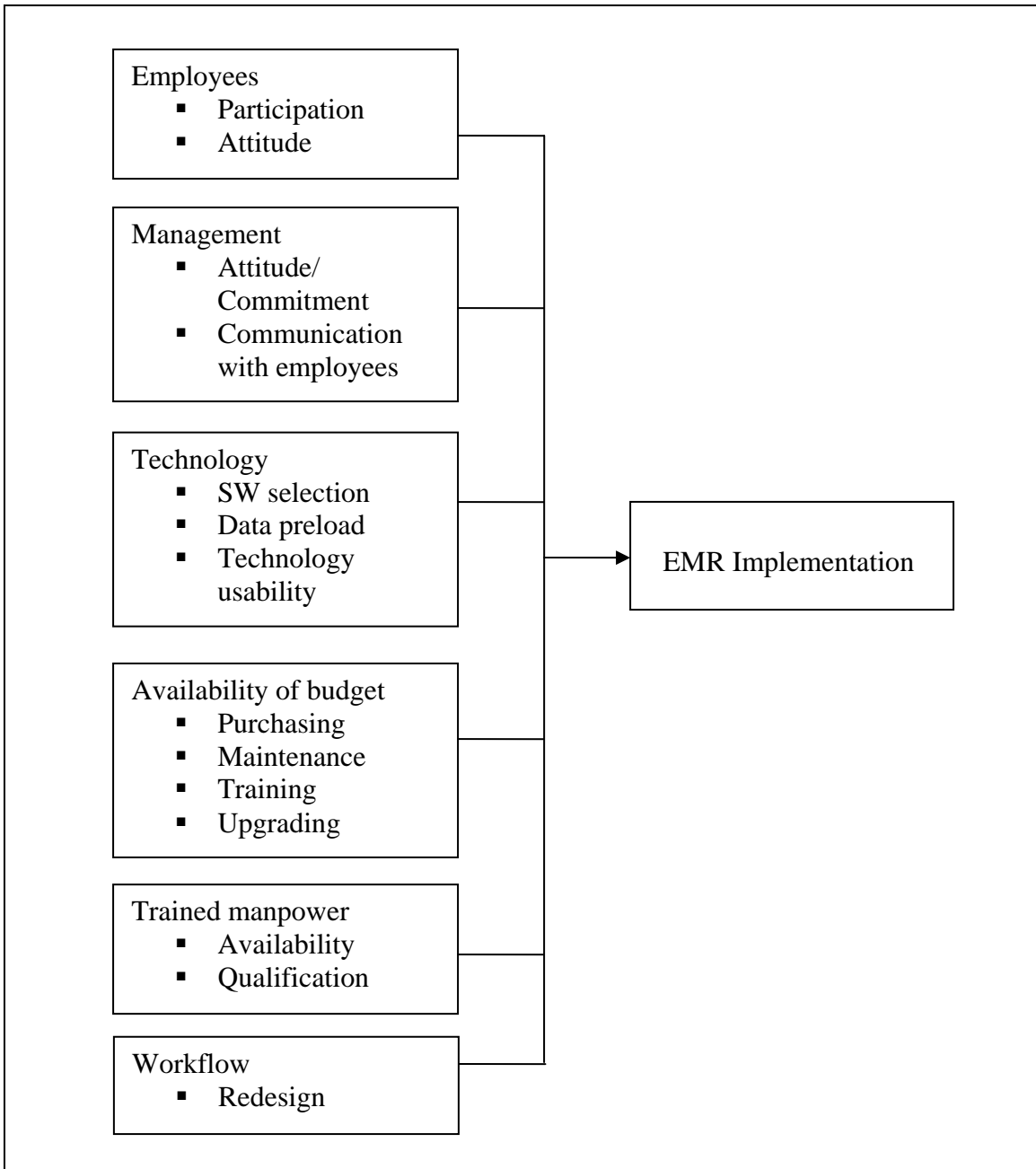


Figure1. Conceptual Framework of factors that affect EMR implementation

3 Objective of the study

General objective

- The overall objective of the study is to identify factors that affect the implementation of EMR system in selected government owned hospitals in Addis Ababa.

Specific objectives

- To assess the attitude of health professionals towards EMR.
- To assess the practice of EMR in selected hospitals in Addis Ababa.
- To identify factors affecting EMR implementation in government hospitals in Addis Ababa.

Research questions

The study was designed to answer the following basic questions:-

1. Do health professionals and management support EMR implementation?
2. What kind of medical record keeping systems are currently in place in the selected hospitals use?
3. Are there trained manpower (capable to use and to run the unit) assigned to the EMR?
4. Is there budget allocated for EMR? If so, is it adequate to run EMR? (i.e. adequate running cost, purchase of necessary materials, maintenance and the like)
5. Are there adequate and reliable EMR equipment and accessories suppliers in the country?
6. Which of the factors are the most crucial obstacles to implement EMR in the selected hospitals?

4 Methodology

4.1 Study area

The study was conducted in ten government owned hospitals and the only two non-government hospitals that are using EMR in Addis Ababa. Addis Ababa is the capital city of Ethiopia which has an estimated total population of 3,147,000 consisting of 1,511,000 men and 1,636,000 women, with an estimated area of 530.14 square kilometers or 204.69 square miles. This chartered city has a density of 5,607.96 people per square kilometer and has 43 Hospitals, 28 Health Centers, and 103 special, 146 higher, 99 medium and 94 lower level private owned clinics (1).

The study areas of this study are twelve hospitals that were drawn from government and non-government hospitals. Ten are government owned, out of which five of them (Zewditu, Gandhi, Ras Desta , Menelik II and Yekatit Hospitals) are administered under Addis Ababa Health Bureau, four of them (Amanuel, Kidus Paulos, ALERT, and Kidus Petros Hospitals), are administered under Federal Ministry of Health and Tikur Anbessa Hospital under Addis Ababa University. The other two hospitals are Kadisco General Hospital and Myungsung Christian Medical Center (Ethio-Korea hospital) that are non-government hospitals and the only hospitals found in Addis Ababa using EMR system.

4.2 Study Design

The study is a cross-sectional study design with both quantitative and qualitative data collection methods that was conducted between November, 2009 and June, 2010 and data collection has been conducted from March to May 2010.

4.3 Study population

The study population for this study was physicians, nurses, laboratory, pharmacy and other health professionals as well as planning, monitoring and evaluation and system administrators drawn from ten government hospitals and the two non-government hospitals in Addis Ababa.

4.3.1. Inclusion criteria: - All health professionals, planning, monitoring and evaluation as well as system administrators who are currently working in all government owned hospitals in Addis Ababa providing service for the public and any non-government hospital in Addis Ababa who have implemented EMR system before the proposal date.

4.3.2. Exclusion criteria: - Health professionals, planning, monitoring and evaluation as well as system administrators who are on study leave and government hospitals that are not for public (polices and defence forces) as well as non-government hospitals which did not implemented EMR.

4.4 Sample size

Different sample sizes were taken for different data collection methods that were considered necessary for the study, and they are stated as follows:

4.4.1 Questionnaire

After the number of all health professionals (physicians, nurses, laboratory and pharmacy as well as other health professionals) were collected from corresponding hospitals the sum of aggregated total of health professionals eligible for the study was identified, which came to be 3008. This sum (3008) was considered as a total population size to estimate the study sample size. The sample size determination or selection was based on the following general rules (48)

- For a total population less than 100 or fewer; to select the entire population.
- If the population size is around 500 (500 ± 100), to select 50%.
- If the population size is around 1,500, to select 20%.
- Beyond (about $N=5000$), to select a sample size of 400.

Based on this assumption, since the sum of aggregated total population was 3008 ($1500 < 3008 < 5,000$), by considering the larger the sample size, the more representative it is likely to be, a sample size of 400 is considered as representative sample size for this study. Then, considering a 15% contingency, a total of 460 sample size was taken.

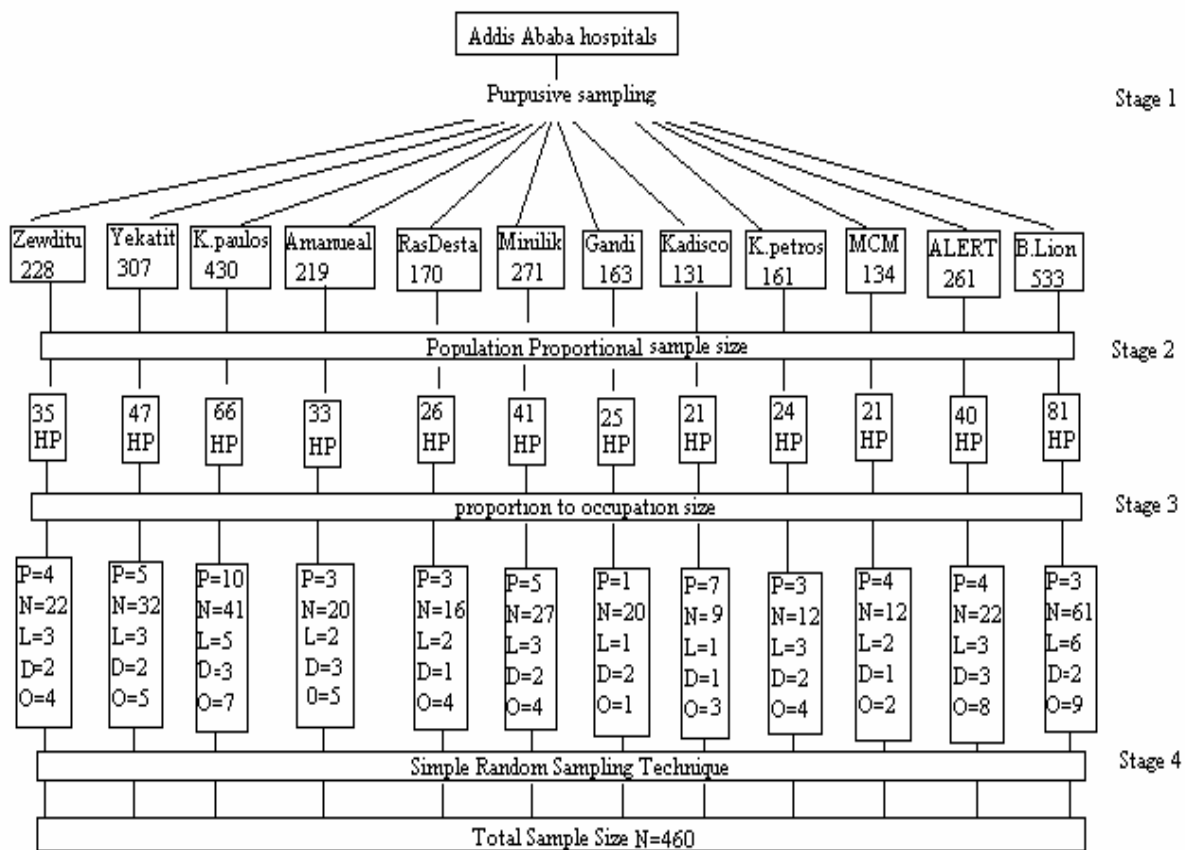
4.4.2 Interview

A total of twelve key informants from each hospital has been interviewed, from these 8 of them are head of planning, monitoring and evaluation, 3 EMR system administrators and 1 matron nurse.

4.5 Sampling procedures

The study uses different sampling procedure, purposive and simple random sampling techniques. At first stage, ten government hospitals and the only two non-government hospitals that have implemented EMR were selected purposively from Addis Ababa hospitals. At the second stage, number of participants were calculated and allocated for each hospital based on the proportion of their total population from the sample size (N=460). At the third stage, physicians, nurses, laboratory and pharmacy as well as other health professionals were classified according to their occupation (physicians, nurses, laboratory and pharmacy as well as other health professionals) and their proportion was determined from the sample size allocated for the hospital. Finally they are selected by simple random sampling technique. This sampling procedure is depicted in Figure2.

For the interview key informants were selected purposively from each hospital, and a total of twelve key informants were interviewed.



HP=health professionals, P=Physician N=nurse, L=laboratory, D=Pharmacy, O=other

Figure2. Pictorial representation of sampling procedures

4.6 Data Collection Technique

To gather data related to the research topic questionnaire was developed in English after a review of relevant literatures. Then, the questionnaire was distributed to the selected health professionals (Physicians, nurses, laboratory and pharmacy as well as other health professionals) to assess factors affecting EMR implementation. The questionnaire includes close ended and open ended items. In order to get detailed information and supplement the results of quantitative study, qualitative data collection method (interview) was utilized. Semi-structured questions were developed to guide the interview. Then, these questions were first prepared in English and translated into Amharic for the interview, to enable the interviewees to express their idea in depth.

4.7 Data Analysis Procedure

The data collected by the questionnaire was entered using EPI-INFO software version 3.3 and finally analyzed using SPSS version 11.0 software. The assessment on the current medical record practice and health professionals' attitude is described using frequencies and percentage. Furthermore, chi-square test is employed in order to identify the associations between implementation support with different variables and management commitment with type of organization. For further investigation, odds ratio is used to assess the contribution of each individual variable (which were statistically significant in the setup ($P < 0.05$)) in explaining the variation in the dependent variable. Average mean was used to analyze responses in rating scores for different factor that can affect EMR implementation and t-test was used to compare the differences of the mean between government and non-government hospital respondents. The result of statistical t-test are significant in the setup $p < 0.05$ significant level.

The in-depth interview was conducted in Amharic for data collection. Notes taken during the in-depth interview or discussion were translated back into English and were categorized according to their items. Finally, the responses of the interviewee were summarized and presented as it was forwarded.

4.8 Data Quality Management

To maintain the quality of data, twelve data collectors, 8 female and 4 male, who are working in each selected hospitals and have experience in collecting data has been selected and thoroughly trained on the objectives of the study, items in the questionnaire as well as how the respondents should fill the questionnaire. Questionnaires were distributed in such a way that the respondents have been helped by the data collectors, in case they need clarification. Furthermore, frequent supervision and assistance has been made by the principal investigator. Before launching data collection the questionnaire was pre-tested on similar population, in selected hospitals, after which necessary modification was made. The completed questionnaire was checked for completeness and consistency by the principal investigator. And the interview is conducted by the principal investigator.

4.9 Ethical Considerations

Ethical clearance was obtained from Joint Academic Commission (Medical and Informatics Faculties) of Addis Ababa University, Addis Ababa City Administration Health Bureau Ethical Review Committee, AHRI-ALERT Ethical Review Committee and Addis Ababa University Medical Faculty Institutional Review Board before conducting the study. After, the ethical clearance obtained, letter of cooperation has been written and given to the respective hospitals. Furthermore, purpose of the study has been delivered along with each questionnaire to participants and was also informed that they had full right to discontinue or refuse to respond to the questionnaire or the interview. And those who had refused to participate were excluded. Letter of agreement was also attached to the questionnaire to obtain the permission of each individual, while verbal consent was obtained from interviewees before conducting the interview. All information communicated with individuals has been kept confidential and privacy is maintained.

5 Result

5.1 Questionnaire

5.1.1 Description of study population

From the ten government and two non-government hospitals a total of 460 respondents who have fulfilled the inclusion criteria were selected, out of which 56 (12.17%) respondents did not return the questionnaire. In addition 5 (1.09%) were excluded because half or more of the questions they filled were unanswered. Thus the response rate for this study was 399 (86.74%).

All of the respondents in this study were Ethiopians. Out of the total 399 respondents, 160 (40.1%) were males and 239 (59.9%) were females. More than half of the respondents were youngsters (20-29 years old) and the majority 145 (36.5%) were between 25- 29 years old and the mean age was 31.57 years. Due to their ratio in the population majority of the respondents were nurses 237 (59.4%) followed by others 55 (13.8 %), physicians 42 (10.5 %), laboratory 39 (9.8 %) and pharmacist 26 (6.5%)

Almost half 207 (51.9%) of the respondents have degree followed by diploma 178 (44.6%), masters 11 (2.8%) and PhD 3 (0.8%). The range of their work experience was from 3 months to 42 years and the majority 227 (57.2%) has less than 5 years of work experience, and about 196 (54.9%) form government hospitals and 37 (9.2%) form non-government hospitals have basic computer training.

Table 1. Characteristics of the respondents, Addis Ababa hospitals, May 2010

<i>Characteristics of respondents</i>	<i>Government hospital</i>		<i>Non-Government hospital</i>		Total	
	Number	%	Number	%	Number	%
Age in years						
20-24	80	22.4	6	15	86	21.7
25-29	126	35.3	19	47.5	145	36.5
30-34	46	12.9	5	12.5	51	12.8
35-39	26	7.3	4	10	30	7.6
40-44	30	8.4	2	5	32	8.1
45-49	20	5.6	3	7.5	23	5.8
50-54	20	5.6	-	-	20	5.0
55 -58	9	2.5	1	2.5	10	2.52
Sex						
Male	148	41.3	12	29.3	160	40.1
Female	210	58.7	29	70.7	239	59.9
Occupation						
Physician	34	9.5	8	19.5	42	10.5
Nurse	213	59.5	24	58.5	237	59.4
Laboratory	35	9.8	4	9.8	39	9.8
Pharmacist	24	6.7	2	4.9	26	6.5
Others	52	14.5	3	7.3	55	13.8
Education Status						
Diploma	158	44.1	20	48.8	178	44.6
Degree	189	52.8	18	43.9	207	51.9
Masters	9	2.5	2	4.9	11	2.8
PhD	2	0.6	1	2.4	3	0.8
Experience						
Less than 5	204	57.1	23	57.5	227	57.2
6-10	50	14	9	22.5	59	14.9
11-15	19	5.3	2	5	21	5.3
16-20	39	10.9	3	7.5	42	10.6
21-25	15	4.2	2	5	17	4.3
26-30	15	4.2	1	2.5	16	4.0
31-35	12	3.36	0	0	12	3.0
36 and above	3	0.84	0	0	3	0.8
Have computer training						
Yes	196	54.9	37	90.2	233	58.5
No	161	45.1	4	9.8	165	41.5

5.1.2 Attitude of respondents towards EMR

The attitudes of respondents towards current medical record, their expectations of further medical record improvement and their perceptions of EMR were assessed. Accordingly, majority of the respondents 344 (97.2%) from government and 38 (92.7%) from non-government hospitals replied that they expect medical record improvements in their hospital, and 342 (95.8%) from government and 40 (97.6%) from non-government were willing to strongly support or support implementation of new methods that can improve medical records (Table 3).

Two hundred eighty nine (82.1%) of respondents from government and 37 (94.9%) from non-government hospitals replied that EMR department should exit, out of which 127 (44.3%) from government and 16 (47.1%) from non-government responded that it should exist independently and the rest 160 (55.7%) and 18 (52.9%) from government and non-government respectively responded it should be merged with other departments. Their feeling about EMR were also asked and about 337 (94.4%) from government respondents replied that EMR is important to provide quality health service while 39 (95.1%) from non-government have similar views and only 5 (1.4%) from government hospital replied EMR doesn't help to provide quality health service. Three hundred twenty eight (92.1%) of the respondents from the government and 40 (97.6%) from non-government hospitals replied they support the implementation of EMR in their hospital. And 29 (7.9%) and 1 (2.4%) from government and non-government hospitals responded they do not support the implementation of EMR in their hospital. The reason they gave for not supporting was that it requires a huge amount of money 9 (31%), training that takes time 15 (51.7%), affected privacy of patients 2 (6.9%), it is difficult to maintain or to repair 3 (10.3%).

Their perception towards paper based medical records were also asked, and 287 (73%) of the respondents replied they strongly agree or agree that paper based medical records have negative impact on the provision of efficient and effective medical service, and 61(15.6%) replied that they do not agree or strongly disagree with the statement. Similarly their perception towards EMR were also asked, and about 383 (96.5%) of respondents replied that they strongly agree or agree that electronic medical records facilitate the provision of efficient and effective medical service while only 2 (0.6%) from government hospital and none from non-government hospital replied they do not

agree or strongly disagree with the statement. Three hundred seventy six (95.4%) of respondents from government and non-government hospitals replied that EMR is better than paper based medical records. Two hundred eighty six (71.7%) respondents from government and non-government hospitals replied from their experience and observations, that hospital management/directors are the major supporters of the implementation of EMR in their hospitals', followed by nurses 263 (65.9%), ICT/IT professionals 261 (65.4%), Physicians 253 (63.4%) and laboratory 246 (61.7%), while 19 (4.8%) of the respondents replied that none of this group do not support the implementation of EMR.

One hundred ninety six (55.5%) of government hospital respondents replied that there is favorable environment to implement EMR in their hospitals' and in non-government hospitals the majority 40 (97.6%) of respondents replied that there is favorable environment to implement EMR. The participants were also asked the level of communication between employees and the management concerning EMR. Ninety five (28.1%) from government and 22 (55.0%) from non-government hospital respondents replied that there is very high or high level of communication, 90 (26.7%) from government and 9 (22.5%) from non-government replied average, 120 (35.6%) from government and 9 (22.5%) from non-government replied very low or low and 32 (8.5%) from government hospital replied no communication at all. In additions, 169 (53.3%) from government hospital and 32 (84.2%) from non-government hospital respondents replied that there is management or administrative commitment to implement EMR in their hospitals'.

Table 2. Attitude of respondents towards EMR, Addis Ababa hospitals, May 2010

<i>variables</i>	<i>Government hospital</i>		<i>Non-Government hospital</i>		Total	
	Number	%	Number	%	Number	%
Expect MR improvement						
Yes	344	97.2	38	92.7	382	96.7
No	10	2.8	3	7.3	13	3.3
Support New methods						
Strongly support	283	79.3	28	68.3	311	78.1
Support	59	16.5	12	29.3	71	17.8
Neutral	8	2.2	1	2.4	9	2.3
Do not support	5	1.4	0	0	5	1.3
Strongly do not support	2	0.6	0	0	2	0.5
Comfort with computers						
Yes	266	76.7	40	97.6	306	78.9
No	81	23.3	1	2.4	82	21.1
EMR department should exist						
Yes	289	82.1	37	94.9	326	83.4
No	63	17.9	2	5.1	65	16.6
How it must exit (326)						
independently	127	44.3	16	47.1	144	43.9
Merged with other department	160	55.7	18	52.9	178	54.6
EMR helps to provide quality health service						
Yes	337	94.4	39	95.1	376	94.5
No	5	1.4	0	0	5	1.3
Do not know	15	4.2	2	4.9	17	4.3
Support EMR implementation						
Yes	328	92.1	40	97.6	368	92.7
No	29	7.9	1	2.4	29	7.3
Reasons for not support (29)						
Huge amount of money	9	31	-	-	9	31
Training that takes time	14	48.3	1	100	15	51.7
Privacy	2	6.9	-	-	2	6.9
Difficult to maintain	3	10.3	-	-	3	10.3
Paper based records have Negative impact on medical service						
Strongly Agree	138	39.1	7	17.5	145	36.9
Agree	120	34.0	22	55.0	142	36.1
Neutral	35	9.9	10	25.0	45	11.5
Do not Agree	48	3.6	1	2.5	49	12.5
Strongly do not Agree	12	3.4	0	0	12	3.1

Table 2. Continued

<i>EMR facilitate the provision of medical service</i>							
Strongly Agree	238	66.9	28	68.3	266	67	
Agree	106	29.8	11	26.8	117	29.5	
Neutral	10	2.8	2	4.9	12	3.0	
Do not Agree	1	0.3	-	-	1	0.3	
Strongly do not Agree	1	0.3	0	0	1	0.3	
EMR is better than Paper							
Yes	336	95.2	40	97.6	376	95.4	
No	17	4.8	1	2.4	18	4.6	
Who supports EMR implementation							
Hospital management/director	255	71.2	31	75.6	286	71.7	
Physicians	266	63.1	27	65.9	253	63.4	
Nurses	230	64.2	33	80.5	263	65.9	
Laboratory technician	218	60.9	28	68.3	246	61.7	
ICT/IT professionals	227	63.4	34	82.9	261	65.4	
None	18	5.0	1	2.4	19	4.8	
Favorable environment to implement EMR							
Yes	196	55.5	40	97.6	236	59.9	
No	67	19.0	1	2.4	68	17.3	
Do not know	90	25.5	0	0	90	22.8	
Adequate information while planning to implement EMR							
Yes	141	42.9	33	84.6	174	47.3	
No	188	57.1	6	15.4	194	52.7	
Level of communication concerning EMR							
Very High	38	11.3	5	12.5	43	11.4	
High	57	16.9	17	42.5	74	19.6	
Average	90	26.7	9	22.5	99	26.3	
Low	72	21.4	5	12.5	77	20.4	
Very low	48	14.2	4	10.0	52	13.8	
None	32	9.5	0	0	32	8.5	
Administrative commitment to implement EMR							
Yes	169	53.3	32	84.2	201	56.6	
No	148	46.7	6	15.8	154	43.4	

5.1.3 Perceived barriers to EMR implementation

Both from government and non-government hospitals respondents ranked factors that can affect implementation of EMR in their hospitals'. Using likert scale statistical computation was made for the responses given by the group of respondents and the average mean were calculated (Table 4).

On the basis of this calculation, when the average mean of each variable was compared, lack of adequate budget was found to be the main barrier to implement EMR in both government and non-government hospitals. When this is compared between government and non-government hospitals, lack of budget was ranked first with mean value of 3.46 in government hospitals and 2.63 in non-governmental hospitals and when t-test was computed to see the significant difference in government and non-government groups, it was observed that there was significant difference at $p < 0.05$ significant level.

Lack of trained or capable EMR administrator was ranked second with mean of 3.385 in government hospital and ranked third in non-government hospitals with mean of 2.36. Lack of reliable and adequate EMR equipment suppliers in the country was ranked third with mean of 3.36 in government hospital and second in non-government hospitals with mean value 2.54. Lack of well established workflow/structure was ranked fourth in both group, with mean value 3.34 in government and 2.26 in non-government hospitals. Lack of suitable and usable EMR equipment was ranked fifth with mean of 3.31 in government hospital and ranked last (7th) in non-government hospitals with mean of 2.00. Lack of support from leadership/management was ranked sixth in both government and non-government hospitals, with mean value 3.047 and 2.19 respectively. Lack of employees (physicians, nurses, and others) readiness and positive attitude towards EMR was ranked last (7th) with mean of 2.798 in government hospitals and ranked fifth in non-government hospitals with mean value 2.22.

When t-test was computed to see the significant differences in the two groups, it was observed that there was significant difference in every factor at $p < 0.05$ significant level.

Table 3. Perceived barriers to EMR implementation, Addis Ababa hospitals, May 2010

Variables	Government								Non-Government								Average		t-statistics	
	Rating score								Rating score								X	R	t-value	P-value
	1	2	3	4	5	X	R	1	2	3	4	5	X	R						
%	%	%	%	%			%	%	%	%	%									
Lack of support from leadership/management	17.3	20.8	25.8	12.3	23.9	3.047	6	54.1	8.1	13.5	13.5	10.8	2.19	6	2.958	6	3.4879	0.0005		
Lack of employees readiness and positive attitude towards EMR	23.1	23.1	21.5	15.9	16.5	2.798	7	36.1	30.6	16.7	8.3	8.3	2.22	5	2.74	7	2.3718	0.0182		
Lack of reliable and adequate EMR equipment suppliers in the country	14.6	16.8	20.3	14.3	34.0	3.36	3	29.7	21.6	24.3	13.5	10.8	2.54	2	3.276	3	3.2638	0.0012		
Lack of suitable and usable EMR equipment	15.9	15.6	18.5	21.3	28.7	3.31	5	51.4	16.2	13.5	18.9	0.0	2.00	7	3.17	5	5.3401	0.0000		
Lack of adequate budget to implement EMR	13.5	16.1	17.4	17.4	35.7	3.46	1	25.7	25.7	20	17.1	11.4	2.63	1	3.37	1	3.2251	0.0014		
Lack of trained or capable EMR administrator	14.6	14.3	20.7	18.5	31.8	3.385	2	30.6	27.8	22.2	13.9	5.6	2.36	3	3.28	2	4.1258	0.0000		
Lack of well established workflow/structure	15.3	16.6	19.7	15.6	32.8	3.34	4	38.2	17.6	26.5	17.7	2.9	2.26	4	3.236	4	4.1398	0.0000		

1=Very Low, 2=Low, 3=Moderate, 4=High and 5=Very High, X= Mean, R= Rank, t-value= calculated value and P-value= significant level.

5.1.4 Factors that affect users support for EMR implementation

In order to assess variables that can affect users support for EMR implementation, chi-square test was carried out. Age, sex, occupation, education status, computer knowledge, work experience, type of organization, their attitude about EMR importance and level of communication were analyzed using chi-square test. Every variables were not found to be significant ($p>0.05$) (Table 5).

Table 4. Relation/Association between different variables and EMR implementation support, Addis Ababa hospitals, May 2010.

<i>Variables</i>	<i>Support EMR implementation</i>		<i>Chi-square</i>	P-value
	Yes	No		
Age in years				
20-24	83	3	6.63	0.469
25-29	143	11		
30-34	45	5		
35-39	26	4		
40-44	28	4		
45-49	22	1		
50-54	19	1		
55-58	10	0		
Sex				
Male	147	12	0.02	0.879
Female	221	17		
Occupation				
Physician	40	1	2.69	0.61
Nurse	218	18		
Laboratory	35	4		
Pharmacist	25	1		
Other	50	5		
Education Status				
Diploma	159	18	4.38	0.223
Degree	196	11		
Masters	10	0		
PhD	3	0		
Have computer training				
Yes	219	14	0.97	0.324
No	149	14		

Table 4. Continued

Experience				
Less than 5	211	16		
6-10	54	4		
11-15	19	2		
16-20	37	5	3.06	0.879
21-25	16	1		
26-30	16	0		
31-35	11	1		
36 and above	3	0		
Type of Organization				
Government	328	28	1.6	0.206
Non-government	40	1		
EMR is important to provide quality health service				
Yes	348	28	3.75	0.185
No	3	1		
I don't know	17	0		
EMR is better than paper based medical records				
Yes	347	28	0.0916	0.762
No	17	1		
Level of Communication				
Very High	38	5		
High	73	1		
Average	92	7	7.73	0.1716
Low	70	6		
Very low	45	7		
None	29	3		

5.1.5 Comparison of management commitment between government and non-government hospitals

As can be seen from Table 6, 169 (53.3%) of respondents from government hospitals and 32 (84.2%) respondents from non-government hospital replied that there is management commitment towards EMR implementation. Thus, management commitment towards EMR implementation was higher at non-government hospitals than in government hospitals. When this difference was analyzed using chi-square the difference was found to be significant at $p < 0.05$ significant level.

When odds ratio (OR) is used to measure the strength of association, management commitment to implement EMR was found to be 4.67 times higher in non-government hospitals than government hospitals with 95% CI (1.8, 12.82).

Table 5. Relation/Association between Management commitment with type of organization, Addis Ababa hospitals, May 2010

	<i>Type</i>				<i>Chi-square</i>	<i>P-value</i>	Crude OR (95%CI)
	Non-government		Government				
	Frequency	%	Frequency	%			
<i>management commitment</i>	32	84.2	169	53.3	13.19	0.000288	4.67(1.8,12.82)
yes							
No	6	15.8	148	46.7			

5.2 Interview

In order to get detailed information and supplement the results of the questionnaire, an in-depth interview was conducted with twelve key informants from each hospitals, who are working in planning, monitoring and evaluation as well as EMR system administrators.

5.2.1 Current medical record keeping system

All selected government hospitals, except one which is in testing stage to implement EMR system, were keeping patients medical records on papers and cards. Four of them said that they also record patients' demographics data in computers. And the two non-governmental hospitals were implemented EMR with the scheduling, documentation, order entry (although level of sophistication varied), patient history, report generation functionalities. From the two non-government hospitals only one have basic decision making support system, such as, drug interaction and dosage restrictions.

5.2.2 The current medical record keeping system efficiency

Most of the interviewees said that, though they doubt about efficiency, the current medical record keeping system is functioning for the purpose it is intended. One nurse remarked by saying; "...we are keeping records appropriately and regularly, and daily performance has been recorded in forms everyday. But we use a lot of papers to record patient's demography and other histories, on every form repeatedly everyday for inpatients. And to save paper we record many details in small space that doesn't describe it well ...We are recording data repetitively which is very tiresome and we waste a lot of time that is not appropriate"

Other interviewee, from planning, monitoring and evaluation department, said "When a physician orders laboratory test the sample will be taken from the patient and then sent by messenger to the laboratory and again the result will be taken back to the physician, which will take time and energy. Also, our hospital has two branches that are 12 km apart, and to report or to take results they have to travel this distance that will consume time, fuel, cost and human resource."

The other interviewee said “...even if we improved our paper based record keeping system still there are problems. For instance, when we inspect the records, out of 1500 records 479 of them were not in their place, they may be misplaced or lost. The problem is some physicians are giving medical record files to patients to take it back to the reception. But some patients will take it to their homes instead of giving back to reception. As a result, records will be lost and we have found patient medical records outside the hospital... Furthermore, patient record files which don't have age, date of birth, sex, full name and other records were found.”

Regarding patient records security issues, one has said “...hear we are recording patient's private information on these papers that has been told from families, the patient, and diagnosis results. But, since these files can be accessed by any employees, we are just wasting patient's secrets.” In general, almost all interviewees had mentioned different drawbacks in their current medical record keeping system.

On the other hand, interviewees from hospitals that had implemented EMR have indicated that EMR has importance to store patient's file confidentially, so that unauthorized body can not have access to it. Furthermore, EMR has importance for administrative functions, such as, financial income auditing. Besides this, they have also mentioned different drawbacks along with EMR. One system administrator has said that “...if the system fails for few minutes, health professionals are not willing to use paper based medical record at all and they are almost become EMR dependents.”

5.2.3 Plan to implement EMR

All of the interviewees from government hospitals said that their hospitals have a plan to implement EMR, but the plan for implementation is controlled and coordinated by Tulane University in collaboration with Federal Ministry of Health (FMOH) and Addis Ababa Health Bureau (AAHB). Though they have information that there is a plan to implement EMR in their hospitals, they did not have detailed information about when it will start functioning.

5.2.4 Availability of trained manpower

In the selected ten government hospitals two of the interviewee said that they don't have IT professionals while eight of them have said that they have IT professionals. Out of those who have said that they have IT professionals, four of them have said that the IT professionals are not working in IT department, since the department doesn't exist. And three of them indicated that they are working in IT department for maintaining computers, networking the system and the like. The remaining one has IT department that are working as EMR system administrator. In short, except one all the remaining nine government hospitals have IT professionals that are not working as EMR system administrator since the unit does not exist. The two non-government hospitals have indicated that they have IT professionals working as EMR system administrator.

5.2.5 Availability of budget for EMR

Currently none of the government hospitals indicated that they have budget for EMR implementation, except the one which is at testing stage. Most of the government hospitals have budget for computer training purpose. While, the two non-government hospitals have indicated that they have budget for all EMR expenditures.

5.2.6 Availability of EMR suppliers

From the total twelve interviewees, both from the government and non-government hospitals, seven of the interviewees didn't know whether EMR suppliers are available in the country or not. Four of the interviewees said that there are EMR suppliers in the country and only one said there is no EMR supplier except Tulane University. One interviewee who has said that he has long year of experience in EMR software, had indicated that there are definitely EMR software suppliers in the country, and they can develop software based on the requests from health organizations. And if need be, they can give trainings and support as well.

Those who have said there are EMR suppliers in the country have mentioned different companies such as Infranet technology PLC, Cybersoft and private/individual software developers that can provide EMR software and training.

Regarding technology ease of use, all system administrators indicates that EMR technology is simple to use and is not sophisticated. One EMR system administrator suggested that "... currently we don't worry about giving trainings for new employees, they can teach each other and it will not take them more than three days to understand the functions of the system."

5.2.7 Existence of resistance to EMR implementation

Concerning resistance to EMR implementation, interviewees from government hospitals were asked. Four of the interviewees said that, there can be a very little resistance that may arise from their previous experience, computer illiteracy or knowledge. Furthermore, they have said that, since resistance is human nature some degree of resistance can exist naturally. And six of interviewees had replied that there will be no resistance from users to implement EMR. Most of the interviewee who said that there will not be a resistance against implementation of EMR, have justified that, since EMR helps to decrease the work load and increase efficiency there will be no resistance.

5.2.8 Factors affecting EMR implementation

Most of the interviewees said that unavailability of budget is the main factor affecting implementation of EMR. They clearly stated that budget has been affecting most of their works, without budget it is difficult to implement any new system including EMR. In addition to this, one interviewee has replied that the current record size has some impact on the implementation of EMR, according to his view, since the hospital have a lot of patient data that need time to record into computer, changing the whole system within short period of time will be difficult.

5.2.9 To mitigate factors that affect EMR implementation

In order to mitigate the mentioned factors, interviewees have emphasized on creating awareness, strengthening internal income (to generate profit), supporting domestic software developers, having sufficient budget for EMR implementation, providing appropriate training for health professionals, creating awareness by discussion between health professionals on advantages and disadvantages of EMR and forcing employees to use the system in case of resistance.

6 Discussion

Information about EMR implementation is scarce in our country. This study would provide important information regarding practice, health professionals' attitude towards EMR and factors affecting EMR implementation. In this study both quantitative and qualitative data collection methods were used to attain the objectives of the study.

As can be seen from the result of this study, efforts to introduce EMR in government hospitals have been started and have shown some progress. Though the development is shown to be slow, the efforts have played significant role in creating awareness. It is now known that using EMR in our country has a lot of advantages to deliver quality health service.

Three hundred forty four (97.2%) respondents of government hospitals have indicated that they need further medical record improvements and the majority (92.1%) of the respondents supports the implementation of EMR in their hospital. This may show that they have get tired with the present inefficient medical records keeping system. This inefficiency was also confirmed by the qualitative study. On the contrary, 28 (7.9%) of the respondents did not support the implementation of EMR in their hospital. The majority of the respondents who did not support EMR implementation remarked that the time that takes for training is their major concern. Furthermore, resistance to EMRs is not unlike that of experienced in other software adoption over the past several decades (24). In such cases creating awareness of the functionality and benefits of EMR as well as creating spare time for training before the implementation phase is necessary and will ultimately reduce resistance.

In general, lack of employees' attitude toward EMR, did not found to be a significant factor to affect EMR implementation in government hospitals. In addition to this, health professionals ranked lack of employees' attitude as a last factor to affect EMR implementation. Inline with this finding another study also showed that, users' attitude are not significant barriers to affect EMRs adoption (40).

The Chi-square analysis of this study showed that age, sex, occupation, education status, having computer training, experience, and type of organization were not found to be associated with supporting EMR implementation. In contrary to this, however, other studies (28) showed that age had a significant positive relationship with the overall user reaction towards EMR. They suggested that older people are reluctant to accept new technology, particularly computer systems.

This study found out that level of communication of employees with management did not found to be significant factor that affects their attitude to support EMR implementation. However studies have showed (40), communication level of employees with management had a significant negative relationship with overall users' support to EMR implementation. Furthermore, perceived benefits of EMR did not found to be factor that affects their attitude to support EMR implementation. Which is contrary to the finding of Likourezos A. et. al. (47).

In general, bivariate analysis of this study showed that age, sex, occupation, education status, having computer training, experience, type of organization, level of communication between employees and management as well as perceived benefits did not significantly affected health professionals' attitude to support EMR implementation.

The possible explanation for these findings could be that, these variables may not directly affect their attitude, since EMR did not yet implemented in all hospitals. In general, from the findings of this study, we can conclude that the majority of health professionals have positive attitude toward EMR and supported its implementation.

One hundred sixty nine (53.3%) from government and 32 (84.2%) from non-government hospital respondents indicated that there is management commitment to implement EMR in their hospital. This shows that management commitment at non-government hospitals is higher than government hospital to implement EMR. This is may be the reason why non-government hospitals have implemented EMR before government hospitals, or other wise the existence of EMR in non-government hospitals have positively influenced the perception of respondents. When management commitment difference was analyzed

between government and non-government hospitals using chi-square, it showed significant difference at ($p < 0.05$).

However, 71.2 % respondents from government hospitals indicated that hospital management/directors support EMR implementation more than other professionals indicated. In addition, lack of support from leadership or management had been ranked sixth by both groups of respondents as a factor to affect EMR implementation. Therefore, since management has commitment and support to implement EMR, it did not shown to be a significant factor affecting EMR implementation in government hospitals.

The qualitative study has shown that the availability of suppliers is not an issue to the government hospitals if they need it and they have mentioned different EMR suppliers in the country. This indicates that, suppliers' availability is a matter of information gap or lack of information and therefore, it is not shown to be significant factor affecting the implementation EMR in the government hospitals.

From the interview conducted, it was found that eight out of ten government hospitals have IT professionals, who can be capable to run EMR with minimum training. Therefore, lack of trained manpower can not be significant factor to hinder the implementation of EMR in government hospitals.

The result of interview conducted with key informants, the two non-government hospitals have budget allocated for EMR, while all government hospitals, except one hospital at testing stage, have no budget allocated for EMR. Furthermore, these interviewees were indicated lack of budget (for purchasing EMR software, computers, and networking the system) was the main reason for not implementing EMR in their respective government hospitals. Both government and non-government hospital respondents had further strengthened the idea by ranking lack of adequate budget first and indicated as major factor that affects EMR implementation. In Conformity to this, studies made in other countries had showed that financial cost of EMR technology was the primary impediment to adoption and widespread of EMR (9, 46, 47, 49). Therefore, lack of budget is significant factor to affect the implementation of EMR in government hospitals.

Limitations of the study

Since, some participants were unfamiliar with EMR, a lack of prior knowledge may have affected their responses. As the result, the extent to which the findings were affected by these limitations is unknown. In addition, lack of previous similar study done in our country may also affect the comparison of the findings.

7 Conclusion and Recommendations

7.1 Conclusion

Studies have shown that inefficient patient record keeping system has contributed for low quality health care provision. As a result, some countries have changed their paper based medical record system into EMR to increase their efficiency. Even though the importance of EMR has been known to be enabler to provide quality healthcare services, Ethiopia has lagged behind in adopting EMR technology. From ten observed government hospitals only one hospital is in testing stage to implementing EMR. Furthermore, EMR technology has been implemented only in few non-government hospitals.

The result of this research thesis has also showed that health professionals attitude towards EMR is positive and lack of employees attitude toward EMR was not found to be a significant factor to affect EMR implementation in government hospitals. However, their knowledge and skill regarding computers was found to be low and almost half of the professionals do not have basic computer training. So, there is a need to work in this area in order to make users qualified to use EMR, and thereby to maintain their positive attitudes.

When management commitment and support towards EMR implementation was analyzed, it was not found to be significant factor to affect the implementation of EMR in government hospitals. However, management commitment towards implementation of EMR varies between government and non-government hospitals. That is, it is higher in non-government hospitals than in government hospitals.

Regarding availability of EMR technology suppliers, the study did not show lack of availability of suppliers as a significant factor to affect the implementation of EMR. In other words, except the existence of information gap, EMR suppliers are available in the country if need be.

Concerning the availability of trained manpower who is capable to run EMR, the result has shown that lack of trained manpower, was not a significant factor to affect EMR

implementation in government hospitals since there are IT professionals who can be capable to administer EMR with minimum training.

In this study the most important factor identified to be barrier to implement EMR in government hospitals was the availability of budget. All government hospitals except one hospital at testing stage, have no budget allocated for EMR. Therefore, a possible key factor that has been found to be significant to affect implementation of EMR in government hospitals is budget, though the other factors still have influence on the implementation of EMR. Thus, if budget is secured it is possible to implement EMR in government hospitals and if adequate budget is allocated it is also possible to tackle all other factors affecting EMR implementation in government hospitals.

7.2 Recommendations

After analyzing the information gathered through questionnaire and interview, the following recommendations are forwarded based on the findings of the study:

1. Sufficient budget for EMR implementation and running cost should be allocated.
2. Making government hospitals to generate income can help as a source of financial aid for different system implementation.
3. To enhance EMR implementation, the cost of EMR implementation should be brought down through financial subsidy or donations.
4. Strengthening the already existing program (such as, Tulane University's program) on EMR implementation can help to sustain and improve the implementation rate.
5. Challenges and opportunities created while implementing EMR in pilot studies should be well documented.
6. To minimize the challenges that can arise with implementation of EMR, target oriented discussions on EMR should be made in hospitals in order to increase awareness.
7. Effective training should be provided for health professionals and other staffs in order to increase users' motivation, support and capability to use EMR.
8. Supporting domestic EMR software suppliers can help to sustain the implementation and can ensure availability of technical support promptly when required.
9. Further detailed research should be conducted on designing a strategy how to implement EMR in health facilities.
10. Conducting future studies with larger samples and different healthcare organizations could help to identify factor in country level.
11. In order to increase the success of adoption and utilization, healthcare organizations should systematically examine employees perceptions related to EMR.

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Addis Ababa University
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Health Informatics Program

Questionnaire for assessment of factors that affect the implementation of Electronic Medical Record (EMR) in Addis Ababa hospitals

Information sheet

My name is YOSEPH DIRIRSA. I am a postgraduate student at Addis Ababa University, Health Informatics Program. I am doing my graduate thesis with the objective to identify factors affecting the implementation of electronic medical record system in Addis Ababa hospitals, which will be important to improve the success of implementation. Electronic Medical Record (EMR) is a system of keeping records of patient demographics, medical histories, and all records of patient treatment in a computerized format.

You are selected to participate in this study, because your response is vital. This questionnaire contains questions that are related to Electronic Medical Records (EMR). Filling the questionnaire will not take more than 20 minutes. Your name will not be written on this form, and will never be used in connection with any of the information you provided and will be used only for research purpose. You do not have to answer any questions that you do not want to answer or even you can leave filling the questionnaire. There are no potential risks that may cause any harm in any form to the participants who will be involved in this study. Your participation is purely voluntary. However, your honest response to these questions will be helpful to better understand what determines EMR implementation and use in hospitals. I would greatly appreciate your help in responding to this questionnaire.

For more information you can contact:

The principal investigator, Yoseph Dirirsa Telephone: _____ E-mail: yosephdirirsa@yahoo.com

Or Addis Ababa University, medical faculty IRB contact address _____

Consent form

Considering the information you get from the information sheet, I would be thankful if you spend some time to answer questions related to the issue. Would you be willing to participate? (Indicate by ticking the appropriate response)

- Yes (if Yes, please continue to the next page)
- No

Date _____

Name of data collector _____

Signature of data collector _____

Date _____

Name of Supervisor _____

Signature of Supervisor _____

Addis Ababa University
Faculty of Informatics
Health Informatics Program

Questionnaire to be filled by physicians, nurses and other health professionals concerning EMR.

I. Please give appropriate answer to the following questions by writing in the space provided or by marking “X**” in the box**

1. Name of your hospital _____

2. Sex
 - A. Male
 - B. Female

3. Age _____ (in complete years)

4. Educational status
 - A. Diploma in _____
 - B. Degree in _____
 - C. Masters degree in _____
 - D. PhD. in _____
 - E. Other (please specify) _____

5. Your position in the hospital (at present) _____

6. Work Experience (in years) _____

7. Nationality
 - A. Ethiopian
 - B. Non-Ethiopian

8. Did you get any training that helped you to use computers?

A. Yes

B. No

9. Do you feel comfort while using computers?

A. Yes

B. No

10. Do you expect further medical record improvement?

A. Yes

B. No

11. Do you support if there are new methods that can further improve medical record?

A. I strongly Support

B. I Support

C. I am Neutral

D. I do not Support

E. I strongly do not Support

12. Do you think that EMR department/unit should exist in your hospital?

A. Yes

B. No

13. If your response to question number "12" is "YES" how it must be existed?

A. Independently (by its own)

B. Merged with other department/unit

C. In other form (please specify) _____

14. Do you think that EMR is important to provide quality health services?

- A. Yes
- B. No
- C. I do not know

15. Do you support the implementation of EMR in your hospital?

- A. Yes
- B. No

16. If your response to question "15" is "NO" the reason is: (multiple answers is possible)

- A. It requires huge amount of money
- B. It requires training that takes time
- C. It affects the privacy of professionals as well as patients, since it can be shared by many
- D. It is difficult to maintain/repair
- E. Others (please specify) _____

17. Paper based medical records have negative impact on the provision of efficient and effective medical service

- A. I strongly agree
- B. I agree
- C. I neither agree nor disagree
- D. I do not agree
- E. I strongly do not agree

18. Electronic medical records facilitate the provision of efficient and effective medical service

- A. I strongly agree
- B. I agree

C. I neither agree nor disagree

D. I do not agree

E. I strongly do not agree

19. In your opinion, do you think electronic medial records are better than paper based medical records?

A. Yes

B. No

20. Based on your response to question number “19” what are the reasons

21. From your experiences and observations, is there favorable environment to implement electronic medical records in your hospital?

A. Yes

B. No

C. I do not know

22. From your experiences and observations, which one of the following groups supports the implementation of electronic medical records? (multiple answers is possible)

A. Hospital management/directors

B. Physicians

C. Nurses

D. Laboratory technician

E. ICT/IT professionals

F. None of them

23. Based on your response to question number “22” what is the reasons for their support?

24. If your hospital has implemented or planned to implement EMR, do the employees (physicians, nurses, and other concerned) have adequate information while planning to implement electronic medial records?

A. Yes

B. No

25. How do you level the communication between employees and management concerning EMR?

A. Very high

B. High

C. Average

D. Low

E. Very low

F. None

26. Are there management/administrative commitment to implement EMR in your hospital?

A. Yes

B. No

II. Below there are some major factors that affect the implementation of electronic medical records (EMRs) in hospitals. From your experience, observation and knowledge rank the factors which most affect the implementation of EMR. Please mark in the box below that corresponds with its level. (1) If it is very low, (2) if it is low, (3) if it is moderate (4) if it is high and (5) if it is very high.

Factors		Rank				
		1	2	3	4	5
A.	Lack of support from leadership/management					
B.	Lack of employees (physicians, nurses, and others) readiness and positive attitude towards EMR					
C.	Lack of reliable and adequate EMR equipment suppliers in the country					
D.	Lack of suitable and usable EMR equipment					
E.	Lack of adequate budget to implement EMR					
F.	Lack of trained or capable EMR administrator					
G.	Lack of well established workflow/structure					
H.	If any mention and give a rank -----					

THANK YOU VERY MUCH FOR COMPLETING THIS QUESTIONNAIRE

APPENDIX 2

Consent form for interview

My name is Yoseph Dirirsa, I am a postgraduate student at Addis Ababa University, Health Informatics Program. I am doing my graduate thesis with the objective to assess factors that affect implementation of electronic medical record system in Addis Ababa hospitals, which will be important to improve the success of implementation. Electronic Medical Record (EMR) is a system of keeping records of patient demographics, medical histories, and all records of patient treatment in a computerized format.

You are selected to participate in this study as key informant, because your response is vital. This interview contains questions that are related to Electronic Medical Records (EMRs). Responding to the questions will not take more than 40 minutes. Your name will never be used in connection with any of the information you provided and will be used only for research purpose. You do not have to answer any questions that you do not want to answer. Your participation is purely voluntary. However, your honest response to these questions will be helpful to better understand what determines EMR implementation in hospitals. I would greatly appreciate your help in this interview.

Can we begin now?

Yes _____

No _____

Interview Guideline

1. How is the current patient medical record keeping system operating?
2. The current record keeping system efficiency
3. Do you have a plan to implement electronic medical record system?
4. How the organization chart structured, is there IT professionals in your hospital?
5. Is there budget allocated for EMR?
6. Is there EMR equipment suppliers in the country?
7. Other than selling EMR equipment, do they give support in implementing, maintenance, training, and the like?
8. Do you think the organization can face any resistance to implement EMR?
9. What are the main influential factors that affect the implementation of EMR?
10. What possible solutions would you suggest to mitigate the problems?

Name of the hospital _____

Date of interview ___/___/___

Time: Beginning _____ Ending _____

DECLARATION

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

Name: Yoseph Dirirsa

Signature _____

Place: Health Informatics program, Addis Ababa University

Date: _____

This thesis has been submitted for examination with my approval as a University advisor.

Name: Prof. Damen H/Mariam

Signature _____

Date: _____