Exploring Challenges in Patient Monitoring and Clinical Information Management of Antiretroviral Therapy (ART) and the Perceived Usefulness of Electronic Medical Records (EMRs) in HIV Care in Ethiopia

by

Mikael Gebre-Mariam
BHSc, University of Western Ontario, 2004

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of
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In the Faculty of Human and Social Development
Health Information Science

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Supervisory Committee

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Abstract

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The implementation of electronic medical record (EMR) systems is a complex process that is receiving more focus in developing countries to support understaffed and overcrowded health facilities deal with the HIV/AIDS epidemic. This thesis research uses exploratory-grounded theory to study clinician perceived benefits of EMRs in antiretroviral therapy (ART) clinics at four hospitals in Ethiopia. The study is designed to understand the process, technology, social and organizational challenges associated with EMR implementation in resource-limited areas. The research found the attitude of ART clinicians towards the implementation of EMR systems to be overwhelmingly positive. The data showed that perceived benefits of EMRs are improved continuity of care, timely access to complete medical record, patient care efficiency, reduced medication errors, improved patient confidentiality, improved communication among clinicians, integration of various HIV programs, timely decision support and overall job motivation. Conversely, drawbacks to EMR implementation include productivity loss and negative impact on the interaction and relationship between clinicians and their patients. The study proposes a conceptual framework classifying key components for successful EMR implementation in Ethiopia.
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Dedication

For my Lord and Savior Jesus Christ. For my parents, Hailu and Mariam, for always encouraging me to pursue what’s in my heart. Thank you for your unconditional love and continual words of wisdom.
CHAPTER 1: INTRODUCTION

1.1 Introduction

The current health landscape of many developing countries is a dire one, with many facing double and triple burdens of disease (i.e. infectious and chronic). One contributor to this condition is the HIV/AIDS epidemic. HIV/AIDS has the highest prevalence in developing countries. About 68% (22.5 million) of the approximately 33 million people living with HIV/AIDS (PLWHA) reside in sub-Saharan Africa where HIV/AIDS is the leading cause of death. Approximately 90% of children infected with HIV live in this region with 76% of all AIDS deaths in 2007 occurring in sub-Saharan Africa. The current state of AIDS in this region highlights the astounding health care challenges faced by these countries along with the unmet need for antiretroviral treatment (ART) (UNAIDS & WHO, 2007).

Along with high prevalence of HIV/AIDS, tuberculosis, malaria and other infectious diseases, many developing countries face rising levels of hypertension, cardiovascular disease, diabetes and other “lifestyle” related disease. Sub-Saharan Africa and other developing countries with high HIV/AIDS prevalence are considered to be in a state of health crisis as the burden of disease in these regions overwhelsms an already overstretched health care system minimizing its capacity to adequately respond to other health care needs. As early as 1997, the public health spending for AIDS alone exceeded 2 percent of the gross domestic product (GDP) in 7 of 16 African countries included in the study. During that time it was estimated that total health spending of these countries accounted for 3.5 percent of the GDP (Cockcroft, 2002). As the AIDS epidemic continues to increase it leaves little resources to supply other sectors (UNAIDS, 2000).
In attempting to address the multifaceted health care issues of developing countries, a comprehensive approach was proposed by the Alma-Ata Deceleration in 1978. The document proposed a comprehensive primary health care (CPHC) approach in an attempt to address both the causes and effects of diseases. The document takes a broad perspective by focusing on the political, socio-cultural, environmental and biological aspects of ill health. It suggests comprehensive health interventions that integrate preventive, promotive, curative and rehabilitative aspects of health care (WHO, 1978). CPHC implementation in many developing countries requires accurate and timely management of information in the four quadrants of CPHC (i.e. preventive, promotive, curative, and rehabilitative). Continuous access to data is essential in order to monitor disease progress in the population and provide quality health care. In the curative and rehabilitative quadrants of CPHC, information is useful for supporting health care decision-making. The collection and retrieval of clinical data at the facility level is useful for individual patient management to support health professionals diagnosis and management of disease. In the promotive and preventive quadrants, aggregated clinical data at the regional and country level is essential for planning, policy making, funding, implementing, monitoring and evaluating health programs (WHO, 2005; WHO, 2003).

The need for computer-based health information systems in health care has been proven to be a fundamental tool to improving quality of care and reducing medical errors. In the 1990s, the Institute of Medicine published two significant papers that identified electronic medical records as an essential technology for health care (Institute of Medicine, 1991; Institute of Medicine, 2001). To date the use of electronic health information systems is limited or non-
existent in many developing countries. The poor dissemination of information technology from the developed to the developing world continues to be a reality. This poor dissemination of technology is often referred to as the “digital divide”. Daniela Hart, in her paper on a project that introduced computer education to the poor living in the slums of Brazil phrased this phenomenon; “technological apartheid” (Hart, 2002). The challenge is not isolated but entwined with overarching issues of infrastructure development, as the issue of development is also a health issue.

1.2 HIV/AIDS in Developing Countries

HIV/AIDS is one of the world’s greatest health challenges as an estimated 33 million (2007) infected people worldwide need treatment (UNAIDS/WHO, 2007). Acquired Immune Deficiency Syndrome (AIDS) is the late stage of Human Immunodeficiency Virus (HIV) disease characterized by a group of symptoms and signs caused by HIV which cause a deterioration of the immune system (Weiss, 1993). Nowhere else is the impact of the HIV/AIDS epidemic more severe than in sub-Saharan Africa where HIV/AIDS has its highest prevalence. About 68% (22.5 million) of the approximately 33 million people living with HIV/AIDS (PLWHA) worldwide reside in sub-Saharan Africa where HIV/AIDS is the leading cause of death (UNAIDS/WHO, 2007).

HIV/AIDS is a global emergency that has received extraordinary attention from the international community in the areas of prevention and treatment. One area of focus in HIV care has been the accessibility of antiretroviral therapy (ART) for those living in low- and middle-income countries. ART involves the administration of a combination of drugs to

In many health facilities, most HIV care is acute and episodic in nature (WHO, 2005). Nonetheless, there has been an evolution in HIV care from disease care that is acute to health care that is chronic in nature (Clanon, 2007). Chronic care in HIV is vital because the focus is the patient’s overall health and not the disease. Here the patient remains at the center of their care. In chronic care, a proactive and standardized care process that focuses on behavior and not just administering medication is ensured (Clanon, 2007). In order to establish chronic HIV care there must be continuity in the HIV care process. An essential requirement for continuity of care is record keeping, which provides summaries of care histories - allowing health workers to be updated on the patient’s previous medical history including; the patient’s HIV stage, weight, functional status, prophylaxis, current and past medication, education and psychosocial support they have received, just to list a few (WHO, 2005).

The World Health Organization (WHO) has developed patient monitoring guidelines that provide essential minimum data elements for standard HIV care and ART patient monitoring (WHO, 2005). Along with tracking data for individual patient management, health care workers need to summarize patient data for the group of patients they are responsible for. In the current state of many health facilities in sub-Saharan Africa, there are a growing number of patients in HIV care and ART making the tracking and monitoring of patients a challenge (WHO, 2005).
1.3 The Primary Health Care Landscape in Ethiopia

Ethiopia is located in North Eastern Africa and borders five countries. With a population of 75.3 million (2007), it is the second most populous country in Africa (UN Data, 2007) with 85% of the population living in rural areas. Ethiopia is one of the least developed countries in the world with an estimated per capita income of US$100 in 2002. Poverty is common with 47% of the population estimated to live below the poverty line. The total adult literacy rate is 36%. In 1994, Ethiopia established a federal government structure as a result of a new constitution composed of nine Regional States: Tigray, Afar, Oromia, Amhara, Somali, Benishangul Gumuz, Southern Nations Nationalities and Peoples Region (SNNPR), Gambella, Harrari and two city Administrations (Addis Ababa and Dire Dawa) (Federal Ministry of Health [FMOH], 2005).

The Ethiopian health care system consists of public and private health care providers. In the public sector, the decision making responsibilities for the development and implementation of the health system are shared between the Federal Ministry of Health (FMOH), the Regional Health Bureaus (RHBs) and the Woreda Health Offices. The FMOH and RHBs administrate policy matters and provide technical support, while the woreda health offices manage and coordinate the operation of the primary health care services at the woreda (district) level. The primary health care services are organized into a four-tier system made up of a primary health care unit (PHCU) which is made up of one health center and five satellite health posts, the district hospital, zonal hospital and specialized hospital. The PHCU provides care for 25,000 people, while district and zonal hospitals each serve 250,000 and 1,000,000 people respectively (FMOH, 2005).
The first evidence of the HIV/AIDS epidemic in Ethiopia was detected in 1984. To address the impact of AIDS, the government of Ethiopia produced a HIV/AIDS policy in 1998 and subsequently established the HIV/AIDS Prevention and Control Office (HAPCO) and the National AIDS Council to improve the prevention, treatment and accessibility to HIV care and to improve support services available to PLWHA. In January 2005, the government began free ARV treatment for all eligible patients. By the end of 2007, 113,298 patients had started ART in over 270 public and private facilities throughout the country. As of January 2007, the number of patients started on ART was 67,235, against a target of 100,000. By 2009, there was 62% coverage among those who are eligible for the treatment (FMOH-HIV/AIDS Prevention and Control Office [HAPCO], 2009). Pediatric ART uptake has also been below the national target and is an area that needs much focus. (FMOH-HAPCO, 2007).

1.4 Statement of the Problem

Along with international support, many developing countries are scaling up their ART programs. Funding in response to AIDS in the period between 1996 and 2008 has increased from $300 million (US) to $10 billion (US) annually (WHO, 2008). Initiatives such as the World Health Organization’s (WHO) “3 by 5” initiative and the President’s Emergency Plan for AIDS Relief’s (PEPFAR) “2-7-10” goals are two of many initiatives that aim to scale up the provision of ART as well as support the treatment of millions of individuals infected with HIV (WHO, 2005). In the period between 2003 and 2006, there was a 10-fold increase in ART coverage in sub-Saharan Africa (WHO/UNAIDS, 2007). However, there is growing
concern that many developing countries lack the infrastructure and patient monitoring systems to support the complicated treatment regimens associated with ART (Loewenson 2004; Fraser 2004; New York Times, 2003). Therefore, the ability of countries to provide and sustain effective long-term HIV care with ART requires patient monitoring systems that integrates care, prevention and treatment at health facilities (WHO, 2005).

As a chronic disease without a cure, HIV/AIDS care involves: (a) a lifetime of care and treatment, (b) a multidisciplinary approach, and (c) laboratory, pharmacy and clinical data to monitor patient disease. Clinicians need to carefully and frequently monitor patient status and initiate appropriate therapy (Siika et al., 2005; Makadon et al., 1990; Makadon et al., 1990). In addition, the rapid emergence of new research and information about HIV is greater than any information on any other disease in the history of medicine (Safran et al., 1995). The dissemination of this new information to practitioners and its incorporation into clinical practice guidelines and clinical decision support tools remains a challenge in many developing countries. In addressing these gaps, effective health care delivery requires innovative tools and methods that will provide clinicians with easy access to patents’ information, reporting, guidelines, and methods that support adherence to guidelines (Safran et al., 1995).

In this effort, electronic medical records may be one infrastructural component that will support clinical care processes, knowledge transformation and evidence-based quality improvement initiatives (Safran et al., 1995). In the 1990s, the Institute of Medicine published two significant reports that identified electronic medical records (EMR) as an
essential technology for health care (Institute of Medicine, 1991; Institute of Medicine, 2001). EMRs are electronic records that are kept within a clinic, health center, private practitioner’s office and other primary care settings (Nagel, 2007). An EMR is an application environment composed of the clinical data repository (CDR), controlled medical vocabulary (CMV), clinical decision support system (CDSS), computerized provider order entry (CPOE), pharmacy and clinical documentation applications. The patient's electronic record is supported across inpatient and outpatient environments; is used by healthcare practitioners to document, monitor and manage care delivery within the care delivery organization.” (Garets and Davis, 2005). EMRs are vital for improving quality of care and treatment of HIV/AIDS patients by supporting care documentation, monitoring patient drug adherence as well as response to therapy (Siika et al., 2005). Such tools establish continuity of care from the point of diagnosis to the treatment of various opportunistic infections (OI) and the management of OI prophylaxis and ART (PEPFAR, 2000). To date the use of electronic medical record systems by clinicians for patient monitoring and management is limited or non-existent in many sub-Saharan African countries (Asangansi et al., 2008; Rotich et al., 2003; Tierney et al, 2006; Parent et al. 2001, Braa, 2001, Braa, Heywood, Sunking, 1997). Furthermore, little is reported in the literature about the use of EMRs in this region (Asangansi et al., 2008).

1.5 Significance and Purpose of the Study

There is very limited evidence in the literature discussing the utilization and benefits of computer-based record systems in developing countries from the perspective of clinicians (Asangansi et al., 2008; Braa, 2001). Studies done in various developing countries including Mozambique, South Africa and Mongolia indicate the limited extent to which health
information is used to support local health services and decision-making. Health workers at health centers in these countries express that health information systems are purely used as upward reporting tools and that they are not designed to support them in patient monitoring and management (Braa & Nermunkh, 2000; Braa et al., 1997). Understanding clinician’s information needs for patient monitoring and decision making in caring for HIV patients is an essential component of developing knowledge and understanding how EMRs can be effectively utilized in ART and HIV care. Therefore, the objectives of this research were:

1.6 Research Objectives

The objectives of the research were to:

- describe current clinical patient monitoring and HIV/antiretroviral therapy (ART) management processes and tools
- conceptualize the challenges associated with clinical monitoring and management of patients in ART
- describe the current use of electronic medical record systems by clinicians in ART programs and HIV care
- identify the factors affecting the implementation of EMRs
- explore clinicians’ perceived usefulness and attitude towards the implementation and use of an electronic medical record for ART and HIV care

1.7 Research Questions

The specific research questions developed to achieve this aim were:
1. What are the current patient monitoring and management practices of clinicians in antiretroviral therapy (ART) and HIV care in Ethiopia?

2. What are the common challenges associated with clinical monitoring and management of patients in ART or HIV care in Ethiopia?

3. What are the factors affecting the implementation of EMRs in Ethiopia?

4. What are the clinician-perceived usefulness of EMRs in ART and HIV/AIDS Care?

This study utilized an exploratory, grounded theory methodology to investigate the research questions outlined above. In order to summarize the current state of knowledge in the area to serve as a background for the study, a literature review of the development and implementation of various health information systems in different developing countries was carried out. This will be discussed in the following section.
CHAPTER 2: Electronic Medical Record Implementation in Developing Countries

2.1 Introduction

This literature review covers the development and implementation of health information systems in developing countries to support acute and chronic disease management by health professionals. The scope of this literature review will address information systems used for management of clinical data for the purpose of monitoring patients at the facility level. The reason for this particular focus is motivated from the fact that there is very little evidence demonstrating progress in the development, implementation and use of clinical information systems that have patient management and monitoring capabilities in developing countries (Asangasi et al., 2008; Braa, 2001; Braa, Nermunkh, 2000; Braa, Heywood, Sunking, 1997; Rotich et al., 2003; Tierney et al, 2006; Parent et al. 2001).

Currently, the common application of health information systems in developing countries is for the aggregation of collected data in order to contribute to the reporting of standardized indicators at the district, national and international levels for aspects of population health, monitoring disease progress, monitoring programs, planning, policy making, and funding purposes (Parent et al., 2001; WHO, 2005). Studies done in various developing countries including Mozambique, South Africa and Mongolia indicate the limited extent to which health information is used to support local health services and decision-making. Health workers and managers at health centers in these countries expressed that health information
systems are purely used as upward reporting tools and not for supporting them in their work (Braa & Nermunkh, 2000; Braa et al., 1997).

2.2 Electronic Medical Record – Primary Level Care

A commonly cited pilot study that discusses the logistics and challenges of health information system implementation in sub-Saharan Africa is the Mosoriot Medical Records System (MMRS) study. The study reports on a collaboration between researchers at an Indian University and Moi University College of Health Sciences (MUCHS) in Kenya. This pilot project has experienced great success and continues to be an example of a system that is financially and technically sustainable, supporting 60,000 patients and over 150,000 visits in the four years since its implementation (Fraser et al, 2005). The MMRS is an electronic medical record (EMR) system. It was implemented in 2001 and supports a primary care health center in rural Kenya; the Mosoriot Rural Health Centre (MRHC). It provides primary and emergency care to a surrounding population of approximately 40,000 persons and contains a number of clinics including: antenatal, child welfare, pediatric, adult medicine, family planning, and sexually transmitted infections. (Rotich et al., 2003)

The lack of appropriate tools for information collection and management of patient data was a challenge for many rural health centers in Kenya. Prior to implementation of the MMRS, there was no permanent patient registry or unique identifier. Patient visit information was recorded during patient visits in a logbook maintained at the MRHC’s registration office and at each clinic. Minimal data regarding each visit was documented by hand into the logbook. This data included the patient’s name, chief complaint, diagnosis, and treatment or drug
prescribed. As well, patients carried their own patient booklet that nurses and clinical officers would use to make clinical notes. Patient’s booklets act as personal health records and are taken home by patients and brought to each visit. A number of challenges were noted with this method of record keeping; first, the booklets were sometimes forgotten or lost. Furthermore, the cost of purchasing booklets each year was $0.25(US). This is costly for many families with little or no income. Lastly, data collected in the logbooks was minimal and timely access to the logbook was not possible (Rotich et al., 2003).

The research team attempted to address these and timely reporting issues by designing a simple EMR that comprised of a registration module, data entry module, reporting module, a paper encounter form and a data dictionary. New patients were entered into the MMRS and given unique patient identifiers and plastic cards with their ID number. In order to achieve user acceptance of the MMRS, the researchers imposed few workflow changes. For example, during each visit, each patient was given an encounter form and directed to the appropriate clinic. Nurses documented their observations on the encounter form instead of in the logbooks or patient’s booklets. Every clinician, laboratory technician, pharmacist, and financial officer documented the observations on the encounter form, which was then submitted to the checkout clerk upon departure. The clerk entered the encounter form and submitted it to the patient to keep as a personal record. Data entry on the encounter form was minimized by using check boxes (Rotich et al., 2003).

The researchers performed an evaluation on the effect of the MMRS on workflow at MRHC by conducting a pre and post-implementation time-motion study. Research assistants
followed patients, health care providers, and medical record clerks using personal digital assistants (PDAs) to record their observations. Pre-established sets of activities (e.g. physician interaction with other staff, time with patients, data entry by clerks, patients waiting) were available for each subject. Subject activities were observed from start and timed. The study observed at least 100 patients (n=101 pre-implementation and n=115 post-implementation) for the duration of their visit and health care workers (n=16 pre-implementation and n=14 post-implementation) were followed for their entire shift on the day of observation. Clerks (n=5 pre-implementation and n=6 post-implementation) were followed for two day during pre-implementation and a week during the post-implementation period. After data collection, t-tests were conducted to test for differences in time taken to complete activities. The results indicated that patient visits were 22% shorter, patients spent 58% less time with providers (p<0.001), and 38% less time waiting (p = 0.06). Clinicians and health workers spent 50% less time interacting with patients, two thirds less time interacting with each other, and more time on personal activities (Rotich et al., 2003).

In successfully implementing an EMR in a developing country, the authors had to address a number of challenges. Access to electricity was crucial for the upkeep of the MMRS. Careful planning in workflow changes as well as designing a system that was “sensitive culturally” by involving MRHC clinicians and staff in the design and progress of the MMRS were important factors is gaining user acceptance. The authors also attempted to establish ownership of the system by encouraging the Kenyans (faculty and technicians from MUCHS) to be involved in majority of the development and maintenance of the system. The
reporting module of the MMRS served as a useful tool in meeting the monthly reporting requirements for the Kenyan Ministry of Health (Rotich et al., 2003).

Another HIS that has been successfully implemented in a developing country is the Lilongwe Central Hospital Patient Management Information System. The system was deployed at Lilongwe Central Hospital (LCH) in Lilongwe, Malawi in May 2001. LCH is an 800 bed government hospital with a 216 bed pediatric department. The pilot project was carried out in the pediatric department of LCH where a custom-built Patient Management Information System (PMIS) with computer-based order entry (COE) was deployed. Prior to the implementation of the COE, a review of pediatric patient charts highlighted various problems with documentation including a large number of dosage calculation errors in medication orders, and errors in transcribing orders from the chart by nurses. Also, incomplete and illegible documentation accompanied specimens sent to the lab. This resulted in delays and repetition of tests (Douglas et al., 2003).

The pilot project attempted to address these problems by installing 14 touch screen based clinical workstations to be used by clinicians in real-time for the purpose of ordering medications as well as laboratory and radiology tests. After the HIS implementation, researchers performed a weekly review of patient charts over a 4-month period. They measured physician’s use of COE. The review showed that COE was used in more than 80% of pediatric admissions. The introduction of COE reduced the number of errors in medication dosage calculation and eliminated nurses’ transcription of orders. As well, completeness and legibility of the documentation accompanying specimens to the lab greatly improved. This
pilot project demonstrated that COE can be successfully implemented and adopted in resource poor settings and can be built, deployed, and sustained at a relatively low cost with the use of local resources. The study also demonstrates that COE can improve patient care in developing and developed countries (Douglas et al., 2003).

Similar results were experienced in Asia. There, a HIS with a maternal and child health focus was implemented. According to Sing et al. (1992) a Maternal and Child Health Software (MCHS) was deployed in a 20 bed referral rural hospital in Bhorugram, India, that provided health services to 40 villages with a population of 49,137 (1991 census). The hospital faced many challenges including high physician turnover due to the rural environment and harsh weather conditions. The study evaluated the status of the project and the use of MCHS 4 years after its implementation. A health team comprised of a physician, auxiliary nurse midwives and a community health worker visited a village on a fixed day every month to collect data. The results showed that the full immunized child (FIC) status over a 4 years period (1992 to 1996) increased from 45% to 81% in the diphtheria, pertussis and tetanus (DPT) vaccine and from 46% to 77% in the oral polio drops vaccine. There was also an increase in antenatal registration from n=384 to n=705 in 1996 (an increase of 29%). These trends over 4 years showed the benefits of using a computer-based system in primary care. Other benefits of the computer based information systems include financial savings accruing from improved immunization coverage. Drop outs from the immunization program increased the cost of an FIC from $15 to $54(US). As a result of the improvement detailed in the study the cost of an FIC has dropped from $33 to $18(US). The authors also highlight the benefit of the information system in making substantive data about the local population available for
use in social and health care projects in the area. The lack of a comparable control population was identified as a major limitation of this study. In order to address this limitation, a comparison was done between study data collected after the computer-based system implementation and historical data recorded prior to MCHS implementation (Sing et al., 1997).

Incorporating the use of computers into medical practice is crucial to supporting physician information processing, decision-making, and record keeping. There is little reported research in the literature on the use of the Internet and EMRs in health facilities in Africa (Asangansi et al., 2008). Asangansi et al. (2008) performed a questionnaire-based study to evaluate the level of computer and Internet use and perception of medical record systems by physicians at University College Hospital (UCH), a Nigerian teaching and research hospital. The hospital has 805 beds and has more than 45 medical specialists and sub-specialists and has provided medical care for 12 million patients to date. The study sample consisted of 600 interns and residents undergoing training at UCH. A pre-tested questionnaire that was self-administered was distributed to twenty randomly selected interns and residents. As well, interns and residents completed 145 questionnaires. The questionnaire had 24 questions that were open-ended and close-ended. The questionnaire gathered data about participant socio-demographic status, computer and Internet use and perception about medical records (Asangansi et al., 2008).

The collected data was analyzed using SPSS. The study found 63% of the respondents could use a Word processing software package and 66.9% could use a presentation software
package. Seventy nine percent reported they could use Medline/PubMed. Respondents stated they spent one to five hours on the Internet each week. Fifty one percent of participants had a personal computer. Intern’s perceptions of medical record systems were varied at UCH. Forty one percent of interns identified inaccessible health records as a major problem. Seventy three percent believed the paper-based system hindered research while 89% believed a computer-based record system would be better than the current paper-based system. Respondents felt electronic records would improve physician access to medical records (Asangasi et al., 2008).

In a similar study, needs based assessment of middle and functional level nurse managers at Kenyatta National Hospital in Kenya was carried out. The majority of nurse managers (85%, n=91) did not have computer studies as part of their training in nursing. The majority of the nurses 98.1% (n=105) wanted to be trained in computer applications (Kivuti-Bitok, 2009). The attitude of nurse managers towards the use of computers in nursing was not significantly influenced by accessibility to a computer or previous training in computer (p=0.05) (Kivuti-Bitok, 2009).

In summary, this section provided a review of EMRs that have been implemented to support primary care in various developing countries. As discussed in this review, there are very few documented cases of primary health care facilities in sub-Saharan Africa that have fully implemented and use EMRs. The involvement of various bilateral, multilateral, government and non-governmental organizations in addressing the various diseases in developing countries has given way to many vertical disease specific programs (Brugha et al., 2002;
Such vertical disease specific programs focus exclusively on one disease such as HIV, TB and malaria with little coordination in management, administration, and prevention and care involved in these programs (Braa, 2001; Darrell et al., 2003). The following section of this review discusses health information systems that have a specific disease focus, called disease management systems.

2.3 Disease Management Systems

In this section we review the literature on disease management information systems. These systems are specifically designed to support the management of health information collected about a specific disease. HIV/AIDS, TB and malaria are referred to as the “big three” disease. They are diseases of great impact whose treatments are sometimes managed and administered in a vertical format where separate attention is paid to all aspects of each disease’s control in prevention, treatment and care (Darrell et al., 2003).

A small number of computer-based record systems have been implemented across sub-Saharan Africa and various developing countries to support HIV care. These systems will be discussed in terms of their implementation and use in this section. The Academic Model for the Prevention and Treatment of HIV (AMPATH) Medical Record System (AMRS) was the first sub-Saharan African electronic medical record system used in the comprehensive management and clinical care of patients infected with HIV. Implemented in an urban hospital and five rural clinics in Kenya, the system provided HIV/AIDS specific information and supported the decision-making needs of health care providers (Siika et al., 2005). As well, the system was used in program monitoring in meeting the documenting and reporting
requirements for funding of mother to child transmission programs such as MTCT-Plus (Rosenfield & Yanda, 2002). Currently, AMRS is used to document care, monitor drug adherence and response to therapy as well as provide data for quality improvement activities and research.

Web-based medical record systems have also been used in the management of HIV patients. According to Fraser et al. (2004), an HIV-EMR System has been implemented in seven rural clinics in Haiti to track patient clinical outcomes, laboratory tests, and drug supplies. The HIV-EMR is a web-based EMR for HIV and TB treatment that was initially pioneered in Haiti (Fraser et al., 2004) by Partners in Health (PIH) and was modified and implemented in two health districts in Rwanda in 2005. HIV-EMR supports three main functions: patient monitoring, program monitoring, and research. The patient monitoring aspect of the EMR provided patient information including medical summaries, and alerts. In addition, the HIV-EMR’s program monitoring component produced aggregate information for fulfilling internal and national reporting requirements (Allen et al., 2006).

The HIV-EMR was used to capture clinical data that included demographic data, clinical assessment data, laboratory results, and the social circumstances of patients. The system supported e-mail and web communication across sites through satellite-based Internet access. E-mail consultation was done daily by doctors at remote clinics who sought decision support in the treatment of patients (Fraser et al., 2004). Within the system, decision support for physicians was available for laboratory result interpretation. The HIV-EMR checked patient’s data to provide alerts to clinicians of low CD4 counts, incorrect drug regimens,
allergies and drug interactions. The HIV-EMR also allowed patient drug regimens to be recorded for all patients on ART. Based on this data, the system calculated the total pharmaceutical requirements for a patient group for a specified period of time, thereby ensuring there was an uninterrupted supply of drugs available (Fraser et al., 2004).

In the past few years the Brazilian Ministry of Health has made great strides in the fight against HIV/AIDS with the support of a national electronic database. Brazil is a middle-income country that has been providing over 95,000 patients living with HIV/AIDS (PLWHA) (approximately 15% of all PLWHA in Brazil (2001)) with free, universal access to ART. Brazil has experienced dramatic results from this effort. Supporting the coordination and monitoring of ARV drugs, is the Computerized System for the Control of Drug Logistics (SILCOM) developed by the Brazilian Ministry of Health (Bastos et al., 2001).

SILCOM is an Internet based drug management system, which ensures that there are no duplicate prescriptions and ARV combinations that cause serious side effects. SILCOM is integrated with a second database called the Laboratorial Procedures Information and Surveillance System (SISCEL). This database ensures that the correct ARV drugs are being prescribed given the clinical and laboratory results of each patient. As of 2001, 111 facilities (representing 65% of all patients receiving ARVs) have the online capabilities linking them to SILCOM and SISCEL (Bastos et al., 2001).

A research study conducted in 15 countries in Africa, South America and Asia was designed to describe the electronic medical database used in twenty-one ART sites in developing
countries. The study conducted surveys on the use of EMR systems in ART programs. Of the twenty-one sites, 15 (83%) used an electronic database. The median percentage of patients lost to follow-up one year after starting ART was 8.5%. The median percentage of missing data for key variables per site was 10.9% and there was a decline after data management training. Strategies implemented to reduce patients lost to follow-up included local outreach teams, community-based organizations and checking death registry data, which reduced patients lost to follow-up. The study concluded that the data collected and the retention of ART patients was unsatisfactory for many sites. This was mainly due to inadequate training of staff to manage data and tracing of lost patients.

Based on findings of this literature review, various EMR development and implementation efforts across different developing countries have been done in silos. It should also be noted that as a result of poor documentation and publication, important information, evidence and knowledge transfer has not occurred, leaving a gap in the knowledge about electronic medical record utilization in acute and chronic HIV disease management. For example, in South Africa a number of hospital-based information systems are currently in place in various provincial hospitals. Patient Administration and Billing system (PAAB), a homegrown information system has been implemented in a number of hospitals in Gauteng, Mpumalanga and North West provinces. Other more sophisticated systems such as Medicom and Meditech have also been implemented in 12 hospitals and 5 clinics. Oasis is used in 6 hospitals while Systech is used in 3 academic hospitals in the Western Cape Province (South African National Government, 2003). However, there are very few studies that
comprehensively discuss the deployment, utilization and evaluation of these systems in South Africa based on informatics standards and disease outcomes.

Based on these and other studies there are a number of issues and challenges identified in implementation and use of EMRs in developing countries. Prior to the implementation of EMR’s in pilot sites, the lack of appropriate tools for information collection and management of patient data was a challenge for many health care centers (Rotich et al., 2003; Fraser et al., 2005; Allen et al., 2006). Within medical care, documentation errors occur in medication ordering and administration processes - including dosage calculation errors in medication orders, and errors in transcribing orders from the chart by nurses. Also, incomplete and illegible documentation accompany specimens sent to the lab resulting in delays and repetition of tests (Douglas et al., 2003). A common problem often identified is the lack of information communication technology (ICT) skills and education as well as networks of support (Braa, 2001). As well, the maintenance and upgrading of hardware and application software is an issue as there are very few formal ICT companies providing support in many developing countries (Braa, 2001).

Additional concerns related to workflow changes and “culturally sensitive” design by local clinicians and staff were highlighted as important factors to consider in gaining user acceptance and establishing local ownership (Rotich et al., 2003). A widespread drawback identified by many studies was the poorly developed infrastructure in many of these developing countries and particularly in rural sites. In these areas, the very basics of uninterrupted electricity supply, Internet connections, roads and human resources need to be
provided. These and other issues need to be identified and addressed in order to have useful
EMRs that are financially and technically sustainable in developing countries.

2.4 Discussion

The literature reviewed on the implementation of information systems to support chronic
disease management by clinicians, sheds light on the progress and developments that have
been made in developing countries. To date, a number of the EMRs discussed (e.g. MMRS
and PIH-EMR) continue to support the local health facilities in which they were deployed.
The OpenMRS collaboration continues to expand as it attempts to foster self-sustaining
health information technology to help those involved in actively building and managing
health systems with the aim of meeting the information and decision-making needs of
officials, health professionals and funders in these developing nations.

In many of these countries there is also a large gap between private health facilities; those
that cater to the few rich and public health facilities; those that provide health care to the
masses. For example, in South Africa, seven times more money per capita is spent in the
private sector, which provides care for approximately 20% of the population than in the
public sector that serve the remaining 80% (Goudge, 1999; Ojikutu et al., 2007). Within
these two groups of facilities there is a gap in information technology diffusion where
privately funded facilities have shown more progress in utilizing information technology to
manage their health information.
There are a number of questions that still remain unanswered. Are developing countries ready for EMRs? Is it justifiable to spend the limited local resources on implementing EMRs, which could otherwise go towards providing much needed medical care? Are the pilot studies mentioned just examples of few well funded pilot studies that have financial and human resource backing? Would the same results arise in a less well resourced setting? Is there a potential for technical and financial sustainability on local resources? Is it feasible to implement EMRs with the far-reaching challenges of inadequate infrastructure, unavailability of technically trained personnel, environmental and geographical issues and limited financial commitment from governments? These are questions further research may perhaps attempt to tackle in the near future. That said, it should also be noted that the implementation of EMRs in health facilities in resource-limited regions is affected by more than just technical, financial and organizational challenges, but also political and governance challenges. Mulugeta et al. (2007) in their discussion of the design, development, implementation and use of an information system to support ART in Ethiopia identify the politics involved in gaining entry to deploy and scale up such systems as a key challenge (Mulugeta et al., 2007).

2.5 Conclusion

In summary, it is clear that there are a wide range of financial, infrastructural, political, and logistical challenges facing developing countries in addressing the health care needs of their populations. Health care provision, including HIV/AIDS, TB and malaria need to be dealt with from the prevention, health promotion and curative perspectives. Within this CPHC ideology, the need for development and deployment of innovative tools to support health
care providers in providing quality health care services must be considered in these
developing nations. The information management (i.e. data collection and retrieval) of an
exponentially growing patient caseload enrolled into primary and disease specific care
programs cannot continue to be managed on paper. Such tools as EMRs and computer-based
record systems are essential at the population level but also at the facility and patient levels.
Most of the research in the literature focused on health care organizations and the use of
technology at a population level of monitoring. As a result, little is known about the
perspective of clinicians. In this research, the researcher explores clinician perspectives in
EMR utilization and the benefits of its use in ART.
CHAPTER 3: RESEARCH APPROACH

3.1 Methodology

A descriptive, exploratory grounded theory study was used to explore clinicians’ perspectives on the utilization and benefits of electronic medical records (EMRs) in ART for clinical decision-making and patient monitoring. Semi-structured interviews and questionnaires were used to ask open-ended and close-ended questions about clinical practice guidelines, methods of documentation, computer competency, challenges around patient monitoring and management, decision-making, and EMR access and perceived usefulness in ART and HIV care.

Grounded theory is a methodology that allow for the discovery of theory from data that explains underlying social processes (Glaser & Strauss, 1967). “The procedures of grounded theory are designed to develop a well integrated set of concepts that provide a thorough theoretical explanation of a social phenomena under study” (Corbin & Strauss, 1990). Grounded theory describes as well as explains (Corbin & Strauss, 1990). The data for a grounded theory study can come from various sources including interviews, observations, government documents, multimedia such as videos and tapes, newspapers, books and anything that would describe the topic being studied (Corbin & Strauss, 1990).

Grounded theory research principles were selected for this project for the following reasons. Grounded theory has been in use since 1960s. In research that aims to generate theory, grounded theory is among the most widely used and influential methods of qualitative
research (Jackson & Verberg, 2007). Because grounded theory allows theory to emerge from the data, the researcher begins a study with no preconceived theory and as a result, the theory derived from the data is likely to reflect reality (Strauss & Corbin, 1998). Grounded theory places considerable value on contextual settings with the potential to develop detailed information about a particular phenomenon and to be influenced in the context in which the study is undertaken (Glaser & Strauss, 1967). Grounded theory will provide an in-depth understanding of clinicians’ experience and perspectives of reality in caring for HIV patients and what impact electronic medical record systems can have on their care processes. Understanding clinicians’ information needs for decision-making in caring for HIV patients is an essential component of developing knowledge and understanding on how EMRs can be better utilized in HIV care and ART. Grounded theory can therefore enhance understanding and provide a meaningful guide to further action in addressing key information management issues that affect clinicians.

3.2 Participants

In grounded theory, participants that provide insights and extensive knowledge about a phenomena being studied are selected (Corbin & Strauss, 1990). “Sampling in grounded theory proceeds not in terms of drawing samples of specific groups of individuals, units of time, and so on, but in terms of concepts, their properties, dimensions, and variations.” (Corbin & Strauss, 1990). For this study a non-probability, convenience-sampling technique called snowball sampling was used. In snowball sampling, participants are asked to refer someone they know who might be appropriate for the study. This method is often utilized in
situations where researchers cannot get a list of participants who share the sample characteristic (Jackson & Verberg, 2007).

Computer knowledge or Internet experience are not requirements for entry. As well, previous experience with electronic medical records was not a criterion for study entry. The inclusion criteria for the sample include:

1. read, write, and speak English
2. give written, informed consent
3. be eighteen years or older
4. be a physician or nurse
5. be practicing or having practiced in the past 2 years
6. have at least 1 years of work experience in HIV care
7. have some familiarity with EMRs

In total, 11 physicians and 19 nurses participated in the study. It should be noted that the sample size was subject to change. Unlike quantitative research, sample size in qualitative research is not pre-determined before data collection but is based on concepts, their properties, dimensions, and variations (Corbin & Strauss, 1990). The focus of grounded theory research is to develop representative concepts (Corbin & Strauss, 1990). As a result, sampling is considered complete when the categories identified are saturated (Strauss & Corbin, 1998). Saturation refers to a condition where newly collected data does not add any new information and confirms previously collected data (Strauss & Corbin, 1998; Jackson &
Verberg, 2007). Saturation is the key determinant of sample size and provides confidence that the phenomenon has been captured in the data collected (Elder et al., 1995; Jackson & Verberg, 2007). Representativeness and consistency in grounded theory is achieved by theoretical sampling (Corbin & Strauss, 1990).

### 3.3 Setting

The study was conducted at ART clinics located in four hospitals in Ethiopia. Three of the hospitals: Hospitals 1, 2 and 3 are located in the capital city of Addis Ababa. The fourth study site; Hospital 4, is located in Hawassa, Ethiopia.


Hospital 1 is a 162-bed hospital located in Addis Ababa. The ART clinic has 5,512 patients currently on ART and 15,000 patients in pre-ART. The hospital has one of the largest ART clinics in the city and serves an average of 180 patients per day. Hospital 2 is a 102-bed hospital and is a smaller facility compared to the other three hospitals in this study. The ART clinic has approximately 1,000 patients in ART and 2,300 patients in pre-ART. Hospital 3 is a specialized hospital whose ART clinic has approximately 4,700 patients enrolled in ART and 2,000 patients in pre-ART and has an average of 100 patient visits to the clinic each day.

The city of Hawassa is located in the Southern Nations Nationalities and Peoples Region (SNNPR) which has a population of approximately 14 million (2005) (FMOH, 2005). The
HIV prevalence in the SNNPR was 3.5% in 2005 (The World Bank, 2008). The region’s health care services are provided by 16 hospitals, 127 health centers, 801 health posts, and 154 private clinics. The SNNPR has one of the fewest hospitals for the size of its population, with an average of 880,313 populations per hospital (FMOH, 2007). Hospital 4 is a 350-bed university hospital and provides services to approximately 14 million people and serves as a referral site for nearby health centers providing primary and emergency care. The ART clinic has approximately 9,000 patients currently enrolled in ART.

The four ART clinics in this study are located in hospitals and are integrated with various HIV/AIDS programs including: pediatric ART, prevention of mother to child transmission (PMTCT), mother to child transmission (MTCT) plus, voluntary counseling and testing (VCT), TB/HIV, opportunistic Infection (OI) prophylaxis and treatment, sexually transmitted infections (STI) care and prevention, home-based and palliative care and various social support programs offered by NGOs. Five US universities provide technical support for HIV and ART facilities for designated geographic regions in Ethiopia. The Addis Ababa city administration and SNNPR region receive technical support from John Hopkins University (JHU). The university provides various forms of support from supplying paper forms used in ART clinics, updated practice guidelines, providing training to clinicians, and various medical and administrative supports.

ART clinics are staffed with adherence counselors, HIV/AIDS nurse specialists (HANS) or HANS nurses, professional and non-professional counselors, physicians and data clerks that manage the clinic's medical data. Data clerks or coordinators are responsible for recording
and compiling the clinics medical data in order to generate monthly reports and cohort analysis. The first points of contact when patients come to the clinic are the registration clerks. The patients initially present their patient card and their unique ID number. Once the patient’s chart is retrieved, they are forwarded to the visit room for nurses to browse and record patient encounter information. Because ART involves the close monitoring of patients, it is closely associated with laboratory services with some ART clinics having their own designated laboratory technicians. ART clinics are also closely linked with pharmacy due to regular refill of ARV drugs involved in the care. The process between ART clinics and lab and pharmacy are discussed in the following sections.

3.4 Patient Characteristics from ART Clinics

The majority of patients that receive care at the four ART clinics are adults. Most of the patients at Hospital 4 live in rural communities and villages and are of a low socio-economic status. The main source of income for pastoral inhabitants is subsistence farming. There is also significant unemployment. Many live with minimal means, some unable to have three meals a day as poverty is more prevalent among rural dwellers than those residing in urban areas. The rural regions experience a relatively widespread epidemic with some regions having high HIV prevalence rates greater than 5% (The World Bank, 2008). An overwhelming majority of clinicians emphasize the social and economic challenges that ART patients face as a major challenge to maintaining good adherence. One of the main causes for poor adherence is unavailability of basic necessities; for instance the lack of food to take with their ARV regimen. As indicated by one clinician in the following quote:
There are major economic and social problems with many patients. Many patients start their ARV medications and discontinue. For example, they complain that they don't have food to eat prior to taking their medication… Most of the problems with discontinuing are related with lack of food. (Hospital 4, Subject 003, Line 30)

The low economic condition of the patient population also makes it difficult and at times impossible to follow up on patients that may have missed their appointments or have dropped off from treatment. This is due to that fact that most patients from rural areas do not have home or mobile telephones. The patient population in the Addis Ababa region is of a considerably better socio-economic status than those of Hawassa as better employment opportunities exist. Unlike patients in the Hawassa area, majority of the patients in Addis Ababa have telephone contacts, making it possible for clinic staff to track and follow-up lost patients.

A small number of recruited patients are also involved in supporting ART clinics and staff. These support workers are ART patients living with HIV/AIDS (PLWHA) who are employed by the hospital to support clinicians by following-up on lost patients, providing HIV/AIDS education to patients at the clinic, and physically supporting feeble and bedridden patients that attend the clinic. To track lost patients, support workers are provided with patients’ contact information to call patients and find out why they have missed their visit and to encourage them to continue their treatment.
Although the majority of patients enrolled in ART and pre-ART are adults, there are a small number of children in pediatric ART units. Clinicians that work in pediatric ART feel it is an area that has been neglected and receives minimal financial and technical support. From the four study sites, Hospital 1 and 3 were the only two hospitals that provided pediatric ART services. Most children enrolled in pediatric ART are orphans, single parent children or dependent on relatives as they lack adequate social support making it challenging to enroll and keep HIV positive children in ART.

### 3.5 Data Collection

Data was collected from four hospitals that provide HIV care and ART. Data was collected by three methods: questionnaires, participant interviews and observations. See Table 3.1 for summary of participants and data collection methods utilized.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Nurses</th>
<th>Physicians</th>
<th>Data Clerks</th>
</tr>
</thead>
<tbody>
<tr>
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<td>✓</td>
<td></td>
</tr>
<tr>
<td>Interviews</td>
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<td>✓</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**Table 3.1** Summary of participants and data formats

### 3.5.1 Questionnaire

The questionnaire is the first method of data collection and was used to gather information about participant demographics, computer and Internet experience, years of medical/nursing experience, medical/nursing recording practices and the perceived barriers to successful
EMR implementation. Some of the questions were adopted from standardized questionnaires while others were added by the investigator to address issues of concern specific to ART clinicians as identified in the literature. (See Appendix E)

Demographic questions provided general information about the participant’s age, gender, area of medical practice, and years of experience in their practice. Yes/no and Likert-type questions were used to determine the previous computer experience of clinicians. Previous computer experience included knowledge specific to medical computing in addition to general computer experience. Questions related to the communication practices investigated how clinicians communicate with other clinicians regarding their patients, and the type of medical recording system they use and how they access up-to-date clinical information. Finally, the questionnaire provided information on a list of perceived barriers to the successful implementation of EMRs which participants classified as a major barrier, a minor barrier or not a barrier. Segments of the questionnaire were adopted from the IHS Quality of Care/Electronic Health Record Assessment Tool. This instrument was initially developed to ascertain the implementation of electronic health records in Massachusetts primary care practices (Simon et al., 2006). See Appendix E for questionnaire.

3.5.2 Interviews

Qualitative interviews are principal research tools that help researchers understand how participants understand the world in which they work, what goes on in their world, and why people do what they do (Rubin & Rubin 1995). Semi-structured interviews utilizing an interview guide were conducted in-person with each clinician. Unlike structured interviews
where the interviewer asks set questions (Jackson & Verberg, 2007) or unstructured interviews where the interviewer suggests a topic but has few specific questions (Douglas, 1985), semi-structured interviews involve asking some established questions with freedom to probe for emergent themes and ideas by asking additional questions. Most grounded theory interviews become semi-structured in order to allow key themes to emerge and facilitate the development of theory (Holloway, 2005). An interview guide developed from the existing literature review was used to raise questions that highlight key issues that have relevance to the emerging theory (Holloway, 1997).

The interview questions initially helped gather information about the participants’ daily practice including the challenges they face in HIV care and ART followed by their record keeping and patient monitoring practices. Additionally, it gathered information on clinician decision support tools, the support methods in place to help clinicians implement new practice guidelines, the work-flow between ART clinics and lab, pharmacy and radiology, confidentiality of medical records, the mitigation of medication errors, the referral system among ART and the various HIV clinics, and the integration of various HIV and non-HIV programs. Finally, questions regarding clinicians’ attitude regarding the usefulness of an EMR in HIV care and ART was investigated by providing participants with a list of outcomes to which clinicians indicated whether the effect of an EMR would be very positive, somewhat positive, no effect, somewhat negative, or very negative. Clinicians were then asked to explain why they chose a specific answer. This section of the interview was also adopted from the IHS Quality of Care/Electronic Health Record Assessment Tool (Simon et
The interviews were audio recorded and transcribed for analysis. See Appendix D for semi-structured interview questions.

### 3.5.3 Direct Observations

Lastly, direct observation was conducted to understand how clinicians work together with the electronic medical record used at the facility. The observations provided a clearer understanding of the usefulness of the electronic medical record (EMR) in supporting decisions and actions (i.e. monitoring and management of patients) that take place in participants’ work environment. The observation was strictly focused on the daily interaction of participants with the EMR noting the application’s utilization and benefits or disadvantages in their practice.

Notes taken during observations helped to supplement the information gathered during the interview and questionnaire. This technique provided a clearer understanding of the use of the electronic medical record in supporting decisions and actions of clinicians in the HIV care process. Observations were carried out by shadowing participants for a few hours on a selected day, only focusing on the daily interaction of participants with the electronic medical record, noting the applications use in their practice. The researcher did not observe any patient data entered into the system nor shadow clinicians while they were visiting with patients. Only notes from the direct observation sessions of the physicians/nurses interacting with the EMR were transcribed and used in the analysis. The primary researcher was the only individual transcribing audio recorded data.
3.6 Data Analysis

Grounded theory follows specific procedures for data collection and analysis. The analysis stage of grounded theory begins as soon as the first portion of data has been collected. In most qualitative studies, data analysis begins once data collection has been completed. In grounded theory, analysis occurs simultaneously with and immediately after data collection because the analysis should drive the next interview or observation (Corbin & Strauss, 1990). During the data collection process, researchers generate theory by using the constant comparative method. In this approach, every piece of information in every line and paragraph is coded and similarities and differences compared to other pieces of information in the data (Jackson & Verberg, 2007). The steps of the constant comparative method utilized in analysis of data in grounded theory include: (a) concept formation (coding), (b) concept development, and (c) concept modification and integration (Stern, 1980; Streubert & Carpenter, 1999).

Concept forming involves reading data collected to identify underlying patterns. “Concepts are the building blocks of theory” (Strauss & Corbin, 1998). Theories are formed through conceptualization of the data and not the “raw data” itself (Corbin & Strauss, 1990). Events, happenings, objects, and actions/interactions are analyzed and given conceptual labels. Coding is used to identify these concepts within the data. It occurs at three levels: open or substantive coding, axial coding and selective coding.

Open coding is the “analytic process through which concepts are identified and their properties and dimensions are discovered in data” (Strauss & Corbin, 1998). At this first
level of coding, researchers go through the data line by line to identify key processes in the data by breaking it down into discrete parts, closely examining and comparing it for similarities and differences (Jackson & Verberg, 2007). At this initial stage, data collected through interviews and questionnaires was analyzed to initially identify the current patient monitoring and management practices of clinicians in ART. This included data on how patient’s progress and adherence on ART is monitored and identifying and categorizing the challenges associated with the current practices, process and tools. The second component is the use of computer systems or electronic medical records at the hospital and how these tools are used to support clinicians in providing HIV care. The third component dealt with identifying discrete issues around clinician’s attitude and perceived usefulness of EMRs in their practice.

Axial coding is the process linking categories by comparing each category to every other category (Jackson & Verberg, 2007). During this phase, categories were related to their subcategories along the lines of their properties and dimensions. As well, new categories were developed as they emerged in the data (Corbin & Strauss, 1990). The purpose of axial coding is to rebuild the data that has been fragmented during open coding (Strauss & Corbin, 1998).

The final stage of the coding process is selective coding and occurs at the latter stages of the study. Selective coding is “the process of integrating and refining the theory” (Strauss & Corbin, 1998). At this level all categories were integrated around a main or “core” category,
which eventually made up the framework. The “core” category is the central phenomena of the study (Strauss & Corbin, 1990).

3.7 Ethics Approval

An application for ethics review was submitted to the University of Victoria’s Human Research Ethics Board on February 15, 2009. The ethical approval was obtained April 22, 2009, just prior to data collection activities. In order to carry out the research at Hospital 4, application for ethics review was submitted to the Hawassa University, College of Health Sciences Ethical Review Board on December 20, 2009. The notice of ethical approval was obtained January 16, 2009. Additionally, clearance from the City Government of Addis Ababa Health Bureau was required to carry out research at the three Addis Ababa sites. Application for clearance was submitted on May 20, 2009 and notice of approval was obtained on June 2, 2009. See Table 3.2 for a summary of the study timing.

3.8 Timing

<table>
<thead>
<tr>
<th>Date</th>
<th>Research Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>June/July 2008</td>
<td>Reading literature and drafting literature review.</td>
</tr>
<tr>
<td>Aug/Dec. 2008</td>
<td>Finalize proposal</td>
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<tr>
<td>Jan/March</td>
<td>Preparation</td>
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<td></td>
<td>Ethics application in Ethiopia</td>
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<tr>
<td>April/June</td>
<td>Ethics approval obtained</td>
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<tr>
<td></td>
<td><strong>Data collection</strong></td>
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<td></td>
<td>- Interviews and direct observations began</td>
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<tr>
<td></td>
<td>- Questionnaires administered</td>
</tr>
<tr>
<td>July/Dec.</td>
<td><strong>Analysis and Conclusion</strong></td>
</tr>
</tbody>
</table>

Table 3.2 Timing Summary
CHAPTER 4: STUDY FINDINGS

4.1 Introduction

Based on the data collection and analysis, this section provides an overview of the observations and study findings in Ethiopia, including, demographic characteristic of participants, and observations of ART patient monitoring practices and clinical care process, and the medical recording tools and practices of the clinics.

4.2 Demographic Characteristic of Participants

Thirty clinicians participated in the study; 11 physicians (7 males) and 19 nurses (6 males). Sixty two percent (n=18) of participants were under 35 years old, 34% (n=10) were between 35 and 50 while 0.03% (n=1) was over 50 years old. Nurses had an average of 8.89 years of medical experience while physicians had average of 7.61 years of experience. See Table 4.1 for a summary of participants’ demographic characteristics. Physicians saw an average of 104 patients per week while nurses had visits with an average of 200 patients per week. In some ART clinics, nurses reported seeing up to 50 patients on a busy day. The high patient load along with the shortage of clinicians contributes to the heavy workload of clinicians.

The shortage of skilled health workers is evident across various health facilities in the country. At the national level there were a total of 2,679 physicians for a population of approximately 75 million (2005), a physician to population ratio of 1:26,527. The physician to patient ratio is well below the WHO standard of 1:10,000. In 2007, there were 15,544 nurses in the country, a nurse to population ratio of 1:4572. From the two regions where the
study was conducted, Addis Ababa had a relatively higher number of health workers with physician to population ratio of 1:12,692 and 1:3,459 for nurses. In the SNNPR the physician to population ratio is 1:52,556, with the nurse to population ratio at 1: 6,932. (FMOH, 2007).

ART clinics experience the brunt of these shortages, as there is a scarcity of physicians that work in ART clinics on fulltime bases. For instance, at the ART clinic of Hospital 4, there are no permanent fulltime physicians. A number of trained physicians in the hospital work on rotations, with each physician working two weeks every two months. Turnover is one major problem escalating the manpower shortage.

There is a gap in years of clinical experience among participants, with majority having either less than five years of experience (40% (n=12)) or 11 to 20 years of experience (43% (n=13).

As well, participants had an average of four years of computer experience. Majority of participants used computers for performing literature searches (41% (n=12)), Internet (37% (n=11)) and e-mail communication with colleagues (33% (n=10)). Only 27% (n=8) of participants reported of ever having used a computer to retrieve patient information. See Section 4.5.17 for a full summary of clinicians computer competency and experience.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex ((n))</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13 (43)</td>
</tr>
<tr>
<td>Clinical background ((n))</td>
<td></td>
</tr>
<tr>
<td>Physician</td>
<td>11 (37)</td>
</tr>
<tr>
<td>Nurse</td>
<td>19 (63)</td>
</tr>
<tr>
<td>Years of experience</td>
<td></td>
</tr>
<tr>
<td>(\leq 5)</td>
<td>12 (40)</td>
</tr>
<tr>
<td>6-10</td>
<td>4 (13)</td>
</tr>
<tr>
<td>11-20</td>
<td>13 (43)</td>
</tr>
<tr>
<td>(\geq 21)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Clinical practice characteristics</td>
<td></td>
</tr>
<tr>
<td>Mean weekly patient visits</td>
<td>166</td>
</tr>
</tbody>
</table>

Table 4.1 Participant Characteristics

* \(n\) – number of subjects

### 4.3 Observations

#### 4.3.1 ART Clinics and Care Process

One of the primary objectives of ART clinics is to initiate patients on ART and closely monitor the progress of patients to ensure good adherence. Paper-based forms and records primarily support the current monitoring practices of ART clinics.

Most patient appointments at the ART clinic consist of a visit with a nurse for a regular drug refill. Patients are referred to a physician in cases where a patient is being initiated on ART or there is a complication, such as drug toxicity, failing treatment, drug interaction or severe side-effects. The initiation of patients on treatment is time consuming and consists of a lengthy intake process that is completed by nurses. The intake process consists of requesting various baseline lab investigations and filling out a number of intake forms. Once the baseline investigation and the intake forms are completed, physicians determine whether the
patient should be placed in pre-ART or initiated on ART. Prior to prescribing ARV drugs, patients are given adherence counseling while patients on pre-ART are monitored periodically and offered the appropriate OI prophylaxis drugs.

Patients on ART are monitored closely with appointed visits every 14 days for up to 3 months to ensure their adherence and to examine their body’s response to medication. These regular visits also allow clinicians to carefully look for any drug toxicity or drug interactions by observing the patients reaction to the assigned ARV regimen. Patients that experience extreme side-effects are advised to visit the clinic, while patients that have poor adherence are yet again given adherence counseling as they continue to be closely monitored with frequent visits. Those that have maintained good adherence are given ARV drug refills for 2 to 3 months.

4.3.2 Laboratory and ART
A large component of the work done in ART is closely related with laboratory. During the initial stages of the pre-ART care process, intake forms are filled out and baseline investigations completed, including: liver function test, renal function test, sputum, CD4 count, WBC, and hemoglobin. Because ART is laboratory intensive, some hospitals like Hospital 4 and Hospital 2 have laboratory technicians specifically designated to work with the ART clinic.

To order a laboratory test, clinicians fill out a standard lab request form and submit it to the patient. The patient takes the request form to the laboratory department and provides the
requested sample. When the result is ready, the patient is responsible for picking up the result from the laboratory to submit it back to ART clinicians. In the smaller facilities like Hospital 2, lab results are directly sent to the ART clinic. There is no mechanism in place to follow-up on requested lab investigations; only during the next appointed visit can a clinician recognize that a requested investigation has not been completed.

4.3.3 Pharmacy and ART

Nurses support regular patient visits to the ART clinic by prescribing refills for ARV drugs. Standard visits for drug refills involve ensuring that the patient is adhering to their medication, ensuring that there are no complications linked to the medication and writing a paper prescription form to be submitted to pharmacy. Pharmacy has a record of each patient’s specific regimen on a computer-based system. When a medication is prescribed for a new ART patient, pharmacy enters the patient information and their ARV regimen into their system. During drug refill visits, the ART nurse writes a prescription for the specific ARV regimen, which is presented to the pharmacist by the patient. Prior to giving the prescription, the pharmacist checks the computer system to make sure the correct drugs have been prescribed. This process between ART and pharmacy ensures that medication errors are minimized.

Whenever there is any inconsistency between the drug prescribed and the regimen recorded on pharmacy’s computer system, the pharmacist sends the request form back to the ART clinic for verification. Clinicians report that mistakes do occur when writing medication
request forms due to the large number of patients they see daily, however, the majority are caught by pharmacy.

4.4 Medical Record Keeping System

There are two forms of record keeping: paper-based and computer-based. Hospitals maintain a hybrid paper-electronic environment.

4.4.1 Paper-based Recording System

The main method of medical record keeping is paper-based. This is supported by a computer-based ART database that has been implemented in ART clinics in the Addis Ababa city administration and the SNNPR with the assistance of John Hopkins University (JHU). However, paper forms are predominately used at the point of care to record and maintain patient’s medical information.

Ethiopia has adopted generic paper forms to use nationally. The clinical forms help clinicians go through the intake and follow-up process, ensuring coverage of the main parts of a patient’s clinical history. The forms provide a comprehensive overview of the patient, including social and economic conditions. The majority of the forms, with exception of the Social Assessment Form and ART Adherence Counseling Form are filled out once at the initial visit. The ART Assessment and Plan Form is filled out during the second visit. The intake forms consist of: Patient Registration Form, Past Medical/Treatment History Form, General Condition/Physical Exam Form, Clinical Review Form, and Social Assessment Form. All patients are assigned a unique registration number. Patient's forms are compiled in
a folder and shelved by category according to the patient's registration number for easy retrieval. Patients that have been initiated on ART are assigned a nationally recognized unique ART ID number.

### 4.4.2 Computer-based Recording System

Three ART clinics at Hospitals 2, 3, and 4 use the ART Register database implemented by JHU. The database has five modules: registration, follow up/re-fill, reports, data cleaning/QA-QC, and data mart. Table 4.2 provides a breakdown of general EMR components currently utilized at the four study sites.

The registration module is used when inputting a new patient into the database. It includes demographic information such as name, family, work, telephone, patient's support system, and living conditions. The follow-up/re-fill module is used on ongoing bases to update the patient's regimen and regular visits for drug re-fill.

The reports component of the database produces various external and internal reports including: monthly report, cohort analysis, internal report, scheduling report and referral graph. Monthly reports are submitted to the FMOH and provide information on what has happened in the previous month at the clinic, helping to keep track of a cross-sectional summary of all patients currently on ART. The report includes information both on enrolment in chronic HIV care and initiation on ART at each facility. The cohort analysis report allows clinical teams and managers at district and national levels to monitor the proportion of patients who either remain on original first-line regimens or who substitute to
an alternative first-line regimen and the proportion who survive and remain on ART. The internal report is used by clinical teams and hospital managers to monitor the activities of the ART clinic. This report is also used during multi-disciplinary team (MDT) meetings held bi-weekly among managers of various HIV programs to help identify gaps and strengthen the linkage among various HIV programs. Scheduling reports provide feedback on the number of patient visits each day. This module is designed to support the scheduling of patients for upcoming days although it is seldom used. Finally, the referral graph module allows managers to identify the number of patients that come from a specific hospital, clinic or health center.

The data cleaning/QA-QC (quality assurance - quality control) module is useful for identifying lost patients. The module provides a list of patients that have missed their appointments who are then tracked by support workers. Lastly, the data mart allows access to aggregated data for performing queries for various purposes such as research.

The ART database is used and maintained by full-time data clerks who are responsible for entering the daily activities recorded on patients’ paper follow-up forms. The database serves as a backup to the paper record while supporting the reporting activities of the clinic. For instance, in situations where a patient’s health record is misplaced or lost, the patient’s basic record is retrieved on the database. Additionally, in situations where a patient has lost their card, in order to retrieve their charts, the database is used to retrieve the patient’s unique registration number given their name. The patient’s unique registration number is then used to locate the patient’s shelved paper chart. It should be noted that the ART database does not
contain a comprehensive medical record of each patient, for instance, baseline information recorded on the initial intake forms are not entered into the database.

The main output of the ART database is for generating monthly reports and cohort analysis, even though the medical data are still recorded on the ART and pre-ART logbooks. The database is beneficial in expediting the tabulation of data for reporting purposes. Additionally, the likelihood of errors that occur during manual tabulation is also minimized. The database also supports secondary use of the data such as research. However, the ART database is not a fully functional EMR. Components of a fully functional EMR that are not currently utilized in the ART database include order entry, decision support (i.e. alerts and reminders), and clinical documentation. See Appendix C for the complete functionalities of an EMR.

<table>
<thead>
<tr>
<th></th>
<th>Clinical Data Repository (CDR)</th>
<th>Controlled Medical Vocabulary</th>
<th>Master Patient Index (PMI)</th>
<th>Patient Registration/Scheduling</th>
<th>Unique Patient ID</th>
<th>Reporting</th>
<th>Pharmacy Information System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital 2, 3 &amp; 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 4.2 Components of an EMR currently utilized

4.5 Results: Categories

Interview transcripts of clinicians were analyzed line-by-line, labeling concepts that emerged from the data using qualitative data analysis software called NVivo 8. Following the coding of interviews, 67 concepts were identified from the data. These concepts were then grouped
into 20 categories. See Table 4.3 for the categories and their corresponding concepts. These categories are discussed in the following sections.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Infrastructure</td>
<td>technical limitations; Internet access; telephone/mobile networks; electricity</td>
</tr>
<tr>
<td>Clinic working conditions</td>
<td>workflow changes; patient flow/load; patient condition; medical equipment, human resources; heavy work-load; clinic physical working conditions; availability of supplies; medical equipment; drug availability; patient awareness</td>
</tr>
<tr>
<td>Productivity loss</td>
<td>EMR &amp; efficiency; workflow changes</td>
</tr>
<tr>
<td>Decision support</td>
<td>training (new practice); internet access; EMR &amp; medication errors; EMR &amp; decision support; EMR &amp; communication; access to up-to-date knowledge; performance monitoring</td>
</tr>
<tr>
<td>Integration of HIV programs</td>
<td>automation; integration of HIV programs; continuity of care; social support</td>
</tr>
<tr>
<td>Access to patient information</td>
<td>access to patient information; EMR &amp; complete medical record; paper recording system; paper recording system; computer recording system; continuity of care; patient monitoring; time taken to record</td>
</tr>
<tr>
<td>Lost patient follow-up</td>
<td>patient follow-up; social support</td>
</tr>
<tr>
<td>Patient confidentiality</td>
<td>EMR &amp; confidentiality; EMR &amp; safety, disclosure</td>
</tr>
<tr>
<td>Patient privacy</td>
<td>stigma, patient flow/load; clinic physical working conditions, EMR &amp; privacy</td>
</tr>
<tr>
<td>ART adherence</td>
<td>adherence; patient follow-up, patient condition, patient monitoring</td>
</tr>
<tr>
<td>Medication errors</td>
<td>EMR &amp; medication errors; EMR &amp; safety; medication errors; drug interaction/allergy</td>
</tr>
<tr>
<td>Lab investigation requisition process</td>
<td>lab investigation requisition; time take to record; order entry</td>
</tr>
<tr>
<td>Training</td>
<td>training on EMR; technical support</td>
</tr>
<tr>
<td>Patient referral &amp; transfer process</td>
<td>patient transfer in/out; continuity of care</td>
</tr>
<tr>
<td>Clinician communication</td>
<td>Internet access, clinician communication; EMR &amp; communication; continuity of care</td>
</tr>
</tbody>
</table>
Patient-clinician communication | patient-clinician interaction; EMR & patient neglect; unfamiliarity with computers in healthcare
Clinician computer use & competency | clinician computer competency; computer hardware & software, Internet access
EMR & user acceptance | EMR & user attitude; management & governance; EMR beneficial
EMR & cost | EMR & cost; economic limitations, computer hardware & software
EMR & efficiency | EMR & efficiency; EMR & wait time; EMR & communication; workflow changes; wait time; efficiency of providing care; EMR & workflow

Table 4.3 Categories and their corresponding concepts

4.5.1 Basic Infrastructure

Lack of basic infrastructure is perhaps the greatest challenge to EMR implementation in Ethiopia. The dire economic condition of Ethiopia is obvious as there are various infrastructural gaps, which pose barriers to EMR implementation. Basic infrastructure refers to the facilities, systems, services, and installations required for the functioning of a community or society. These include transportation, energy, waste management, communication, and public facilities such as schools and hospitals. According to the study, two essential infrastructures for EMR implementation are energy (electrical power network) and communication (telephone networks, mobile phone networks, Internet). Specific infrastructural issues that were raised by participants include; uninterrupted power supply (UPS), Internet connection, and telephone and mobile phone networking. See Table 4.4 for a complete summary of how infrastructural barriers position among other ERM barriers.

UPS was raised as major challenge by clinicians. During the 3-month research period in Ethiopia, there were scheduled blackouts every other day, sometimes up to four days a week.
The country gets power from hydroelectric dams. During dry seasons, the water level in the dams drops resulting in power rationing where certain regions of the country are deprived of electric power on rotating basis. Many hospitals have generators although they are only used for departments that absolutely need them, such as the emergency and operating rooms.

Many departments like ART do not have generators as indicated by the following quotes:

In our facility, the major challenge will be, first, continuous power supply, and the other is proper networking, Internet speed and efficiency. (Hospital 4, Subject 002, Line 236)

To implement an EMR in our country considering our state, there are many challenges. The cost of computers and implementing the application will be a challenge. As well, there is a problem with electricity and blackouts. (Hospital 1, Subject 009, Line 155)

Technical limitation like network availability, electricity, Internet connection speed is also a major limitation. (Hospital 2, Subject 003, Line 159)

As well, networks for mobile phones were unreliable with sporadic connections. The great majority; 88.24% (n=15) of nurses and 88.89% (n=8) of physicians indicated that lack of infrastructure was a major barrier to EMR implementation. Along with limitation in infrastructure, the technical limitations of systems such as the response time of computer,
Internet, and the EMR system were also identified as major barriers by 40% (n=6) of nurses and 62.5% (n=5) of physicians. See Table 4.4 for complete summary of results.

<table>
<thead>
<tr>
<th>Major Barrier</th>
<th>n (%)</th>
<th>Minor Barrier n (%)</th>
<th>Not a Barrier n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer-related issues</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical limitations of computers (e.g. slow response times)</td>
<td>11 (48)</td>
<td>7 (30)</td>
<td>5 (22)</td>
</tr>
<tr>
<td>Availability of technical support</td>
<td>15 (56)</td>
<td>8 (30)</td>
<td>4 (14)</td>
</tr>
<tr>
<td>Lack of training</td>
<td>25 (93)</td>
<td>2 (7)</td>
<td>0</td>
</tr>
<tr>
<td>Clinician computer skills</td>
<td>10 (36)</td>
<td>13 (46)</td>
<td>5 (18)</td>
</tr>
<tr>
<td>Lack of infrastructure</td>
<td>23 (88)</td>
<td>1 (4)</td>
<td>2 (8)</td>
</tr>
<tr>
<td><strong>Clinical issues</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical productivity loss</td>
<td>6 (28)</td>
<td>9 (44)</td>
<td>6 (28)</td>
</tr>
<tr>
<td>Clinician skepticism</td>
<td>5 (22)</td>
<td>8 (35)</td>
<td>10 (43)</td>
</tr>
<tr>
<td>Patient privacy or security concerns</td>
<td>3 (13)</td>
<td>9 (39)</td>
<td>11 (48)</td>
</tr>
<tr>
<td>Extreme workflow changes</td>
<td>9 (36)</td>
<td>11 (44)</td>
<td>5 (20)</td>
</tr>
</tbody>
</table>

Table 4.4 Perceived barriers to EMR implementation in HIV care

* n - number of subjects

In Summary, the lack of infrastructure is a major challenge to EMR implementation in Ethiopia. Without electricity and proper communication network, such a system cannot be operational. Clinicians highlight the lack of uninterrupted power supply (UPS), Internet connection, and networking as major issues that would affect the implementation of an EMR in their facility.

4.5.2 Clinic Working Conditions

Clinic working conditions encompass various issues related to clinicians’ workplace and physical environment such as workspace, workload, and availability of supplies, human
resources and salary. When asked about the major challenges facing ART at the provider and facility levels, most participants indicated working conditions were an issue.

Clinicians indicated there was little workspace available for patients and clinicians. Clinicians shared their concerns about the limited space at their clinic. Crowded waiting areas and congested hallways were common in most hospitals and ART clinics. Many visit rooms serve multiple purposes and are crammed with desks, shelves and paper work, as one clinician describes in the following quote:

Well, there are some challenges, for instance there is a shortage of space, which makes it hard to accommodate patients and also limited workspace for clinicians. (Hospital 3, Subject 002, Line 46)

These space limitations not only make it difficult for ART clinics to accommodate the large patient load, but they also pose health challenges to clinicians. As one clinician indicates in the following quote:

The space itself is not well equipped, as we can't open the windows, it is not well ventilated which is a major issue, considering we deal with TB/HIV patients. We only have two rooms and they are very small. One room is an examination room where the physician works and the other has multiple purposes, it serves as a card room where medical records are
stored and we also do the adherence counseling there. It is a little crowded as both nurses work out of one room. (Hospital 1, Subject 009. Line 19)

Secondly, issues around human resources and remuneration define the working conditions of ART clinics. One challenge facing ART clinics is the lack of human resources as expressed in the following quotes:

At the clinic level, we do have a shortage of manpower. We have 2 nurses and one physician for 35 to 40 patients a day and when one clinician is away the workload increases. (Hospital 1, Subject 011, Line 42)

We do not have sufficient skilled health workers in our clinic, for instance when I am looking at 40 or so patients on a typical day, I’m working on my own and it would be ideal to have someone assisting you. If I am sick and miss a day at work, the 40 or so patients I would see will be shared among my other colleagues at the clinic. (Hospital 1, Subject 004, Line 28)

The shortage of physicians is also apparent in ART clinics as there are very few physicians that work on full time basis, most ART physicians work on rotations as articulated in the following quote:
At the provider level, there is a challenge with the shortage of physicians. Currently there is one physician and one medical officer at the clinic and this is not sufficient. (Hospital 3, Subject 001, Line 27)

Clinicians believe they are overworked and underpaid; as a result the overall job satisfaction of clinicians is low. This is reflected in the high turnover of clinicians who pursue better opportunities with private hospitals and NGOs. The following quotes explain these issues:

There is high turnover. Even within this clinic, since I have been here there have been a few nurses and doctors that have left. The reason for the turnover is because of the lack of support of staff, so when people get better opportunities elsewhere they leave. The main thing that needs to improve is the salary of health workers. (Hospital 1, Subject 004, Line 36)

At the provider level, the salary is not sufficient compared to the amount of work that we do… There is little motivation with the work aside from the motivation of helping patients. (Hospital 2, Subject 001, Line 16)

Thirdly, the lack of resources and material essential for clinicians to properly carry out their work is also a problem raised by numerous clinicians. These include lack of paper forms for recording patient data, lack of manual practice guidelines, lack of medical equipment such as lab investigation machines, and lack of telephones. Clinicians express their frustration in the following quotes:
Sometimes we run out of intake forms and the forms are not delivered to the clinic in time, so when patient's come in for the first time, the intake form that is used to record baseline information of the patient is not filled out. Therefore, we only fill out the follow-up form and we have to fill out the intake form when the patient comes in again for their follow-up visit. This greatly increases our workload. (Hospital 4, Subject 003, Line 60)

The main problem is not that the patient has to walk to the lab it is the lack of lab equipment. For example, there is one machine for chemistry and it holds specimens for 17 patients at one time. So patients will come as early as 5 am to get in early, if they miss that opportunity they have to come back at night or most often the following morning. (Hospital 1, Subject 007, Line 146)

For the most part, we don't have enough material or resources. Whoever attends the training may receive printed material [practice guidelines] but those that don't attend won't get the printed guideline. (Hospital 1, Subject 003, Line 81)

In summary, the clinic working conditions include various issues related to clinicians’ workplace and physical environment such as workspace, workload, and availability of supplies, human resources and salary. Clinicians raised concerns around small working space
and limited patient visit rooms to accommodate the high patient load. Clinicians feel there is a lack of adequate resources such as; sufficient practice guideline manuals, lab investigation equipment and basic necessities such as telephones in their clinic. Lack of motivation of clinicians is a result of low salaries with some clinics facing high turnover as a result. Due to the high patient load and limited clinical staff, clinicians are often weighed down with the heavy workload.

4.5.3 Integration of HIV Programs

There are a number of programs in HIV care within the hospitals studied in Ethiopia. They include: ART, pediatric ART, prevention of mother to child transmission (PMTCT), mother to child transmission (MTCT) plus, voluntary counseling and testing (VCT), TB/HIV, opportunistic Infection (OI) prophylaxis and treatment, sexually transmitted infections (STI) care and prevention, home-based and palliative care and various social support programs offered by NGOs. For the most part, these programs function as autonomous clinics administered within a hospital, with the exception to home-based care and social support programs that function as independent programs outside the hospital. Due to different funders that take initiatives to support specific programs, the amount of funding, focus and strategic direction of each program vary thus compromising the integration of programs like ART in the continuum of care (FMOH, 2005). For instance, ART clinics in SNNPR receive funding and technical support from the President’s Emergency Plan For Aids Relief (PEPFAR) and John Hopkins University (JHU) (John Hopkins Center for Global Health, 2009), whereas in Hospital 1, pediatric ART gets additional support from the Clinton Foundation. The financial and strategic disparities among these programs contribute to the
integration gaps that currently exist among these entities. An example of such a gap is the poor linkage between PMTCT and pediatric ART as indicated by a pediatric ART nurse in the following quote:

There is also a big gap between PMTCT and pediatric ART. Firstly, the PMTCT clinic is located in a different part of the hospital and there is no straight path from PMTCT to pediatric ART, so patients get lost wondering around the hospital. As well, women in PMTCT who have delivered are not linked directly to pediatric ART so that we can test and provide treatment for the child. Only after a year or two, does a mother come back to the hospital to get her child tested. She knows she has given birth while she is HIV positive but because she has not been linked to pediatric ART, she won't come to the clinic. This is a major gap. An infant must be tested 45 days after being born. (Hospital 1, Subject 011, Line 97)

Multi-disciplinary team (MDT) meetings are held weekly to discuss and address gaps around integration of these programs. Managers and coordinators from the various programs along with NGO representatives get together to compare and go through reports to identify missed patients between the programs. In addition, case studies are presented and discussed. The MDT meetings are beneficial in bringing together the various program heads to identify with each other’s problems and work towards a common objective. However, some clinicians are skeptical about the impact of the MDT meetings in addressing the integration gaps among HIV programs, while others feel it is beneficial as illustrated by the following quotes:
MDT is good practice to reduce gaps among programs. However, the MDT is currently weak because most of the department heads do not attend these meetings on regular basis. As a result, we don't get a chance to listen to the problems that some departments are facing. Because of this, it's difficult to determine how effective the integration effort is. (Hospital 1, Subject 004, Line 95)

We have weekly MDT meetings that help in coordinating among various clinics. We have case presentations but for the most part it's administrative… I feel that the MDT meetings don’t bring much solution to problems; I feel we simply talk about the problems and don't address them. (Hospital 1, Subject 009, Line 83)

Additionally, the MDT does not have the monetary or decision making power to bring about significant changes to some of the larger integration problems that currently exist. The poor attendance and the nominal outcomes indicate that MDT has a minimal contribution towards addressing the issue of integration and continuity of care.

In summary, ART is an integral part of the HIV continuum of care and should not function as silos (FMOH, 2005). Instead, ART should be approached in the context of comprehensive care within the continuum. Information sharing and coordination of care processes are the right steps in the direction of integration. Currently, clinicians identify gaps that exist in the
linkage between various programs in the care continuum. Information technology can play a key role in the coordination and communication of various programs to foster linkage and continuity of care.

4.5.4 Patient Referral and Transfer Process

Patient inter and intra-facility transfer process is an area of continuity of care that was raised during interviews. Patient referral and transfer is the process of transferring a patient to department within the hospital or another health facility to continue their ART care. Inter-facility transfers occur when a patient has relocated and is outside the geographic area covered by a specific ART clinic. In other cases, ART clinics transfer patients who are stable to health centers in order to accommodate the high patient load. The procedure of transferring patients out of the ART clinic is done by the use of paper transfer forms. When patients are transferred to another ART clinic, a transfer form is filled out and given to the patient. The form contains minimal but sufficient information for clinicians to continue the patient’s treatment.

If a patient relocates and wants to continue their ART at another facility, we give the patient an inter-facility transfer form which will provide information like: ART start date, baseline CD4, type of regimen, weight, height, as well as reason for transfer. This information is given to the patient to take to the other facility. The patient's history or folder is kept at the facility, only the referral form is sent. (Hospital 1, Subject 002, Line 141)
There are a number of challenges and drawbacks clinicians identify with the current practice. Firstly, there is mixed opinions about the adequacy of the information that is provided on the transfer forms. Some feel it is adequate while others feel it is insufficient as stated by clinicians in the following quotes:

It is not sufficient. It only provides information about the current condition of the patient, when they started ART, and the patient's adherence. If the patient had drug allergies, it is not recorded on the transfer form. If the patient had changed regimens, we don't record why the regimen was changed. (Hospital 1, Subject 011, Line 82)

The transfer form has all the basic minimal information enough for the clinicians receiving the patient to continue the patient's ART. (Hospital 1, Subject 007, Line 93)

When a patient is transferred to another ART clinic, the complete medical record or chart including the patient’s full demographic information, intake forms with baseline investigations, and encounter information is kept back at the ART clinic. Clinicians confirm that the charts of transferred patients have negligible use at the facility. It is only useful in cases when a patient returns to the clinic to continue their ART and for research purposes.
We keep the medical record here at our clinic even after a patient has been transferred out to another facility. I'm not sure what the purpose of keeping the patients record here is. (Hospital 1, Subject 009, Line 77)

It is useful for situations where patients may come back to continue care at our clinic. Aside from that, it doesn’t have much use and it takes up space in a room that is already very small. (Hospital 2, Subject 003, Line 94)

Secondly, there is no feedback mechanism in place to ensure that a patient that has in-fact been transferred-out and has been accepted and has continued treatment at the receiving health facility. In the current practice, once a transfer form has been issued to a patient, they are no longer tracked by the clinic. The clinic does provide its contact information to the receiving clinic in order to assist them with any questions. Clinicians expressed some of these gaps in the following quotes:

There are gaps in the referral system. One of the gaps is follow-up of such patients. We have no way of following-up on such patients to ensure they have continued their ART at the other facility. (Hospital 1, Subject 002, Line 149)

We never follow-up on patients once they have been transferred out… In cases where the information is not clear we provide contact information on the form and they contact us to clarify things. There have been such cases
where clinicians from another facility contact us about a transferred patient, in which case we pull out their record to answer their questions. (Hospital 1, Subject 007, Line 99)

Additionally, there are minimal feedback mechanisms between departments within the same health facility in the intra-facility transfer process. For instance, lab investigations requested by clinicians that have not been done by patients are only recognized during a patient’s scheduled follow-up visit, which could be days and even weeks later. The lack of feedback within a facility is evident, as one clinician states:

There is no system of feedback, all we do is write the referral form and we don't know if that patient has continued their care at the other facility. This is true not only for inter-facility transfers but also for intra-facility transfers. For example, if a patient is referred to the ART clinic from VCT, we have no way of ensuring that patient has been linked to ART. For instance I have occasions where I do a PICT [Provider Initiated Counseling and Testing] and send them to do lab investigations but some forget and go home. (Hospital 1, Subject 003, Line 96)

In summary, clinicians voiced concerns about the weakness of the referral system. There are a number of challenges in the patient referral and transfer process within and outside the health facilities studied. There is mixed opinions about the adequacy of the information that is provided on the transfer forms. Some clinicians believe it is adequate while others feel it is
insufficient. As well, there is no feedback mechanism to ensure that a transferred patient has indeed continued treatment at another facility. The lack of information transfer and communication mechanisms between facilities contribute to the poor referral system that currently exists between various ART clinics, health centers and hospital departments in Ethiopia where technology is not used to bridge the gaps in this process.

4.5.5 Productivity Loss

Productivity is the measure of clinician’s work or output. Productivity of clinicians refers to the number of patients they see, the type of patient encounters, and their efficiency or the number of patients they see in a specific amount of time. Productivity loss refers to the effects of various variables that inhibit clinicians from performing their tasks up to their optimum level of efficiency.

Productivity loss was identified as a potential barrier to successful EMR implementation. Clinicians relate productivity loss to various factors such as their computer skill, EMR training, technical limitations of the system and workflow changes that results from introduction of an EMR in their facility. About fifty six percent of physicians feel productivity loss would be a minor barrier while 49% of nurses feel it would be a major barrier. During interviews, physicians voiced their apprehension that working on a computer instead of paper during patient encounters would be time consuming considering the current level of clinician’s computer competency. The following quotes highlight these concerns:
Some of the challenges in using a computer-based system is the limited computer competency of clinicians. It could be time consuming for me for instance, to access a patient's medical history. I am also slow in typing so that would be a challenge. So, although it could save time and effort by connecting lab and pharmacy with ART, it could take up time when it comes to clinicians, who see 30 to 40 patients each day. (Hospital 3, Subject 001, Line 40)

In summary, concern about productivity loss due to the introduction of an EMR and new work processes to accompany it pose productivity challenges. Additionally, the concern of clinicians regarding productivity loss is reflective of the clinician’s apprehension about their computer skills and their inability to accommodate more work.

4.5.6 Decision Support

There is continuous emergence of new research and information about HIV (Safran et al., 1995). Clinicians in HIV care need up-to-date knowledge in order to stay current on new practice guidelines and decision support tools to help them make clinical decisions. Clinical decision support refers to the support of clinicians in making clinical decisions to enhance patient care by providing best practices, new medical knowledge and patient-specific assessment and treatment recommendations (Hunt et al., 1998).

Decision support can be provided in the form of manual and computer-based systems that attach care reminders to patient charts for preventative care services and computerized order
entry systems that provide patient-specific recommendations in the order entry process. Such systems have been proven to improve prescribing practices (Bennett & Glasziou, 2003, Walton et al., 2001, and Walton et al., 1999), reduce serious medication errors (Kaushal et al., 2003 and Bates et al., 1999), enhance the delivery of preventative care (Shea et al., 1996 and Balas et al., 2000), and improve adherence to evidence-based care standards (Hunt et al., 1998 and Shiffman et al., 1999). According to a systematic review by Chaudhry et al. (2006), the main effect of health information technology on quality of care is its role in increasing adherence to practice guidelines or protocol-based care by decision support in the form of computerized reminders (Chaudhry et al., 2006).

Clinicians working in ART do not have sufficient access to up-to-date information on HIV care and treatment, and the current methods for accessing such information in their facility are inadequate. Currently, decision support is available to clinicians in the form of posted charts, pamphlets and copies of practice guideline manuals that are updated annually. Clinicians believe that simply receiving paper copies of the guidelines is not sufficient. In some facilities, copies of practice guideline manuals are not available to all clinicians. The training on the new guidelines is also insufficient as illustrated by the following excerpt:

Yes, there are challenges in this area since the guidelines are always changing. When updated guidelines come, training is provided to a selected few, as it would not be possible for everyone to go to the training sessions. Whoever attends the sessions would inform others of the guidelines, so we work by asking and informing colleagues. However, for the most part we don't have
enough material or resources. Whoever attends the training may receive printed material but those that don't attend won't get the guidelines. (Hospital 1, Subject 003, Line 78)

Many clinicians also opt for consulting their colleagues because it is time consuming for clinicians to search through the practice guideline manual in the midst of heavy workload. However, consulting colleagues can also be time consuming, since some clinicians have to go to multiple colleagues to get their questions answered. The following quote illustrates how clinicians use colleagues as a resource to obtain best practice information:

For the most part we consult the clinic’s coordinator and she clarifies things for us if we have questions. (Hospital 1, Subject 003, Line 78)

The majority of clinicians (90.47% (n=19)) perceive an EMR would have a positive effect in making evidence-based care standards available to support best practice. Access to up-to-date knowledge and practice guidelines through online sources and the EMR would be beneficial to clinician practice. Such access would allow clinicians to quickly access specific medical information and review the progress of their cohort; an ART start-up group, which consists of all patients starting ART in the same month. Additionally, Internet access would allow clinicians to retrieve medical journals and communicate with colleagues via e-mail as illustrated by the following quote:
I think this is very positive, putting information on computer-based, I can build my own cohort, and I can get a good knowledge based on my cohort. The other thing is, I can have access to the Internet and online journals.

(Hospital 4, Subject 002, Line 196)

Conversely, the attitude of clinicians in being proactive to access current medical information determines their use of available up-to-date knowledge.

It depends on the individual; some people are very active in finding new information. Other clinicians come out of school and apply what they have learned for 10 years, but science changes every day. Internet access would allow clinicians to access current medical journals. All this depends on the individual's activeness in seeking new and best practice. So, an EMR could provide this current and up-to-date knowledge but people might not go out of their way to access it. (Hospital 4, Subject 009, Line 173)

The way information is presented influences the extent to which it will be utilized. For instance, is the information easily and quickly accessible for clinicians? Some clinicians voice concerns that they may not have the time to search and access medical information online during their work hours. It should also be noted that information alone does not change practice; good decisions based on information changes practice.
In summary, clinicians in HIV care need up-to-date knowledge in order to stay current on new practice guidelines and decision support tools to help them carry out their practice according to protocol in a timely manner. Often, clinicians refer to manual practice guidelines and consult their colleagues with questions or concerns they encounter in the care of a patient. At times, manual practice guidelines are not readily available, so clinicians often opt for consulting their colleagues. Both practices are time consuming and clinicians perceive that access to up-to-date knowledge and practice guidelines through online sources and the EMR would be beneficial to their clinician practice.

4.5.7 Access and Quality of Patient Information

Access and quality of patient information refers to the legibility, completeness and availability of patients’ medical record and clinician’s ability to retrieve specific patient information on timely basis. An essential prerequisite for continuity of care is record keeping, which provides summaries of care history, allowing health workers to be updated on patients’ previous medical history including; the patient’s HIV stage, weight, functional status, prophylaxis, current and past medication, education and psychosocial support they have received (WHO, 2005).

Clinicians were asked about the accessibility and completeness of patient information with the recording system utilized in their health facility. Some clinicians indicated that the documentation is comprehensive, accurate, and available in a timely manner, as two clinicians explained in the following quote:
The paper work and the patient cards are properly organized. Each information has its own format easy to fill-in; there is uniformity, which makes it easy to access. (Hospital 4, Subject 002, Line 67)

The patients’ charts are kept well at the ART clinic; if I need information about a patient’s previous medical history I can easily access it. (Hospital 4, Subject 005, Line 38)

Conversely, some clinicians believe that the predominately paper based system poses challenges when it comes to legibility, timely access and completeness as expressed in the following quotes:

When you look at the patient card, if you wrote it, then you will be able to read it, otherwise there could be cases where it may not be legible. The paper-based system has several challenges. For example, for long-time patients it may be difficult to locate a patient’s card, or since the record has been written by many clinical staff, it could be difficult to read. Accessing the patient files is also time consuming. Once a patient’s record is found, flipping through various paper forms to find what you are looking for is time consuming. (Hospital 2, Subject 003, Line 44)

It would be good if the paper-based system were eliminated because it wastes a lot of time. It is not fast and it is also not easy to use. It takes time
having to flip through papers, having to write, erase and make corrections.

If it is computerized it would be much better and I believe it will be in the future. (Hospital 3, Subject 002, Line 56)

The record is available but there are cases where some portions or lines of the record will be missing because they have not been filled in. (Interview H004, Line 39)

In other cases, nurses improvise and create their own method of recording to keep track of patient follow-up information, as a pediatric ART nurse indicated in the following quote:

For ART there is a follow-up card; however, there is no follow-up card for pre-ART patients. So to address this area, we created our own logbook, which helps us track the number of patients on pre-ART, how many patients transferred to ART and how many were lost from pre-ART. This logbook is used for our purposes only. Those on pre-ART are given a specific serial number and we check pre-ART patients when they come in to take their OI or other medications. (Hospital 1, Subject 009, Line 58)

As well, the medical record of patients in ART is kept at the ART clinic to ensure confidentiality. In cases where a patient has to visit another department in the hospital, the patient’s chart (card) is transferred to the department.
A patient has only one health card at the hospital. So whatever care the patient is receiving is recorded on the patient card and whatever department he goes to, they have to show that card. Because HIV care is confidential, we usually keep the card here at the ART clinic; the patient can take it, receive care at other departments and then has to bring it back to us.

(Hospital 4, Subject 002, Line 197)

However, there are also some other drawbacks to the paper recording system when it comes to access to the patient’s medical information. One challenge with this practice is that some ART clinics like Hospital 1, 2 and 4 are closed on Saturdays and Sundays, in which case patients’ charts cannot be retrieved. The care provided can be recorded on the patient’s pocket health card, but their medical history is not available to clinicians. Clinicians explained this dilemma in the following quotes:

For example if a patient is sent to OPD for resuscitation, the card goes with the patient. However, if the patient comes to the hospital on a Saturday or Sunday in which case the ART clinic is closed, the medication he receives is recorded on the patient pocket card that the patient takes home with them. (Hospital 1, Subject 004, Line 65)

The ART clinic is only open from Monday to Friday. If a patient has a problem and they come to [Hospital 1], they will not be able to access their card because it is kept at the ART clinic. Such patients sometimes have to
get a new card to be seen by clinicians, while sometimes clinicians will not see them, because they don't have a card. However, if it is computerized, each unit can access the patient's file and record easily. So yes, there are problems in the area. (Hospital 1, Subject 001, Line 110)

As stated, in some cases, hospital departments refuse to accept patients without charts. Additionally, the safety of patients is compromised since vital medical information such as drug allergies is not available to clinicians as indicated by the following quote:

The drug allergy is written on the patient's card [chart]. With exception to Saturday or Sunday, I send the patient to the emergency and unless I send them with their card, emergency will not see them. (Hospital 1, Subject 005, Line 82)

In summary, clinicians face challenges with having access to complete medical records of their patients. The paper forms are very beneficial providing a level of standardization. However, the paper-based system has drawbacks when it comes to legibility, timely access and completeness. The fact that each patient’s chart is located in one location also limits its accessibility to various clinicians.

4.5.8 Lost Patient Follow-Up

The majority of the care in ART consists of adherence assessment and drug re-fills. Nurses are responsible for assessing adherence and providing counseling with the help of
professional and non-professional counselors. During the early stages of initiating a patient on ART, nurses complete intake forms. Part of the intake form is demographic information of patients, including their address, contact information and social support. This information is useful for tracking patients in situations where they miss an appointment or altogether drop out from treatment. Patients that miss their appointments are called ‘lost’ patients, while patients that have missed multiple consecutive appointments, that have been lost for extend periods of time and cannot be tracked are considered to be ‘dropped out’ from treatment. The following section discusses the lost patient follow up process.

Maintaining high adherence rates is one of the challenges that ART clinics face. Part of this challenge is with the follow-up of lost patients. During the monthly tabulation of data for reporting purposes, data clerks identify lost patients and submit their contact information to nurses and support workers. The data cleaning/QA-QC (quality assurance - quality control) module of the ART database is also used for querying lost patients. However, not all patients can be tracked since they may not have telephones or mobile phones, as indicated by the following quotes:

We use the ART database to find lost patients’ contacts, but many patients do not have phone contact in which case they cannot be tracked. (Hospital 2, Subject 002, Line 47)

For the first phase or the intensive phase, the patients contact, address, telephone number, and ‘kebele’ [district] is recorded so that those who miss
appointments for refill are contacted by phone to follow up and create a means of getting the patient back on treatment. However, we are currently not doing that because most patients don't have a phone contact and we also can't contact individual patients using our own expense. (Hospital 4, Subject 009, Line 76)

Additionally, some of the ART clinics in this study did not have telephones to contact lost patients. Clinicians stated that at times they would use their personal mobile phones to contact patients. Facilities like ART clinic of Hospital 4 just recently installed phone lines in their clinic.

Previously we had a problem because we did not have a telephone at the ART clinic but within the last month a telephone is available through the support of JHU [John Hopkins University]. We use the phone to trace these patients that have been lost. We can't find or follow-up on patients that don't have a telephone number. (Hospital 4, Subject 003, Line 80)

In other cases, because of the stigma associated with the disease, some patients provide incorrect contact information or refuse to provide their contact and address information.

In summary, part of the challenge associated with ensuring high adherence rates is difficulties related to the follow-up of lost patients. Components of these difficulties are linked to the socio-economic condition of patients, as patients in some regions do not have
mobile or home telephones, making it difficult to impossible to track such patients. In addition, services and equipment such as telephones that supplement follow-up activities are lacking, since some hospitals are just getting phones installed. Alternative methods are being utilized such as tracking patients by partnering with ‘kebele’ [district] representatives who will follow-up on patients by visiting their home. However, according to clinicians, this practice is rare. Although an EMR system is not the primary solution in addressing lost patient follow-up, it can play a key role in helping identify lost patients right away so that they can be tracked early.

4.5.9 Patient Confidentiality

Ensuring the confidentiality of patients’ medical records is an important component that impinges on quality of care (Shortliffe & Perreault, 2001, p. 173). “Confidentiality applies to information – in this context, the ability of a person to control the release of her personal health information to a care provider or information custodian under an agreement that limits the further release of that information.” (Shortliffe & Perreault, 2001, p. 174). Challenges with maintaining confidentiality of patients’ medical information were discovered at the four health facilities involved in this study.

The paper recording system presented many opportunities for breach of confidentiality. In the ART visit rooms, there were piles of folders of patient charts, where patients and passersby could view various forms that were left open. Clinicians believe that the current paper record system is easily accessible by the public, as one clinician indicated:
When I am consulting patients, there are patients moving in and out of the room. Patients’ charts are on the table and they can open and look at the charts while I am working with a patient. If there were a computer they would not be brave enough to get on the computer. (Hospital 4, Subject 008, Line 83)

As well, in cases when a patient has to be escorted by a runner or the patient’s medical record has to be transferred from one department to another, runners who transfer these documents can easily view private patient history. This is illustrated in the following quote:

There are challenges in this area, for instance a runner may carry a patient's card to a department and they can see the patient's confidential data. An EMR would improve patient confidentiality using password to protect patient data. (Hospital 3, Subject 001, Line 125)

The majority (90.47% (n=19)) of participants perceive that an EMR would improve the confidentiality of patients’ medical record by enabling password protection, making confidential patient data only accessible to authorized clinicians. This is confirmed by the following quote:

There is no doubt about it; an EMR will improve this [confidentiality]. Currently, the logbooks are on the table, we can't lock it in a cabinet and it is easily accessible to anyone that comes into the room. An EMR would
improve the confidentiality of patients’ record. (Hospital 4, Subject 009, Line 166)

Conversely, clinicians also identified a confidentiality drawback an EMR could pose to HIV patients’ record. Many patients only consent to their nurse and physician involved in their ART to know about their HIV status. Having a complete record of a patient available on the EMR, viewable to any clinician that has password access without the patient’s consent could compromise the patient’s confidentiality.

EMR could compromise the privacy of a patient who may only want their physician to know about their [HIV] positive status. (Hospital 2, Subject 003, Line 131)

However, such issues can be addressed by ensuring that the EMR system’s security will vary by task and be assigned only to those users who require access to each part of the system, e.g. clinical data of ART patients.

In summary, the overwhelming perception of an EMR’s benefit in improving the confidentiality of patients’ medical records is an indication that there are confidentiality concerns that could be addressed. Implementation of an EMR would restructure the workflow within the clinic and altogether eliminate practices such as runners physically transferring patient files from one department to another. Ultimately the majority of
clinicians perceive that an EMR would provide security measures that would better protect confidentiality of patients’ records.

4.5.10 Patient Privacy

Privacy refers to “the desire of a person to control disclosure of personal health and other information” (Shortliffe & Perreault, 2001, p. 174). Privacy is also a person’s desire to control the access of others to themselves.

Clinicians believe there are privacy challenges that an EMR could not address. For instance, the physical layout and location of some of the clinics alongside non-medical offices poses a privacy concern for patients. In one hospital, patients had to wait in a hallway where there was high traffic of general hospital employees. One clinician echoed this sentiment in the following quote:

The privacy of patients is not good because of the location of the clinic next to administrative offices. People walk in and out right next to the health record room. (Hospital 1, Subject 011, Line 132)

Health record rooms at two hospitals were located in high traffic areas with busy data clerks, lab technicians, clinicians and patients moving in and out of the rooms. At times, the health record rooms were left unattended with the doors open. Shortage of examination rooms forces many nurses to carry out multiple examinations in the same room in order to accommodate the large flow of patients as expressed by the following quote:
In our ART clinic I don't think there is any privacy. There are two nurses that work in the same room. Usually we cannot close the door because when I’m consulting one patient another nurse might be calling another patient… and there will also be data clerks bringing folder of patients who are waiting. (Hospital 4, Subject 003, Line 180)

In summary, the various privacy concerns that were raised by clinicians need to be taken into consideration by hospital administrators and government officials in attempting to protect the confidentiality of HIV patients. The question remains whether management feel the privacy of patients is an issue of priority that needs attention and action in the midst of the various competing challenges that need focus within the various hospitals. The role of EMRs on privacy is minimal according to participants as the main privacy issues are related to the physical layout of the clinic and the lack of working space.

4.5.11 ART Adherence

Adherence refers to the commitment of a patient to the prescribed ART regimen. Adherence is one of the major challenges that ART clinicians face. Part of the reason why adherence is a challenge is because it deals with patients’ attitude and awareness. As a result, there is a great emphasis on counseling patients before, during and after initiation of ART. Nurses, professional counselors and non-professional counselors provide adherence counseling and adherence assessments at each clinical visit to minimize failing treatment and patient
dropout. When asked about the main challenges in ART, the majority of patients indicated that adherence was one of the major challenges.

The major challenge is with patients who discontinue their medication for religious reasons, some patients do not adhere to the drug regimen and others prefer traditional medicine. The major challenge we face is in the area of adherence. (Hospital 1, Subject 004, Line 25)

Patients discontinue their ARV regimen for various reasons. Some do as a result of lack of awareness, while others discontinue as a result of their social and economic conditions. Many patients discontinue their ARV regimen because of religious practices of ‘tebel’ or holy water. This is a religious belief that drinking holy water will heal their disease. According to the ceremony, one is not allowed to take any food or medication during the period of drinking holy water. The following quotes echo these adherence challenges:

Most of the problems with discontinuing treatment are related to lack of food. (Hospital 4, Subject 003, Line 32)

The biggest problem regarding adherence is patients that stop medications because they take holy water. We counsel them about this and we are trying to get priests from the churches to inform people. (Hospital 4, Subject 006, Line 46)
They [patients] have many reasons for not adhering to the regimen. Some stop their medication for religious reasons, other stop because they don't have good support, other get tired or lazy because of taking the drug for a long time. (Hospital 1, Subject 001, Line 28)

In other cases, as a result of their improving conditions, patients stop taking their medication believing they are healed. While others become negligent and start missing re-fill appointments.

Addressing the issues around poor adherence has been tackled in various ways. Counseling and carrying out adherence assessment has been important steps towards improving the attitude and behavior of patients. In some facilities, pill counting is used to determine patients’ adherence. Additionally, follow-up mechanisms such as calling patients by phone have been used to track patients in order to get them back on treatment, although with limited success in some regions.

We contact patients that have telephones by calling them. But in most cases these lost patients are missed because they come from long distances. Those without phones we can't follow-up on. (Hospital 4, Subject 006, Line 44)
In some areas, where telephone is less accessible, community representatives from ‘kebeles’ [districts] or wards have been designated to follow-up on patients. However, this practice is rare.

In summary, clinicians raised numerous issues around adherence as major challenges facing ART. Maintaining high adherence rates have been difficult due to patients discontinuing treatment for religious reasons as well as lack of basic necessities like food and social support. Adherence counseling and various follow-up methods are being currently utilized to maintain patients’ adherence to treatment. An EMR can help clinicians target high-risk patients for poor adherence based on their adherence history in order to provide more adherence counseling or short-term drug refills.

4.5.12 Medication Errors

Medication error refers to the prescription and consumption of the wrong drugs or dose, which may result in inappropriate medication use or patient harm. Presently, ART clinics and pharmacy have an error checking method in place to ensure they support each other in minimizing the prescription of wrong drugs and doses. Pharmacy has a computer system that keeps a record of the ARV regimen of each patient in ART. When a patient presents a prescription written by ART clinicians, pharmacy staff checks the system to verify the prescription is correct. Most ART clinicians believe the current system works adequately, although they experience minor challenges.
To reduce medication errors, pharmacy has a computer system that is used to double-check the drugs that have been prescribed by us. Sometimes we have problems when a regimen is changed and it hasn't been updated on the pharmacy computer system. However, our current practice with pharmacy works well. (Hospital 1, Subject 009, Line 147)

Yet clinicians report of cases where patients do receive the wrong drugs and even fewer cases of adverse drug effects. In a U.S. Institute of Medicine study, nearly 98,000 people die in the US each year as a result of medical errors such as incorrect dosage due to poor legibility or delays in accessing needed information to make the proper intervention (Institute of Medicine, 2001). Clinicians reported of medication error occurrence in the following quotes:

We do have medication errors. Sometimes when we have to see a large number of patients we may make a mistake and prescribe the wrong drug. However, when they take this prescription to pharmacy, they pull up the patient's regimen on their computer system to make sure the right medication is prescribed. If there is a mistake they will send it back to us. (Hospital 1, Subject 003, Line 159)

Medication errors are rare but they do occur. Errors may occur during the change of a regimen or in cases where ART prescribes a wrong regimen and pharmacy overlooks it. (Hospital 3, Subject 001, Line 152)
Although clinicians are confident about the current error checking system, 90.47% (n=19) of clinicians interviewed perceive that an EMR would be beneficial in further ensuring that medication errors do not occur.

This [EMR] will be beneficial because it can identify and flag when such medication errors take place. Currently, there are medication errors that occur, for example, with the dose prescribed. As well, most of the physician’s handwriting is difficult to read. The EMR could address some of these problems. The EMR will be a very good tool to reduce medication errors. (Hospital 1, Subject 001, Line 187)

An EMR with order entry functionalities would also provide automation with pharmacy allowing computerized ordering of medications which would make the ordering of prescriptions more efficient by reducing the back and forth that occurs in cases where patients’ regimen has been changed, an error in prescription has been identified or a prescription is illegible.

Because we see so many patients we could write a different dose or write a wrong drug and a computer system that would link with the current pharmacy system would be very good in reducing medication errors. (Hospital 1, Subject 004, Line 173)
Along with automating of ordering between ART and pharmacy, an EMR would provide useful decision support by providing alerts on drug allergies. Currently drug allergies are written on patients’ charts with a red pen and at times it is not written at all. Two studies of computerized provider entry from the LDS Hospital (Evans et al., 1999 and Evans et al., 1998) demonstrated statistically significant decreases in adverse drug events. The first study identified the effect of computerized alerts on antibiotic use, decreasing antibiotic-associated adverse drug events from 28 to 4 events, and decreased length of stay from 13 to 10 days (Evans et al., 1998). The second study demonstrated a 0.6 percentage point absolute decrease (from 0.9% to 0.3%) in antibiotic-associated adverse drug events (Evans et al., 1999).

In summary, although the occurrence of medication errors are not carefully documented, clinicians had mixed opinions about the prevalence of medication errors with majority stating that medication errors were rare due to the pharmacy system and error checking system used. Others on the other hand, expressed their concern over medication error occurrences that result from repeated and heavy workload. That said, the majority of clinicians perceive that an EMR would improve the rate of medication errors in their practice. One outcome of EMRs on quality is to reduce medication errors (Chaudhry et al., 2006).

4.5.13 Lab Investigation Requisition Process

The laboratory requisition process involves clinicians, lab technicians and patients. The process starts with a clinician’s request for a lab investigation, the presentation of the requested sample by a patient, the completion of the investigation by a lab technician and the
provision of results to the requesting clinician. A large component of the work done in ART is closely related with laboratory. During the initial stages of the pre-ART care process, intake forms are filled out and baseline investigations completed. These include: liver function test, renal function test, sputum, CD4 count, WBC, and hemoglobin. Because ART is laboratory intensive, some hospitals like Hospital 4 and Hospital 2 have laboratory technicians specifically designated for the ART clinics.

To order a laboratory test, clinicians fill out a standard lab request form and give it to the patient. The patient takes the request form to the laboratory department and provides the requested sample. When the result is ready, the patient is responsible for picking up the result from the laboratory to submit it back to ART clinicians. In the smaller facilities like Hospital 2, lab results are directly sent to the ART clinic. There is no procedure in place to follow-up on requested lab investigations; only during subsequent appointed visit can a clinician recognize that a requested investigation has not been completed, as expressed in the following quote:

… the patient is responsible for taking ownership. The same goes for pharmacy, once we prescribe a drug or re-fill we don't follow-up to ensure the patient has picked up those drugs. (Hospital 1, Subject 001, Line 77)

There are a number of challenges in the lab requisition process. Clinicians report that many patients complain of the long wait times at the laboratory. Generally, it may take from two days to a week to get a lab investigation done. For instance, Hospital 1 has one laboratory
that serves all the departments in the hospital. As a result, the heavy workload results in long wait time as the clinician stated in the following quote:

We have one lab department for the hospital serving OPD, ART, and all other departments, so there is a high workload there. When I request for a lab investigation, the patient receives the request form and take it with him. We do follow-up on patients that may not have done their lab tests only when they come in for their next appointment. The wait time is very bad at lab and patients always complain about this. (Hospital 1, Subject 005, Line 88)

The long wait time is also a result of the scarcity of lab equipment. At Hospitals 1 and 4, the lab departments have one CD4 count machine, which can handle up to 40 patients per day. The lab is open at 6am and accommodates those that come early. Some patients have to make frequent visits from long distances, which take a toll on patients financially and physically. Additionally, the unavailability of lab equipment to determine viral load is another challenge, making it difficult for physicians to make timely decisions regarding the development of resistance to an ARV regimen. Currently, resistance to ARV drugs is determined clinically. Clinicians in the following quotes expressed these challenges:

Patients have to come very early and there is a long wait time. For example, to do liver function test and CD4 count they can only do up to 40
people per day. Sometimes equipment is broken and there aren’t enough reagents… There is equipment shortage. (Hospital 1, Subject 008, Line 45)

The main problem is not that the patient has to walk to the lab it is the lack of lab equipment. For example, there is one machine for chemistry and it holds specimens for 17 patients at one time. So patients will come as early as 5 a.m. to get in early, if they miss that opportunity they have to come back at night or most often the following morning. (Hospital 1, Subject 007, Line 146)

There are some challenges in laboratory. For CD4 count they have a machine that can only do up to 40 patients per day. The lab is open at 6am in the morning and accommodates those that come early, and there are a few that can afford to do it elsewhere. The patient is given a lab request form by a clinician and they have to take it to lab, get it done and then pick up the result to bring it to us. In our end once we have the result the care process is quick, it's usually the lab that takes some time. The CD4 might take a day or two to get to us. (Hospital 1, Subject 003, 53)

Patients have the option of getting their lab investigations done outside the hospital at their own expense; however, this is too costly for most patients. Additionally, bedridden patients that have difficulty moving also face challenges getting to and making frequent visits to the lab.
To sum-up, clinicians highlighted various challenges in the lab requisition process. Clinicians indicate that many patients complain of the long wait time at the laboratory, which is made worse by limited lab investigation equipment. The paper work is time consuming and lab results sometimes go missing as they are physically attached to patients’ charts. As well, there is no feedback mechanism to notify clinicians of incomplete lab investigations.

4.5.14 Training

Clinicians training and refreshers are issues majority of clinicians recognized as an area of concern that needs much improvement in their health facility. Training refers to teaching new nurses on ART, education on new practice guidelines, and refreshment courses for clinicians to build on their skills and experience, as well as, training on computers. The perceived importance of training on an EMR prior to implementation was also an area of focus that will be discussed in this section.

To accommodate the high patient flow, nurses were often recruited from other departments and provided training in ART. At times, these nurses, especially new graduates, felt they were not adequately trained. Some nurses in ART indicated that they have little formal training in providing ART. Those that have been working in ART clinics learn through hands-on experience with help from colleagues. These concerns were voiced by clinicians in the following quotes:
At the provider level there is very little training provided. For example, I have been working in ART for about a year and I have not received any formal training, I have learned by simply observing other clinicians. (Hospital 2, Subject 002, Line 18)

I am a nurse and I only have one month of training to work in ART and so considering the care that needs to be given it's challenging to provide this care on one month of training. (Hospital 1, Subject 005, Line 29)

Clinicians also indicated their lack of motivation working in ART. In addition to the low wages, the lack of training provided to them hindered advancement and growth in their career and was a factor that clinicians believed contributes to lack of motivation, as expressed in the following quotes:

There are no refreshment courses or trainings, and we are not updated on our practice/profession. (Hospital 1, Subject 004, Line 39)

Sufficient and continuous training needs to be given to clinicians, because the work can make some to get fed up. For example, having to work both in the ART and VCT clinics can be challenging for clinicians. And in order to improve these conditions there needs to be training of health professionals and refreshers. These training and refreshers will also
improve the outlook of clinicians on their profession and practice.

(Hospital 4, Subject 001, Line 146)

Additionally, the annual training on new practice guidelines provided to ART clinics are not sufficient to enable clinicians to implement new guidelines into practice. When new practice guidelines are introduced, the onus is on the clinicians to learn and implement these guidelines. The following quotes elaborate on this issue:

Yes, there are challenges in this area since the guidelines are always changing. When updated guidelines come, training is provided to a selected few, as it would not be possible for everyone to go to the training sessions. Whoever attends the sessions would inform others of the guidelines.

(Hospital 1, Subject 003, Line 78)

There are some training provided on new practice guidelines but it is poor.

(Hospital 1, Subject 010, Line 123)

We receive new guidelines every year and we are given the practice guideline manuals. We have training every so often. The training provided is not sufficient. (Hospital 3, Subject 002, Line 96)

Another concern of clinicians is the comprehensiveness and availability of training that would be offered on the EMR, if implemented in their facility. Majority of nurses and
physician respondents, 92.59% (n=25) believe lack of training would be a major barrier to successful EMR implementation in their facility. This in part reflects on the lack of confidence of clinicians of their computer skills. Clinicians strongly believe that implementing an EMR without sufficient training will result in inadequate utility of the tool and consequently minimal benefits realized from its implementation as expressed in the following quotes:

The knowledge of the individuals in using the system [EMR] and the training could be a challenge. (Hospital 4, Subject 004, Line 142)

When such a system as an EMR comes, it is necessary that training be provided. (Hospital 1, Subject 001, Line 215)

Computer skills of clinicians is very limited, unless they receive training. So I feel these are few of the challenges because even if you have a fully functional system [EMR] if the people that are using the system are not well trained on how to use it, it will not be very useful. (Hospital 4, Subject 001, Line 225)

I would accept using such a system in my work as long as I have received sufficient training. (Hospital 4, Subject 006, Line 140)
It should also be noted that the lack of training available to clinicians across the various areas of clinical care, for instance, in implementing new practice guidelines into their work, reinforces the belief that the resources and manpower will not be adequate to provide sufficient training in order to use an EMR effectively.

In summary, clinicians understand the need and importance of training in the workplace to build on their years of medical education. Clinicians believe the lack of motivation among many of their colleagues is a result of limited opportunities to develop and enhance their professions. Clinicians raised various issues in the area of training. New nurses that were recruited to work in ART reported receiving little to no formal training on ART and training provided on new practice guidelines was inadequate. Additionally, the majority of nurses and physician believe lack of training on an EMR system prior to its implementation would be a major barrier to successful EMR use in their facility.

4.5.15 Clinician Communication

Clinician communication refers to the interaction of clinicians in a health facility regarding their patients or issues related to their practice. The high patient flow and heavy workload of ART clinicians makes it difficult for clinicians to communicate with colleagues outside their unit/department. Clinicians affirm that it is frustrating and time consuming to walk to another part of the hospital to locate a fellow clinician who is involved in their patient’s care as expressed by the following quote:
What happens often when you go to a different department to request information about the patient is that they will either say: 'come back another time, we are busy' or 'we can't help you'. If computerized, you can easily access the patient's info from your desk. You also see the work of other departments with your patient. (Hospital 4, Subject 009, Line 152)

In other cases, clinicians are too busy to follow up on a specific case of a patient with a colleague as articulated in the subsequent quote:

Since colleagues are busy or I’m too busy to track them down, there are times when I may go home without accessing a patient's specific result. If we had e-mail available, we could quickly send a note to the colleague and receive the result promptly. This is good because it will make our work easier. (Hospital 1, Subject 002, Line 230)

Common examples among ART clinicians include, following up with a lab technician about a specific result, error checking about a prescribed drug with a pharmacist or following up with a VCT counselor about a new patient. Clinicians believe that implementing an EMR would have positive implications on the interaction within the healthcare team. They perceive that the availability of e-mail would improve the communication between health professionals and consequently strengthen the link between various departments as in the below excerpts from clinician interviews.
If we had e-mail, it would make the communication I have with other health workers much easier. I would not have to waste time finding a colleague who may be occupied with work. (Hospital 1, Subject 004, Line 127)

An EMR would make it easier to interact with other clinicians instead of me having to walk to another department to find the clinician I am looking for. (Hospital 2, Subject 003, Line 118)

About 80.95% (n=17) of clinicians perceive that an EMR would improve the interaction within the health care team by allowing easy access to the full medical record of a patient and would also save time by enabling colleagues to connect with each other via e-mail. Similar findings were discovered in a pre and post-implementation time-motion study of the Mosoriot Medical Record System (MMRS) in a primary care health center in Kenya. The study shows that subsequent to implementation of the MMRS, health care providers spent two thirds less time interacting with other staff (p=0.0002) and tripled their time spent in personal activities (15% vs. 46%; p=0.001) (Rotich et al., 2003).

The benefit of an EMR system in improving the efficiency of care also affects data clerks who spend numerous hours tabulating data from multiple logbooks to generate monthly reports and cohort analysis. At times, the data clerks are backlogged up to two months and have to get help from the government health office to get caught up. Data clerks indicate that it takes about a week to do a monthly report. According to the study by Rotich et al. (2003),
data clerks spent two thirds less time interacting with other staff and almost doubled their time registering patients. They also spent one sixth of the time writing reports (3% vs. 18%) and more time searching for information (3% vs. 0.5%) (Rotich et al., 2003).

In summary, there are various challenges that hinder the timely and effective communication of clinicians. Difficulty of finding fellow clinicians involved in their patient’s care, the lack of easier communication methods such as e-mail compounded with the heavy workload of clinicians hamper the interaction of health professionals. Clinicians perceive that an EMR system will improve some of these gaps and improve the overall interaction within the health care team by enabling access to complete medical record and allowing e-mail communication.

4.5.16 Patient-Clinician Communication

Patient-clinician communication refers to the interaction of patients with their care providers during and outside the appointed visits. Since ART is a life-long treatment, the communication and relationship between clinicians and patients is vital.

The patient-clinician communication varies from the larger hospitals to the smaller sites. Clinicians at the smaller sites like Hospital 2 that has approximately 1,000 patients in ART and 2,300 patients in pre-ART have the ability to know their patients closely. Clinicians in these facilities indicate that they have a very close relationship with their patients with some patients feeling comfortable enough to share their personal matters and life problems with them, as one clinician states in the following quote:
Currently, our communication with patients is like a family, they share their personal life openly. (Hospital 2, Subject 001, Line 88)

In the larger site like Hospital 1, that has approximately 9,000 patients in ART and 15,000 in pre-ART, it is difficult for clinicians to forge close relationships with their patients.

We don't have much time so we can't communicate with each patient as we would like. (Hospital 4, Subject 008, Line 79)

As a result, having accurate recording of patient history and encounter information is vital. In the following quotes, clinicians share the perceived effect an EMR would have on the interaction between clinicians and patients:

Communication between provider and patient will be easier because we will have comprehensive information about the patient. (Hospital 4, Subject 005. Line 94)

It will help me to access the patient's medical history very quickly, which will help in my communication and visit with the patient. (Hospital 1, Subject 009, Line 121)
About 57% (n=12) of participants perceive an EMR would have a positive effect on the patient-clinician communication. Clinicians perceive that having a complete medical history of the patient accessible to them would improve the communication with patients and allow them to utilize their visit time effectively. Approximately 43% (n=9) of participants believe an EMR would have very minimal to no effect on the interaction between providers and patients outside work hours. This is due to the fact that majority of the patient populations do not have access to computers or e-mail. Other confounding conditions of patients also determine this, as indicated in the following quote:

> It depends on the educational level of the patient. Many don't have education on computers or Internet connection to use e-mail. (Hospital 4, Subject 009, Line 160)

Physicians indicate that in rare cases, they communicate with patients over the phone outside clinic hours. Physicians believe that e-mail communication would be more favorable as indicated by a physician in the following quote:

> Currently most of the communication outside the visit is by phone whenever they have a question. However, if it were through the Internet it would be good. Sometimes there are cases when patients call me at night when they have a problem. (Hospital 1, Subject 002, Line 237)
Twenty eight percent (n=6) of physicians identified the challenges of working on a computer system during a patient encounter. They believe it would have a negative impact on the patient-clinician interaction and relationship. The idea of computers in health care is a new concept to many patients and therefore may result in patients feeling neglected during the patient-provider encounter. Clinicians expressed their concerns in the following quotes:

This could be a challenge in using the recording on a computer system during a patient visit. Patient might feel ignored. Patient physician communication could be reduced but it could improve as they get use to it and may accept it. Let alone on computer, working on paper while seeing a patient does have a negative impact on patients who may feel they have not been heard. Patients are sensitive. (Hospital 2, Subject 003, Line 123)

I think there could be some difficulty because patients want clinician’s attention and an EMR could divert clinician’s attention from the patient to the EMR. Our patients are sensitive, in one case a patient transferred out of our clinic because she felt her nurse was tired of her. However, I believe it could be possible to do all the computer data entry and work right after a patient visit. (Hospital 3, Subject 001, Line 118)

In a pre and post-implementation time-motion study of the Mosoriot Medical Record System (MMRS) in a primary care health center in Kenya, the time health care providers spent with patients dropped by half: from a third to a sixth of their workday (p=0.004) (Rotich et al.,
2003). Chaudhry et al. (2006), found that the effect of health information technology on provider time was mixed. Two studies showed increase in physician time associated to computer use (Tierney et al., 1993), while another study on outpatient use of electronic health records showed an increase in clinic visit time of 0.5 minutes (Overhage et al., 2001). However, the studies suggested that time requirements decreased as physicians grew familiar with the system, although formal long-term evaluations were not done. In another study, through the use of computerized order entry with alerts to physician pagers there was an 11% decrease in time to deliver treatment (Kuperman et al., 1999).

In summary, clinicians have mixed feelings about the effect of an EMR on clinician-patient communication. Some clinicians feel it will reduce the personal and face-to-face interaction that is so vital for patients. Considering the magnitude of the disease and its impact on both the physical and psychological aspects of patients, the interaction and relationship between care provider and patient is critical. On the other hand, clinicians feel an EMR would allow them to access a comprehensive record of a patient’s health care enabling them to have meaningful and focused communication with their patients during their encounter.

4.5.17 Clinician Computer Competency and Experience

There are various barriers to the implementation of electronic medical records (EMR) in health facilities in developing countries. The successful use of EMRs in this region is in part dependent on the ability of health professionals to use computers. Little is reported in the literature about computer and Internet use and the general computer competency of health
professionals in developing countries. Clinician computer competency refers to the general aptitude of clinicians on word processing, Internet and e-mail use.

Interviews and questionnaires were administered to investigate the current use and competency of nurses and physicians who work in ART clinics at four hospitals in Addis Ababa and Hawassa, Ethiopia. Based on the 30 clinicians who took part in the study, nurses had an average of 3 years of computer experience while physicians had an average of 5 years of computer experience. The questionnaire provided mixed results, as 55.56% (n=10) of nurses believe the computer skill of clinicians is a minor barrier while 50% (n=5) of physicians believe it is a major barrier. See Table 4.4 for complete summary of results. Through interviews, clinicians expressed their frustration due to the lack of computers, telephones and Internet connection in their clinic, making it difficult to contact and follow-up on lost patients, access current medical information and develop their general computer skills.

Of clinicians who administered self-rating of their computer skills, 45.45% of physicians and 36.84% of nurses rated their computers skills as ‘lowest’ while 36.63% of physicians and 63.16% of nurses rated their computer skills as ‘average’. In addition to the lack of computer access at work, clinicians indicated that general computer training was not part of their formal education contributing to the poor computer competency of clinicians.
With computer competency, I don't have knowledge about computer use since I have never received any kind of training. (Hospital 1, Subject 010, Line 153)

I myself have not learned how to use a computer. In our clinic, there are only a few that use computers and this could be a challenge. (Hospital 1, Subject 007, Line 211)

Most clinicians here do not have good computer competency because we are nurses by profession. So if we use such a tool it would be a challenge and there might not be people who will support us in learning to use such a system. (Hospital 4, Subject 003, Line 214)

According to a similar study of a need-based assessment of middle and functional level nurse managers at Kenyatta National Hospital in Kenya, majority of nurse managers (85%, n=91) did not have computer studies as part of their training in nursing. Majority of the nurses 98.1% (n=105) desired to be trained in computer applications (Kivuti-Bitok, 2009).

Of the participants at the four Ethiopian health facilities, almost all clinicians indicated that they do not have computers at home or adequate access to them at the workplace. About 64% of physicians and 68.42% of nurses stated that they use computers in the workplace.
Of those who use computers at the workplace and/or at home, computers were predominately used for searching literatures and word processing, 60% of physicians and 31.58% of nurses use computers for literature searches while 63.64% of physicians and 36.84% of nurses use computers for word processing. Computers were rarely used for clinical tasks including; test result retrieval (18.82%), entering patient information (23.22%), and retrieving patient information (23.22%). See Table 4.5 for summary of results. The following quotes further reflect the challenges around poor computer competency:

There needs to be basic computer knowledge to use EMRs; currently the skill of clinicians on computers is not very good. There are no training provided on computers. There needs to be skilled and trained human resources. (Hospital 2, Subject 003, Line 152)

Many clinicians indicated that their computer skills would not be sufficient to utilize an EMR if it were to be implemented in their health facility. They emphasize the importance of training to improve their computer skills as indicated in the following statements:

The computer competency of clinicians is not very good as most of us do not use computers on regular basis. This lack of familiarity with using computers makes it more challenging in making such a system [EMR] useful. However, as clinicians get familiar, I think it will have many benefits. (Hospital 1, Subject 009, Line 158)
Such a computer-based system is very beneficial but we need trained users.

In this country and in our clinic most of the staff are not very well trained with the use of computers. Most people do not have computer skills.

(Hospital 1, Subject 002, Line 291)

When such a system as an EMR comes, it is necessary that training be provided. (Hospital 1, Subject 001, Line 215)

Frequency of Internet use was minimal among nurses; 26.32% of nurses used the Internet daily while 47.37% used the Internet once in less than a month or not at all. Physician use of the Internet was more frequent as 54.55% used the Internet daily while 27.27% used it less than a month or not at all. Clinicians were asked about the use of e-mail for clinical purposes, 63.64% of physicians indicated that they used e-mail for clinician or colleague communication, while none of the participants used e-mail to communicate with patients. Among nurses, 21.43% of nurses used e-mail for clinician or colleague communication while no one used e-mail to communicate with patients. See Table 4.5 for complete summary of results.

<table>
<thead>
<tr>
<th>Use of Information Technology</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Internet use</td>
<td>11 (37)</td>
</tr>
<tr>
<td>E-mail communication with colleagues</td>
<td>10 (33)</td>
</tr>
<tr>
<td>Literature search</td>
<td>12 (41)</td>
</tr>
<tr>
<td>Retrieving patient information</td>
<td>8 (27)</td>
</tr>
</tbody>
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Table 4.5 Clinicians' computer use summary

* n – number of subjects
Patient and clinician electronic communication is not common due to patient’s economic condition as the majority of patients do not have computers at home. As a result, e-mail communication between patients and clinicians is not currently practical.

In summary, the overall attitude of clinicians towards the use of EMRs in their practice is positive, given the improvement of their general computer skills and the availability of adequate training on EMRs. Majority of the clinicians did not have computers and Internet access at home. However, this does not seem to have an effect on the attitude of clinicians towards computer use in their practice. In the Kenyan study, the attitude of nurse managers towards the use of computers in nursing was not significantly influenced by accessibility to a computer (p=0.05) (Kivuti-Bitok, 2009). That said, basic computer training of clinicians is a major area of focus in the process towards EMR implementation at the point of care.

4.5.18 EMR and User Acceptance

Perceived usefulness is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance.” (Davis, 1989). People will tend to use or not use an application to the degree they believe it will help them perform their job better (Davis, 1989). To be beneficial, EMRs need to be accepted by clinicians, relevant and easily applicable in practice. Numerous information systems have failed because developers have neglected users’ judgment about a system’s feasibility, time requirements, and usefulness in clinical practice (Anderson et al., 1994 and Aronsky et al., 2001).
The acceptance of an EMR by clinicians is a factor to successful implementation of an EMR within a health facility (Handy et al., 2001). Clinicians were in agreement on the significance of an EMR system in their facility. They strongly perceive that skepticism will not be a barrier to the successful utilization of an EMR. Thus 66.67% of physicians consider clinician skepticism towards EMRs use as a minor barrier while 50% of nurses feel it is not a barrier at all. The following quotes also express these sentiments:

I think at the end of the day the benefit is for the patient and it would improve our work efficiency and so the resistance will not be a factor. We have to be in line with the times and up on the new technology so I feel this system would be beneficial. (Hospital 1, Subject 004, Line 194)

I don't think there will be resistance, initially there might be difficulties until users get familiar with the computer system. Since the positive effects are good this challenge can be overcome. (Hospital 1, Subject 003, Line 174)

On the other hand, some clinicians voiced concerns over the acceptance of EMRs by clinicians due to issues such as time requirements of using a new system as expressed in the following quotes:
It could be time consuming for me for instance to access a patient's medical history, I am also slow in typing, so that would be a challenge. (Interview S001, Line 41)

Another challenge is the attitude of clinicians. What is their motivation and do they desire to accept this change? This would be a challenge until everyone gets used to it. (Hospital 3, Subject 001, Line 161)

Whenever new things are introduced there will be resistance whether the change is good or not. There will especially be resistance for change that will increase workload but if it improves our work to make it efficient it is good. (Hospital 1, Subject 002, Line 301)

In summary, the changes that accompany the introduction of an EMR system require good change management and clinician engagement in order to get clinicians on board, to gain acceptance and ensure appropriate utilization of the system. Throughout the interviews, clinicians had an overall positive attitude toward the introduction of this technology to improve the quality of care and support their practice. However, there were concerns regarding acceptance of the system during the early phase of the implementation, where there will be a learning curve as clinicians familiarize themselves with the systems and new work processes.
4.5.19 EMR and Cost

The cost associated with the implementation and operation of EMR systems is a major concern in resource-limited areas. Conversely, an EMR may also have cost saving implications by improving care process and quality of care. Cost in this case refers to not only monetary value but also nonmonetary effects of an EMR system that have cost saving implications.

Improving the cost-effectiveness of health care is an objective of the Federal Ministry of Health (FMOH) and various NGOs that provide funding and technical support in Ethiopia. Clinicians were asked about the cost-effectiveness of the practices in their clinic and what effect, if any, an EMR would have on the overall cost of health care. About 86% (n=18) of participants perceived that an EMR would have a positive impact on controlling the cost of health care.

Participants perceived that an EMR could have cost-saving implications in the long run. An EMR could help support the organization and management of health information for better planning and strategizing. Cost saving could also be realized by improving the efficiency of care by saving time of clinicians, decreasing utilization of care and helping effectively utilize human resources. Additionally, cost savings would be realized by minimizing paper use and the duplication of work such as lab investigations due to lost paper forms and errors in recording. The following quotes expressed by clinicians elaborate on this area:
It will have cost saving effects. Sometimes there are cases where a patient's paper card may be lost, in which case the patient has to do the investigations again which wastes time and resources. If there is a computer system this thing will be improved and it will save money.

(Hospital 1, Subject 007, Line 162)

It would reduce cost of paper. It would save time and make use of human resources more effectively. (Hospital 2, Subject 002, Line 93)

An EMR could maximize the work force to make the most work with the limited number of clinicians. (Hospital 4, Subject 009, Line 145)

Conversely, other participants have mixed feelings and indicated that implementation of such a systems would be very costly. The cost involved in purchasing and setting up computers, software and networks, the ongoing operational costs to keep the systems functional, and the hiring of staff to maintain and support the system they believe would offset the effect of an EMR on controlling the cost of health care. Clinicians in the following quotes echoed these sentiments:

I believe the cost of implementing such a system might be high, for setting up networks, telephones etc. As well, there will be ongoing operation costs to keep these lines working as well as to hire staff that overlook the maintenance of the system. (Hospital 1, Subject 002, Line 222)
I think buying computers and technical support staff will take up more cost. The benefit of an EMR saving time could save money in the long run and maximize manpower. (Hospital 4, Subject 005, Line 80)

In summary, the challenges with evaluating cost-effectiveness of EMRs in health care are apparent as indicated by the limited studies that directly measure cost savings (Chaudhry et al., 2006). One of the main challenges involves translating nonmonetary effects of an EMR in health care into monetary estimates. Although most clinicians perceive that an EMR will help make their clinic cost-effective in the long run, they recognize the high initial cost involved in implementing and operating such a system.

4.5.20 EMR & Efficiency of Care

According to Knapp (1984), efficiency of care is a combination of equity, economy and effectiveness (Knapp, 1984). Building on this definition, effectiveness refers to the extent to which patients receive the care they need in an ethical and cost effective way.

Clinicians perceive that the implementation of an EMR can improve efficiency in two areas: provider time and patient wait-time. Attitude towards the effect of EMRs on provider time was positive. Participants perceive that an EMR could improve some of the current challenges that exist between ART and laboratory, making their work more efficient.
An EMR would create a level of automation that would allow clinicians to electronically prescribe, verify and follow-up on requested lab investigations reducing the time and paper work that take place in the current practice as expressed in the following quotes:

The paper-based system has some challenges. For example, for a long-time patient, it may be difficult to locate a patient’s chart. Accessing the patient chart is time consuming. Once a patient’s record is found, flipping through various paper forms to find what you are looking for is also time consuming. As well, when results come back from a requested investigation, a clinician doesn’t have time to record what is written on the result sheet on the patients chart, it is time consuming and it would required a lot of paper. A computer system could address these challenges. (Hospital 2, Subject 003, Line 46)

Moreover, clinicians expressed concerns over the accessibility of the complete paper patient record. With the current predominantly paper-based system, there are problems with lost or misplaced records, illegible records, and incomplete records. The documentation of intake and follow-up forms is also time-consuming. EMRs can decrease documentation-related nursing time (Wong et al., 2003 and Pierpont & Thilgen, 1995).

There are a lot of lab investigations requested and not all of the slips are attached to the patients chart, sometimes clinicians record the results on the
chart but not all requested lab results are recorded on the patient’s chart. The slips do get lost. (Hospital 2, Subject 002, Line 34)

The patient charts have to be retrieved manually and there is difficulty in locating charts as some may even be lost or misplaced. (Hospital 4, Subject 005, Line 38)

Currently, our efficiency is relatively good. Our efficiency can be improved if clinicians focused in providing care as opposed to pulling out patient’s cards. (Hospital 2, Subject 002, Line 120)

Patient wait-time was another area clinicians believe EMR could have an effect. Participants perceive that the average wait time of patients will decrease due to reduced travel of patients between laboratory, radiology, pharmacy and the ART clinic, with the support of computerized order entry and automation across the departments. An EMR can also minimize duplication of lab and radiology tests. Clinicians echoed these sentiments in the following quotes:

I think with such a system the wait time could be reduced. By having an EMR, it would reduce the time required in accessing his [patient] card or patient medical history file. As well, it would reduce the wait time at the laboratory and will reduce the effort of patients who might have to go to
various units like lab to pick up results. The EMR would reduce the work and wait time of patients. (Hospital 1, Subject 001, Line 175)

The amount of effort on-behalf of patients will be reduced. They would not have to pick up lab results and bring it back to ART and waste time through this process. (Hospital 2, Subject 001, Line 105)

It [EMR] will reduce the amount of work or effort required from a patient. For example, we won't have to tell our patients to go get their lab results; we don't have to deal with patients who lose their lab investigation request forms. Such a computer-based system will address these challenges and reduce the back and forth of patients. (Hospital 1, Subject 002, Line 214)

In summary, clinicians perceive that the implementation of an EMR can improve efficiency in provider time and patient wait-time. Attitude towards the effect of EMRs on provider time was positive. Participants perceive that an EMR could improve some of the current challenges that exist between ART and laboratory, making their work more efficient. An EMR would create a level of automation, reducing the time and paper work that take place in the current practice. In addition to improving access to the complete medical record of a patient, an EMR would reduce the patient wait-time by reducing the movement required by patients to various departments.
4.6 Paradigm Model

In the quest for a higher level of conceptual abstraction, axial coding was utilized. In this process, the paradigm model (Strauss et al., 1990) was used to further analyze the data by establishing relationships and contextualizing the phenomenon by modeling the action and interaction strategies of the actors. The paradigm model consists of causal conditions, the phenomenon, the contextual conditions, the intervening conditions, the action/interaction strategies, and the consequences of these. Figure 4.1 illustrates the paradigm model.

The numerous categories that have emerged through this phase of data analysis are interlinked. The paradigm model was used to relate the categories to each other and the core phenomenon in order to explicate the story line. Initially, the core phenomenon had to be identified. Throughout the study, numerous key ideas have emerged, however all revolved around the core phenomenon; implementation of an EMR system. After committing to a central theme, all other categories were classified into one of the five paradigms according to their properties and dimensions as discussed in this section. The majority of the categories were identified as causal conditions and consequences since part of the research’s aim was to explore the practices and challenges of patient monitoring and clinical data management in ART and the perceived usefulness of EMR systems in HIV care. The remaining categories were grouped under contextual conditions, intervening conditions or action/interaction strategies. Figure 4.1 shows the association between the various categories.
According to Strauss and Corbin, (1990), phenomena are “the central ideas in data represented as concepts”. The phenomenon addressed in this study is ‘EMR implementation’ in HIV care in Ethiopia. The phenomenon in the EMR implementation framework, illustrated in Figure 4.2, is located inside the triangle at the center of the framework and represents the ‘core’ category and the major theme of the research.
4.6.2 Causal Conditions

Causal conditions refer to events and variables that support and influence the phenomenon; EMR implementation. The causal conditions are: inadequate confidentiality of medical records; limited access to complete patient information; medication errors and drug interaction; laborious lab investigation requisition process; disparities in clinician communication; gaps in the integration of HIV programs; inefficiency of care; lack of follow-up in patient referral/transfer process; and minimal clinician decision support. The causal conditions are located at the top of the EMR implementation framework illustrated in Figure 4.2. Each of these categories emerged as challenges within HIV care and ART that could be addressed by the use of an EMR system. As well, the existence of fundamental building blocks that support EMR implementation were identified as causal factors that support EMR implementation. They include the existence of standardized paper forms; ART database with clinical data repository (CDR); master patient index (MPI), unique patient ID and existence of a pharmacy information system. Figure 4.2 illustrates the causal conditions in the EMR implementation framework.

4.6.3 Contextual Conditions

Contextual conditions consisted of infrastructural, economic and organizational factors. The EMR implementation framework illustrated in Figure 4.2 shows the contextual conditions located adjacent to the core phenomenon. The organizational context consists of shortage of human resources, high patient load, heavy workload for clinicians and shortage of physical
space. Although these contextual conditions may not all be directly related to EMR implementation, they do have an indirect effect. The organizational context is discussed in more detail in the section titled ‘Clinic Working Conditions’.

Two types of infrastructure that directly affect EMR implementation were identified in the study; energy and communication infrastructures. Energy infrastructure mainly deals with uninterrupted electricity supply while communication infrastructure comprises of telephone and mobile networks, and Internet including high-speed data cables or wireless technologies. The infrastructural contextual conditions are discussed in the section: ‘Basic Infrastructure’. These infrastructural components directly affect the technological component of intervening conditions. More specifically, lack of electricity and networking relates to ‘technical limitations of the system’.

The economic condition of government and organizations is a contextual condition that affects EMR implementation in a developing country setting. Participants highlighted the dire economic condition of many hospitals and the importance of support and funding from international organizations in this effort. Financial backing is mandatory to implement such a system. This contextual condition affects both the technological and organizational aspects of the intervening conditions. For instance, the availability of funds to carry out such a project will increase management buy-in and also support the purchase of hardware and software and other costs related to EMR implementation. See Figure 4.2 for complete summary of contextual conditions in the EMR implementation framework.
4.6.4 Intervening Conditions

Intervening conditions comprise of organizational and individual conditions, technological conditions, and cost. The intervening conditions are located on the left and right side of the core phenomenon in the EMR implementation framework illustrated in Figure 4.2. Individual conditions consist of user attitude and general computer competence of clinicians. From the data, clinicians’ access to computers at home and/or at work did not affect the attitude of users towards EMRs. However, their attitude was associated with their computer competency and experience. Additionally, clinicians felt their limited computer skill would further increase their workload. As a result, both user attitude and computer competency are intervening conditions that are drivers for the action/interaction strategies of computer and EMR training, EMR user acceptance, and ultimately the use of the system.

At the organizational level, intervening conditions include management buy-in or acceptance of an EMR and their support of its implementation and use. Some clinicians recognized this as a key area and raised concern that administrators and government officials were not aware of the benefits of EMRs. The idea held by some hospital management that technology and computers have no use for clinicians has to be dispelled. Some clinics reported of their computers being taken for administrative use with the assumption that they had no use in the clinic. Management buy-in and commitment is important if a health facility is to successfully implement an EMR system. This intervening condition relates to cost or funding, as well as, the action/interaction strategies of the organization in project management and workflow changes within the hospital.
The second sets of intervening conditions are cost and technological conditions. Cost is an important factor for EMR implementation. As discussed previously, the importance of outside funding is necessary since the implementation of an EMR can be a costly venture. Financial backing is key to the purchase of hardware and software, the hiring of technical staff, the training of clinicians, project management and troubleshooting and support. Although clinicians believe that the benefits of the EMR in patient safety and cost-savings can be realized in the future, the initial cost of such a system can hinder its successful implementation.

Technological conditions consist of three areas: hardware and software, system quality and service quality. System quality deals with usability, response time, ease of use, availability, security, data accuracy, and easy access to help (DeLone & McLean, 2003). Additionally, any technical limitations related to the system fall under system quality. Service quality deals with the availability of technical staff and their ongoing maintenance of the system and support of users (DeLone & McLean, 2003). These technological intervening conditions directly affect the action/interaction strategies of EMR acceptance and use. A system with numerous glitches and downtime will cause lack of confidence resulting in poor user acceptance. The support of clinicians is also vital considering the level of computer competency and experience of clinicians. Figure 4.2 illustrates the intervening conditions in the EMR implementation framework.
4.6.5 Action/Interaction Strategies

Action and interaction strategies are the purposeful and goal-oriented activities that agents perform in response to the phenomenon and intervening conditions. This section of the paradigm coding describes how users and groups involved with the use, implementation and management of the EMR act and interact. Action and interaction strategies are classified into users and organization. The users mainly consist of clinicians and clerks and their involvement with the EMR during pre and post-implementation include basic computer training, EMR training and consequently use of the system. ‘Use’ is often voluntary and can be measured as frequency of use, time of use, number of access, usage pattern and dependency (DeLone & McLean, 2003). ‘Use’ was grouped under action/interaction strategies and not as a consequence because it was believed that ‘use’ is a behavior and therefore an action influenced by the phenomenon and precedes impact and benefits (Seddon, 1997). System usage itself cannot be a measure of success, just assuming more ‘use’ will produce more benefits is not accurate, since the nature, extent, quality, and appropriateness of the ‘use’ must be considered (DeLone & McLean, 2003). At the organizational level, action/interaction strategies include troubleshooting and support, workflow changes and project management and control. It should be noted that each component in the action/interaction strategy is a necessary but not sufficient condition for the resultant consequences in the framework. Figure 4.2 illustrates the action/interaction strategies located below the core phenomenon of the EMR implementation framework.

4.6.6 Consequences

Intended and unintended consequences are the byproducts of the phenomenon and the action and interaction strategies. According to participants’ perceived effects of an EMR, the
intended consequences of an EMR include: improved continuity of care, timely access to complete patients’ medical record, improved patient care efficiency, efficiency and effectiveness of work for clinicians, reduced medication errors, improved patient privacy and confidentiality, automation across various departments in the hospital, improved communication between clinicians, availability of decision support, integration of HIV programs, efficiency of data entry and retrieval, and improved job satisfaction. Unintended consequences of EMR implementation include; clinician productivity loss due to the level of clinician computer competency and negative impact on patient-clinician interaction due to electronic data recording and retrieval at the point of care. See Figure 4.2 for complete list of consequences at the bottom of the EMR implementation framework.

4.7 EMR Implementation Framework

Building on the paradigm model, an EMR implementation framework is presented in the following diagram. The EMR implementation framework builds on the categories identified in the paradigm model to represent the relationships between these categories in a concise method. At the top of the framework are listed the causal conditions that support and influence the phenomenon; EMR implementation. Contextual conditions consisting of infrastructural, economic and organizational factors are located closest to the core phenomenon. Intervening conditions comprising of organizational and individual conditions, technological conditions, and cost are located on the left and right side of the core phenomenon in Figure 4.2. Action and interaction strategies are the purposeful and goal-oriented activities that agents perform in response to the phenomenon and intervening conditions. They are situated below the core phenomenon of the EMR implementation
framework. Finally, Intended and unintended consequences are the byproducts of the phenomenon and the action and interaction strategies and are positioned at the base of the framework.

![Figure 4.2 Conceptual framework for EMR implementation in ART](image)

In conclusion, an overview of the observations and study findings, including: demographic characteristic of participants, and observations of ART patient monitoring practices and clinical care process, and the electronic and paper-based medical recording tools and practices of the clinics was discussed. Categories that emerged from the data were defined relating them to each other and the core phenomenon of EMR implementation. The paradigm
model was used to further analyze the data by establishing relationships and contextualizing the phenomenon by modeling the actions and interaction strategies of the actors. Through this process the benefits of EMR systems in HIV care were identified and linked to action/interaction strategies, intervening and contextual conditions and causal conditions that focus around patient monitoring and clinical data management challenges in ART.
CHAPTER 5: Discussion and Conclusion

5.1 How the framework fits with findings in the literature review

Various EMRs implemented in developing countries that support primary level care and specific disease management were discussed in the literature review. There are limited studies that have carried out formal evaluations of the impact of EMRs in developing countries. Almost all of the studies were pilot projects deployed with the collaboration of local and international organizations and experts. The EMR implementation framework presented in this study is compared and contrasted with the findings in the literature to examine how it fits with various components of EMR implementations in developing countries. EMR system implementation challenges and benefits, including infrastructural, economical, organizational, individual (user) and technological factors identified in the literature will be compared and discussed in relation to the framework.

A study by Rotich et al. (2003) identified the importance of workflow changes and its effect on user acceptance and use of an EMR. Implementers of the MMRS imposed few workflow changes maintaining the use of standardized encounter forms, which were then entered into the system by data clerks. A time-motion analysis of the study demonstrated that subsequent to implementation, patient visits were 22% shorter, patients spent 58% less time with providers (P<0.001), and 38% less time waiting (p=0.06). Clinicians spent 50% less time interacting with patients, two thirds less time interacting with each other and more time on personal activities (Rotich et al., 2003). These findings support attributes of the EMR implementation framework presented in this study. The consequences of EMR
implementation based on the clinician perceived usefulness of EMRs include patient care efficiency and clinician effectiveness and efficiency of work. Patient care efficiency includes shorter wait time and reduced travel and effort by patients as they move to and from various departments in the hospital. For instance, automating the laboratory and the ART clinic and enabling order entry capabilities would improve the laborious lab investigation requisition process, eliminating the pick-up of lab results by patients. For clinicians, effectiveness and efficiency of work is related to timely access of their patient’s records, improved means of communication with colleagues, data entry and retrieval efficiency and quick decision making capability due to decision support tools.

The administration of patient data on paper-based systems poses many challenges and drawbacks. These challenges include lack of timely access to complete medical record of patients, illegibility of charts and inefficient data entry and retrieval. The framework presented offers a number of causal conditions for EMR implementation that were drawbacks of the paper-based system. Additionally, aspects of current information management practices and the database presently utilized in ART clinics in Ethiopia were recognized as causal conditions for implementation of a complete EMR system. They include, standardized paper form, existence of clinical data repository, master patient index (MPI) and unique patient ID. Rotich et al. (2003), in discussing the pre-implementation phase of the MMRS in Kenya, explain, the challenges of working with a blank slate; a paper-based system that had no permanent patient registry or unique patient ID, contained minimal information and was not timely accessible (Rotich et al., 2003). These findings confirm the causal conditions indicated in the framework, as the existence of clinical data repository and
MPI within the ART database and the existence of a nationwide ART unique ID in Ethiopia were recognized as causal conditions that support successful EMR implementation.

Additionally, prior to the deployment of a patient management system (PMIS) with computer order entry (COE) in Lilongwe, Malawi, researchers identified various problems with the paper documentation system, including dosage errors in medication orders and errors in transcribing orders from the chart by nurses. Researchers also recognized incomplete and illegible documentation accompanied specimens sent to the lab, resulting in delays and repetition of tests. After the deployment of the PMIS, there was a reduction in number of errors in medication dosage calculation and altogether eliminated nurses’ transcriptions of orders. The EMR system also improved the completeness and legibility of documentation accompanying specimens (Douglas et al., 2003). In another study, a survey of physicians in a Nigerian hospital by Asangansi et al. (2008) identified that inaccessibility of patients’ health records from different locations was a major problem for physicians (41.4% of respondents, n=60). Participants preferred a computer based-system over the paper-based system because it would provide better accessibility of records (Asangansi et al., 2008). In the framework, lack of timely access to a complete patient medical history and the occurrence of medication errors and drug interactions were also identified as causal conditions. Consequently, the framework identifies the reduction of medication errors, completeness and timely access to medical records as consequences of EMR implementation and utilization.
Overall perceived usefulness of EMRs was positive in a number of studies conducted in a developing country context. In a study conducted in a Nigerian teaching hospital, 129 residents (89%) believed that the computer-based system would be better than the paper-based system, mainly because of better accessibility to records (Asangansi et al., 2008).

‘User attitude’, ‘user acceptance’ and ‘use’ were identified in the framework as intervening conditions and action strategies.

The technological challenges associated with EMR implementation in resource poor settings were also discussed in the literature. Fraser and co-workers, discuss the deployment of a web-based medical record system called the HIV-EMR in Haiti (Fraser et al., 2004). The implementers faced technical challenges with the loss of network connections and the time required to maintain an updated record to support thousands of patients. Well-trained technical staffs are also vital to maintain an EMR (Allen et al., 2006). The lack of trained IT support staff and data clerks in rural areas were a challenge in the deployment of HIV-EMR in Rwanda (Allen et al., 2006). The component of the framework termed ‘human resources’ under organizational context, ‘service quality’ and ‘troubleshooting and support’ addresses theses issues associated with the overall support delivered by technical staff both with the use of the systems and providing operational and maintenance support. It should be noted that the lack of technical staff discussed by Allen et al. (2006) takes place in a rural setting. In the context of Ethiopian urban settings, the IT workforce is increasing with the growing emergence of technical colleges and universities. The challenge lies in recruiting this workforce to rural sites. Allen et al. (2006) faced similar challenges recruiting IT staff from the capital city of Kigali in Rwanda to the rural site where the EMR system was
implemented. The majority of the Rwandan IT staff at the implementation site were from Kigali, an urban area (Allen et al., 2006). Further challenges exist with recruitment of project managers and informatics experts who have experience working with EMRs.

Training staff on computers and the EMR system emerged as a vital component of successful EMR implementation. There were no studies found that evaluate the impact of health worker’s training on user attitude and use of EMRs in a developing country context. Further, there are only a few studies that investigate health worker’s computer knowledge and skill in these regions (Asangansi et al., 2008). In Nigeria, a study by Asangansi et al. (2008) on residents in a Nigerian teaching hospital found that the main use of computers was for surfing the Internet (95.9%, n=139) and scientific journal searches (79.3%, n=115). Approximately 51.7% (n=75) of residents owned a personal computer.

Identifying the computer competency of clinicians was one focus of the study conducted in Ethiopia. Results varied between nurses and physicians in terms of years of experience, self-rating of their computer proficiency, purpose of computer use, Internet use, and e-mail use. However, there was an overwhelming concurrence that both basic computer and EMR training were imperative to successful deployment of an EMR system in their health facility. Although the attitude of clinicians toward EMR implementation was overwhelmingly positive, there was concern regarding the practicality of EMR use in their practice, primarily influenced by their poor proficiency on computers. Clinicians were concerned that their poor computer competence would slow down their work. As a result, productivity loss was identified as an unintended consequence on the framework. This hinges on computer and
EMR training, as clinicians feel with time and practice their proficiency with computers and the EMR will improve, minimizing its influence on their task productivity. Hence, basic computer and EMR training were included as action/interaction strategies in the framework. According to a study of a needs-based assessment of middle and functional level nurse managers at Kenyatta National Hospital in Kenya, the majority of nurse managers (98.1%, n=105) desired to be trained in computer applications and their attitude towards the use of computers in nursing was not significantly influenced by accessibility to a computer or previous training in computer (p=0.05) (Kivuti-Bitok, 2009).

The cost of EMR implementation in resource poor settings was also raised as a concern in various studies (Douglas et al., 2003; Fraser et al., 2004; Rotich et al., 2003; Fraser et al. 2005). In the study by Fraser et al. (2004) the annual costs of Internet connections as well as capital cost associated with the HIV-EMR in Haiti was a drawback to the sustainability of the systems. The annual cost of Internet access per site was equivalent to two years of ARV drugs and clinical care for one patient (Fraser et al., 2004). In addition, there were costs associated with hardware, software, networking and implementation. All EMR implementations discussed in the literature involved the support and involvement of international organizations and collaboration of experts from around the world, especially in the case of OpenMRS. This points to the significance of international support both financially and technically, working alongside local experts and users. Because the majority of the EMRs implemented in these developing countries are relatively new, it is too early to make conclusions about the financial sustainability of these systems. Additionally, the sustainability of such systems cannot fully be acknowledged until there is no ‘hand-holding’,
so to speak, from those involved in their implementation both financially and technically. Currently, the models for EMR implementation in developing countries, documented in the literature are a few well-funded sites that are not reflective of the reality when it comes to sustainability. The reality is that health systems in sub-Saharan Africa, specifically in Ethiopia have minimal economic capacity. There are numerous competing needs for limited available funds so that, an EMR system may not be considered a priority. Therefore the economic context and the cost of EMR implementation are areas that need careful consideration.

Infrastructural challenges addressed and discussed by various studies include access to reliable electricity (Rotich et al., 2003; Allen et al., 2006; Fraser et al., 2005). Maintaining the operation of the Mosoriot Medical Record System (MMRS) during rotating power outages was a concern of implementers. To mitigate problem of power outage, clinics in Kenya setup multiple backup systems, including UPS battery, solar-powered system, and gasoline powered generators (Rotich et al., 2003). In Rwanda, clinics installed solar power systems (Allen et al., 2006). Alternative means include performing offline and offsite data entry to support clinics that do not have electricity (Allen et al., 2006). However, network outages including Internet connections are also a challenge with EMRs that have off-site servers (Fraser et al., 2004). To mitigate challenges with network outage, Internet based systems that use local data storage could be deployed, as is the case with the HIV-EMR system in Haiti (Fraser et al., 2004) and the SILCOM system in Brazil (Bastos et al., 2001).

Energy and communication infrastructures are fundamental to EMR deployment. The
framework highlights these important infrastructural components as contextual conditions to EMR implementation.

In developing countries, reporting aggregated statistics to funders and government has been a primary focus of health information systems (Braa & Hedberg, 2002). Thus it is imperative that EMRs are designed with the capacity to generating reports to meet internal, federal and international reporting requirements (Fraser et al., 2006; Allen et al., 2006; Rotich et al., 2003). The HIV-EMR implemented in Rwanda has a program-monitoring component used for generating various reports electronically (Allen et al., 2006). Electronic means for generating reports eliminates tedious, time-consuming and error prone manual aggregation of data (Allen et al., 2006; Crawford & Lester, 2005). The MMRS in Kenya has standard reports required by the Ministry of Health built into the system. The system also allows the creation of custom reports (Rotich et al., 2003). Similar findings were found in the study, with data clerks having to spend extensive hours tabulating multiple logbooks to generate various reports. The implementation of an EMR can support the reporting requirements of health facilities. Therefore, timely and accurate reporting was identified as a consequence to EMR implementation.

5.2 How framework fits with other EMR implementations

A number of studies have developed conceptual frameworks that present attributes essential for successful EMR implementation (Ash et al., 2003, DeLone & McLean et al., 2003, & Keshavejee et al., 2006). These frameworks will be compared with the EMR implementation framework presented in this study.
Ash et al. (2003) provided twelve high level principles to guide computerized physician order entry (CPOE) implementation. They used a top-down method involving various discussions and brainstorming session of experts. Furthermore, a bottom-up approach using observation and interviews of hospital administrators, clinicians, and technology staff was conducted at four hospitals that had implemented CPOE. According to their findings, CPOE encompasses computer technology principles, personal principles, organizational principles, and environmental issues. Computer technology principles include temporal concerns, technology and meeting information needs, multidimensional integration, and costs. Personal principles are value to users and tradeoffs, essential people, and training and support. Organizational principles cover foundational underpinnings, collaborative project management, terms, concepts and learning. Lastly, environmental issues consist of the motivation for implementing a system (Ash et al., 2003).

The four overarching principles of CPOE predominantly match with the EMR implementation framework presented in this study at diverse levels, although Ash et al. (2003) present a framework specific to CPOE and not EMR systems. Firstly, the computer technology principles addressed by Ash et al. fall into three categories of the framework, namely: infrastructure, technological, cost and workflow changes. One principle included by Ash et al. (2003) that is not addressed in the EMR implementation framework of the present study is ‘multidimensional integration’, which deals, purely from a technological viewpoint, with integration of different systems to create seamless access for users. In the EMR implementation framework, because EMR implementation was investigated in a developing
country context where there were little or no systems presently used, multidimensional integration did not emerge as a major component in the framework. That said, integration of various systems that could be implemented to support specific departments within the hospital need to be integrated to create a comprehensive EMR system within the health facility. For instance, currently, pharmacy’s information system is not interoperable with the ART database utilized in ART clinics.

The second main principle is ‘personal principles’ which mainly deal with the users of the system. The attitude of users and their motivation to use a system is influenced by the tradeoff between its benefits and downsides (Ash et al., 2003). This corroborates the findings with regard to the importance of user attitude, identified as an intervening condition that eventually has an effect on use of the system. Under personal principles, the involvement of essential leadership is also discussed. They include administrative leaders and the chief executive officer (CEO) or presidential level leadership, clinical leaders such as chief medical officers, and experts that understand both the technological and clinical aspects. Finally, the clinical information officer (CIO) is identified as an essential leader to system implementation (Ash et al., 2003). The importance of leadership was also identified as important component for EMR implementation in the EMR implementation framework. In this context, management buy-in and project management were components included in the framework to address this fundamental area. It should be noted that the organizational structure in terms of management is different in a developing country. In Ethiopia, the positions of CEO and CIO do not exist. The hospital director, medical director, department heads and various administrative staff share leadership and management responsibilities.
Lastly, training and on-site support were also raised as a crucial component for system implementation. Both basic computer and EMR training along with systems support were one of the most consistent themes identified by ART clinicians in the study. Service quality, a term adopted from DeLone & McLean et al., (2003) has been used to refer to technical support, system support and maintenance of the system in the EMR implementation framework.

The third CPOE component is ‘organizational principles’. The first principle under this category is foundational underpinnings, which addresses important criteria related to organizational culture. These include commitment from top-level staff both finically and morally. This has been addressed in the EMR implementation framework under management buy-in which has been identified as an intervening condition along with the economic context. Furthermore, the issues included under organizational context of the framework including organizational characteristics, such as shortage of human resources, heavy workload, and high patient load, are important organizational factors that need consideration in EMR implementation. Terms, concepts, and connotations were identified as principles under organizational principles, pointing to the importance of a standardized medical terminology. One challenge when integrating the practice of various departments is the variations and nuances in terminology (Fraser et al., 2005). Mapping concept codes to standard coding systems such as ICD10, SNOMED, LOINC or HL7 is ideal along with an EMR system that allows expansion of its data model (Fraser et al., 2005). The specifics of standardized medical vocabulary were not included in the EMR implementation framework since it did not emerge in the data and could be an area for future investigation.
Lastly, ‘motivation and context’ was a principal under ‘environmental principles’. In this area Ash et al., (2003) discuss the motivators for EMR implementation such as pressure of stakeholders outside a health facility. In a developing country, this may come in the form of international organizations and funders. However, the likelihood of success of EMR systems hinges on the motivation of clinicians to use the system (Ash et al., 2003). That is why this study has focused on understanding the attitude of clinicians on EMR systems.

DeLone and McLean (2003) proposed a conceptual framework to evaluate information system (IS) success. The framework presents various theoretical bases for IS evaluation organized into seven dimensions: information quality, system quality, service quality, intention to use, use, user satisfaction and net benefits. “The model just has three components: the creation of the system, the use of the system, and the consequences of this system use.” (DeLone & McLean et al., 2003).

System quality and service quality have been adopted to the EMR implementation framework to address themes that have emerged in study. Information quality deals with accuracy, timeliness, completeness, relevance and consistency. In this framework, information quality has been identified as a consequence of EMR implementation and action/interaction strategies such as EMR training and use. Therefore, information quality relates to timely access to complete medical record, timely and accurate reporting, and data entry and retrieval efficiency. Other dimensions such as intention to use, use, and user satisfaction have all been grouped under ‘user attitude’, ‘user acceptance’ and ‘use’ in the
EMR implementation framework. Finally, the net benefits, including individual and organizational impacts are grouped under consequences in this framework.

It should be noted that the D&M IS Success Model is not specific to health information systems and as a result fails to address essential organizational and environmental contextual components identified by Ash et al. (2003). This is essential in dealing with the complex environment of health care organizations. The D&M IS success model is an evaluation framework that focuses on measures for IS success. A literature review by Van Der Meijden et al., (2003), on evaluations of patient care information systems sheds light on the gaps in the D&M IS success model. Van Der Meijden et al., (2003) classified attributes used to assess the success of IS into one of the six dimensions of the D&M IS success model. The study identified attributes that could not be assigned to one of the six success factors. These included: system development, implementation process, and organizational culture and characteristics. Implementation process consisted of communication, training, and technical support. Organizational attributes referred to control and decision-making, management support, collaboration, professional values, support and maintenance, champions, and rewards (Van Der Meijden et al., 2003).

In another framework, Keshavejee et al., (2006) used the systematic review process to integrate various frameworks into an over-arching implementation framework for EMR systems (Keshavejee et al., 2006). The study breaks down EMR implementation into three stages: pre-implementation, implementation and post-implementation, classifying various attributes in each stage under people, process and technological components. Attributes of
the pre-implementation phase include choosing software, involvement of multiple stakeholders, selling benefits and addressing barriers, early planning, project management, governance, and technology/usability factors. Comparing the first stage of Keshavejee and co-workers’ framework to the EMR implementation framework, one component that is not included in the EMR implementation framework is the process of software selection. However, hardware and software components were indirectly addressed in conjunction with system quality issues. Planning, project management, governance, and technology/usability factors have been addressed by corresponding attributes of project management and control, management buy-in, and system quality.

The implementation stage of the framework by Keshavejee et al., (2006) covers integration with other systems, workflow redesign, training, implementation assistance, feedback and dialogue, and privacy and confidentiality considerations. The post implementation factors include: presence of user groups, support, presence of business continuity plan, and incentives. Aspects of the attributes identified by Keshavejee et al., (2006) match with the current proposed framework, with exception of a number of attributes such as feedback and dialogue, incentives, and privacy and confidentiality considerations. The involvement of users and dialogue is essential to improve usability of the EMR although it has not emerged as a key component for implementation in this study. Additionally, both Keshavejee et al., (2006), and Van Der Meijden et al., 2003) consider incentives and rewards as a key attribute. This was not included in the EMR implementation framework.
Confidentiality concerns were raised by a few ART clinicians who felt an EMR would compromise the confidentiality of patients by allowing clinicians with password access to view the medical record of any patient in the system. To eliminate this concern, a security policy that stipulates privacy and confidentiality guidelines for EMR use has to be created. Such policy will ensure that the EMR system’s security will be configured to designate levels of responsibility based on task in order to allow only those users who require access to each part of the system. Although this is an important issue, it did not emerge as a key component for inclusion in the EMR implementation framework.

5.3 Study Limitations

The concept of EMRs is relatively new to many clinicians who participated in this study. To address this gap in knowledge, the researcher provided participants with a definition of an EMR and its functionalities prior to interviews (See Appendix C). Based on the definition provided and their personal knowledge of computer-based record systems, clinicians were asked to identify barriers and perceived usefulness of an EMR. This poses a limitation with regard to clinicians’ full understanding of an EMR and its functionalities, as they have no previous exposure or hands-on experience. Due to time constraints, the researcher could not demonstrate an EMR system to each participant to go through general functionalities prior to the interview. That said, demonstrating an EMR system could bias the response of participants, as their response would be based on the specific EMR selected for demonstration.
Parts of the questionnaire were adopted from standardized questionnaires while additional questions were included by the investigator to address issues of concern specific to ART clinicians in a developing country. As a result, some responses from the questionnaire indicate that participants did not understand the particular question: “What are the routine information requests you receive from your colleagues and from people outside your organization?” The question should have been more specific to elaborate what ‘routine information’ entails.

5.3.1 Generalizability and Credibility

The results of this study are based on the practice of four ART/HIV clinics in Ethiopia. While the results and the framework are consistent with results in other similar studies and those found in the literature review, they may not be generalizable to all ART clinics in developing countries due to the sample size and number of health facilities involved. The study dealt with ART clinics located in urban hospitals and did not address smaller ART clinics located in rural health centers. Additionally, because of cultural differences that exist across many developing countries, this study may not be generalizable to all regions. Furthermore, the study took place in ART clinics that have a hybrid paper-electronic environment therefore may not be generalizable to clinics that may use a predominately paper-based system. The study’s credibility is established through triangulation of data collection and analysis methods (literature review, questionnaires, interviews, and observations).
5.4 Implications for EMR Implementation in Developing Countries

The author believes the findings of this study can support EMR implementers who are exploring the development and implementation of EMRs in developing countries. The report presents a framework specific to the context of resource limited regions providing overarching principles for EMR implementation. The framework can be useful to government officials and hospital management/administrators who may be investigating the development and implementation of EMR systems or the expansion of ART databases to allow order entry and access to patient medical records at the point of care in ART, TB/HIV, PMTCT, paediatric ART and VCT clinics.

5.5 Implications for Health Informatics Practice

The implementation phase of the traditional system life cycle is often viewed as a clearly defined phase with distinct inputs and outputs. However, there are various complex intervening and contextual factors that need careful investigation in the implementation process. EMR implementation is complex because it takes place in a complex health care environment with diverse people and numerous processes. Understanding the organizational dynamics and the social context that affect the introduction of IS in health care are few areas that need assessment in the implementation phase. There are limited number of studies that have set out to thoroughly understand the process of implementation of IS in health care (Aarts et al., 2004). The traditional system life cycle is no longer sufficient to understand the complexities of health IS implementation (Alter, 1999). This study has shed light on the implementation process of EMR systems by attempting to identify the social and organizational contexts in which an EMR would be embedded. Further understanding of the
implementation process of health IS will require access to hospital sites and investigations over an extended time period (Aarts et al., 2004). Findings from such studies have implications for health informatics practices by changing the way implementation of IS is understood and carried out.

5.6 Future Research

Since the implementation and use of EMR systems in developing countries is in its early stages, there are a number of areas that need further research. Out of the numerous studies that addressing health information systems in developing countries, there were only a small number of studies, in the literature, that carried out formal evaluations on the impact of the HIS deployed in this region. Hence, evaluation studies are critical to determine whether the benefits of EMR identified in this and other studies are valid.

In addition, research on the EMR pre-implementation and implementation phases should also be a focus for future research. Areas that need to be explored further include the preparedness and capacity of healthcare institutions to implement EMRs by measuring and assessing areas most critical for adoption and success at the government, healthcare facility, and user levels. Top-down and bottom-up approaches need to be utilized involving experts as well as staff of health facilities including administrators, clinicians and IT staff.

Lastly, the importance of organizational dynamics in EMR implementation along with the social and technical contexts also need further investigation to identify attributes critical for successful EMR implementation in developing countries.
5.7 Conclusion

The implementation of EMR systems is a complex process. Understanding clinicians’ information needs for patient monitoring and decision making in patient care is an essential phase in developing knowledge and gaining understanding on how EMRs can be effectively deployed and utilized in ART and HIV care. The attitude of ART clinicians concerning the implementation of EMR systems was overwhelmingly positive. The perceived benefits of EMRs are improved continuity of care, timely access to complete medical record, patient care efficiency, reduced medication errors, improved patient confidentiality, improved communication between clinicians, integration of various HIV programs, timely decision support and overall job motivation. On the other hand, drawbacks to EMR implementation include productivity loss and negative impact on the interaction and relationship between clinicians and their patients. The study took a bottom-up approach to develop a conceptual framework encompassing key factors, including infrastructural, organizational, technological and user attributes essential for successful EMR implementation in a developing country.
6 References


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List of Appendices

Appendix A: Ethics Approval (University of Victoria)
Appendix B: Ethics Approval (Hawassa University)
Appendix C: Definitions
Appendix D: Interview Guide
Appendix E: Questionnaire
Appendix A: Ethics Approval (University of Victoria)

Human Research Ethics Board
Certificate of Approval

Principal Investigator: Michael Gebre-Mariam
Department/School: HEIS
Supervisor: Dr. Elizabeth Borycki

Co-Investigator(s):
Foralweit Gebre-Mariam, Intermediary, Hawassa University (Ethiopia)

Project Title: Clinician's perspective of exploring challenges around patient monitoring and clinical information management of antiretroviral therapy (ART) and the utilization of electronic medical records (EMRs) in HIV care in Ethiopia

Protocol No. 09-146 Approval Date 22-Apr-08 Start Date 22-Apr-08 Expiry Date 21-Apr-10

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

This Certificate of Approval is valid for the above term provided there is no change in the protocol. Extensions and/or amendments may be approved with the submission of a "Request for Annual Renewal or Modification" form.

Dr. Richard Keeler
Associate Vice-President, Research
Appendix B: Ethics Approval (Hawassa University)

Hawassa University, College of Health Sciences
Research Ethical Clearance Form

Name of Researcher/s: Mikael Gebre Mariam

Topic of Proposal: Exploring challenges around patient monitoring and clinical information management of antiretroviral therapy (ART) and the utilization of electronic medical records (EMRs) in HIV care in Ethiopia.

Dear Sir/Madam,

The Hawassa University, College of Health Sciences Ethical Review Board has reviewed the aforementioned project proposal with special emphasis on the following points:

1. Are all ethical principles considered?
   1.1. Respect for person: Yes ☑ No ☐
   1.2. Beneficence: Yes ☐ No ☑
   1.3. Justice: Yes ☑ No ☐

2. Are the objectives of the study ethically achievable? Yes ☑ No ☐

3. Are the proposed research methods ethically sound? Yes ☑ No ☐

Based on the above-mentioned ethical assessment, the IRB has:

A. Approved the proposal for implementation ☑
B. Conditionally Approved ☐
C. Not Approved ☐

Best regards,

CC:

College of Health Sciences
CHS

Dejene Hallu Kassa
Research & Extension Office Coordinator

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220-87-55 ☟ ☟ 1560 Awassa, Ethiopia
Appendix C: Definitions

AIDS
Acquired Immune Deficiency Syndrome is the late stage of HIV disease characterized by a group of symptoms and signs caused by the Human Immunodeficiency Virus (HIV) that cause a deterioration of the immune system (Weiss, 1993).

Antiretroviral Therapy (ART)
Antiretroviral (ARV) drugs inhibit the replication of HIV. These drugs are given in combination to delay immune deterioration and replication of HIV to improve survival and quality of life. Effective HIV/AIDS treatment requires antiretroviral therapy as a treatment option. WHO recommends that ARV therapy in resource-limited areas should start at the onset of clinical AIDS. When CD4 counts are available, patients with less than 200 CD4 count should be offered treatment (WHO Website, 2008).

Opportunistic Infections (OI)
Infections that are caused by organisms to which the body is normally immune. When the immune system is depressed or destroyed, as in AIDS, opportunistic infections can take hold (WHO Website, 2008).

Electronic Medical Record (EMR)
“EMR: An application environment composed of the clinical data repository (CDR), clinical decision support system (CDSS), controlled medical vocabulary (CMV), computerized provider order entry (CPOE), pharmacy and clinical documentation applications. The patient's electronic record is supported across inpatient and outpatient environments; is used by healthcare practitioners to document, monitor and manage care delivery within the care delivery organization.” (Garets and Davis, 2005).
Appendix D: Interview Guide

1) What is your name and area of medical practice?
2) What are your roles and responsibilities? Please recall a typical day when you are working in your health facility.
   a) Describe what happens at the start of your day, prior, during and after a patient’s visit.
3) What are the major challenges you face in caring for patients in HIV care and ART? (e.g. lack of technical support, man-power shortage, lack of proper equipment, etc.)
4) Describe the patient medical record keeping system and practice in your facility?
5) What specific problems do you have with the medical record keeping system in your facility?
   - Do you find the documentation on ART patients comprehensive, accurate, and available?
   - Describe the process between laboratory, pharmacy and radiology?
   - How do you follow-up on requested investigations (e.g. lab)?
   - How useful would a facility wide patient medical record or a single health record for patient at the hospital be?
6) How do you monitor the progress and adherence of patients in ART (drug toxicity, drug allergies, drug interaction, failing treatment, CD4 count, viral load, weight, functional status etc.)?
   - Do you ever know if a patient has missed a consult or procedure before the patient comes in next?
   - What decision support tools do you have to identify drug interaction, drug allergies, failing treatment, drug toxicity etc.?
7) How are new guidelines implemented into practice?
8) Describe the intra-facility and inter-facility transfer process?
   a) Do you follow up on patients that have been transferred out to another facility?
   b) Are there gaps/weaknesses in the referral network or system? If so, what are they? How do you deal with these gaps?
9) What needs to be in place to establish strong continuity of HIV care with various programs (ART, PMTCT, VCT, TB, OI etc.)?
   a) How is the continuity of care currently among HIV services and non-HIV departments?
10) For each outcome listed below, indicate whether you think the effect of a Electronic Medical Record system (computer-based record system) is, or would be, very positive, somewhat positive, no effect, somewhat negative, or very negative:

<table>
<thead>
<tr>
<th>Effects of EMR on…</th>
<th>Very Positive</th>
<th>Somewhat Positive</th>
<th>No Effect</th>
<th>Somewhat Negative</th>
<th>Very Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Quality of health care for HIV patients</td>
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<td>b) Controlling costs of health care</td>
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<td>c) Interactions within the health care team</td>
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<td>d) Patient-physician communication</td>
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<td>e) Patient privacy</td>
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<td>f) Clinicians’ access to up-to-date knowledge</td>
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<td>g) Efficiency of providing care</td>
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<td>h) Overall patient safety</td>
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<tr>
<td>i) Medication errors</td>
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</table>

11) What is your attitude regarding the implementation and use of an electronic medical record system?
   - How useful would an electronic medical record be for monitoring patients in ART?
     I. Quick access (timeliness)
     II. Decision support tools (alerts, reminders, guidelines)
   - Are other medical staff at your site interested in these technologies? Have any steps been undertaken to acquire them?

12) What do you foresee as the major challenges in implementing an EMR in your clinical practice?
Appendix E: Questionnaire

A. Age, gender and work position
1. Age: □ < 35 □ 35-50 □ >50
2. Gender: □ Male □ Female
3. Work Position: □ Physician □ Nurse □ Resident

B. About your experience with computers
4. Please state the number of years of computer experience __________
5. How would you rate your computer skills? Lowest Average Highest
   □ □ □ □
6. Do you use a computer in the workplace? □ Yes □ No
7. Have you used a computer for?
   a) Test result retrieval □ Yes □ No
   b) Literature search □ Yes □ No
   c) Word processing □ Yes □ No
   d) Entering patient info □ Yes □ No
   e) Retrieving patient info □ Yes □ No
8. How often do you use the Internet for professional use, including e-mail, from home, work, or another location? (Please check only one)
   □ Several times a day
   □ Daily
   □ Weekly
   □ Monthly
   □ Less than monthly or not at all
9. Do you use e-mail for the following clinical activities (check all that apply)?
   □ Clinician /colleague communication
   □ Patient communication

C. About your medical practice
10. How long have you been practicing in your medical field (in years)?
11. Please estimate the number of HIV/AIDS outpatient visits you have in a typical week.
12. What are the routine information requests you receive from your colleagues and from people outside your organization?

13. What types of patient medical information (i.e. patient medical history, ART summary, HIV care & family status, practice guidelines, best practice, etc.) do you feel you and your colleagues feel are not sufficient to enable you to provide better services or better do your work?

14. How do you find out current information on disease or treatment (books, medical journals, Internet etc.)?

15. What are some of the challenges you have encountered in turning this knowledge or information into practice or actions?

D. About the medical recording system for clinical tasks in the hospital

16. What type of medical record system is used in your health facility?
   - □ Paper based
   - □ Computer based
   - □ Both

17. Do you think an electronic recording system would be more useful than the paper based recording system?
   - □ Yes
   - □ No
   - □ Indifferent

18. Why do you say so (in 17)?
19. How often do you use the medical recording systems at your facility to assist you with the following tasks:

<table>
<thead>
<tr>
<th>Task</th>
<th>Never/ almost never</th>
<th>Seldom/ rarely</th>
<th>About half of the time</th>
<th>Most of the time</th>
<th>Always/ almost always</th>
<th>Computer based system</th>
<th>Paper-based system</th>
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</thead>
<tbody>
<tr>
<td>1. Review patient’s problems</td>
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<td>2. Seek specific information from patient record</td>
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<td>3. Follow the result of a particular test or investigation over time</td>
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<td>4. Obtain the results from new tests or investigations</td>
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<td>5. Enter daily notes</td>
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<td>6. Obtain information on investigation or treatment procedures</td>
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<td>7. Review patient’s ART summary (e.g. ART history, start date, drug allergies etc.)</td>
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<td>8. Review patient’s HIV care and family status</td>
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<td>9. Review patient encounter information (e.g. functional status, clinical stage, weight, TB status, dose dispensed, adherence assessment etc.)</td>
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<td>10. Patient demographic information (e.g. name, gender, unique patient ID)</td>
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</table>
20. How much of a barrier do you think each of the following might be to the successful implementation and/or use of an Electronic Medical Record (EMR)/computer-based record system in your facility?

<table>
<thead>
<tr>
<th></th>
<th>Not a barrier</th>
<th>Minor barrier</th>
<th>Major Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Computer skills of you and/or colleagues/staff</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>b) Availability of computer technical support</td>
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<td>☐</td>
<td>☐</td>
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<tr>
<td>c) Lack of training on EMR use</td>
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<tr>
<td>d) Productivity loss</td>
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<td>e) Extreme workflow changes</td>
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<tr>
<td>f) Clinician skepticism</td>
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<td>g) Privacy or security concerns</td>
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<td>h) Technical limitations of systems (e.g. slow response time of computers)</td>
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<tr>
<td>i) Lack of infrastructure (e.g. internet connection, computers, uninterrupted power supply)</td>
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