Factors Affecting the Adoption of Health Management Information Systems (HMIS) Among Health Workers: The case of SmartCare Software in Addis Ababa Regional Public Hospitals

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To all those people, I dedicate my thesis with acknowledgement and pride!

DEDICATION

I specially dedicate this thesis to my brother Dr. Getnet Teshager who has been a great motive for me; I also dedicate it to my mom Lackech Yayeh and my sister Genet Teshager who have raised me to be the person I am now. May God give them peace and happiness in their life and give them heaven in the hereafter, Amen!

ACRONYMS

AACA: Addis Ababa City Administration
ANC: Anti Natal Care
AUB: Actual Use Behavior
BI: Behavioral Intension
CA: Computer Attitude
CSA: Central Statistics Authority
C–TAM–TPB: Combined Technology Acceptance Model and Theory of Planned Behavior
EE: Effort Expectancy
EMR: Electronic Medical Records
EHR: Electronic Health Records
FC: Facilitating Conditions
FMOH: Federal Ministry of Health
HBC: Home Based Care
HIS: Health Information System
HIT: Health information technology
HMIS: Health Information Management System
HSDP: Health sector Development program
ICT: Information Communication and Technology
IDT: Innovation Diffusion Theory
IS: Information Systems
MDG: Millennium Development Goal
MM: Motivational Model
MPCU: Model of PC Utilization
PE: Performance Expectancy
PIIT: Personal Innovativeness in Information Technology
SCT: Social Cognitive Theory
SEM: Structural Equation Modeling
SI: Social Influence
SPSS: Statistical Package for Social Science
TAM: Technology Acceptance Model
TAM2: Extended Technology Acceptance Model
TPB: Theory of Planned Behavior
TRA: Theory of Reasoned Action
UTAUT: Unified Theory of Acceptance and Use of Technology
TUTAPE: Tulane University's Technical Assistance Program for Ethiopia
VCT: Voluntary Counseling and Testing
WHO: The World Health Organization

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Abstract

Background: *There has been an increasing interest in the area of Electronic Medical Records (EMR) and more and more hospitals all over the world try to keep their patients' records electronically. The adoption of EMR has become a major concern in the healthcare industry, as it is a key factor to the healthcare quality improvement. In Ethiopia, the implementation of Electronic Medical Record (EMR) is through software called SmartCare. SmartCare software possesses numerous advantages and features such as Simultaneous, remote access to patient data, Legibility of record, Safer data, Patient data confidentiality, greater range of data output modalities and Service Integration within the facility (laboratory, pharmacy, prescription & scheduling). However, these systems are not used by the health workers in Addis Ababa Regional Public hospitals.*

Objective: *The objective of this study was to identify and measure the factors affecting the behavioral intention and usage behavior of health workers EMR-SmartCare Software adoption in public Hospitals of Addis Ababa City Administration.*

Methodology: *To identify the factors affecting the utilization of EMR-SmartCare software, a cross-sectional descriptive study which was quantitative were employed and a total of 303 study participants were randomly selected from health workers based on their population size proportionally in selected 5 regional hospitals of city administration using Self-administered questionnaires.*

Results: *The findings provide strong empirical support for all of the main constructs mentioned in the research model, which posits five direct determinants of intention to use EMR-SmartCare software and another two direct determinants of actual Use Behavior as follow: Performance Expectancy(PE), Effort Expectancy(EE), Social Influence (SI), Computer Attitude(CA), Personal Innovativeness in IT(PIIT) as determinant of Behavioral Intention and; Facilitating Conditions(FC) and Behavioral Intention(BI) as determinants of Actual Usage Behavior(AUB). These results maintain enough explanatory power R2 =.702 (Adjusted R squared=.333) to help explain the intentions and actual use behavior of health workers in adopting EMR- SmartCare software.*

Conclusion: *These research findings indicate that the variables in the proposed research model significantly and positively impact the behavioral intention and actual use behavior to adopt EMR-SmartCare software. Among these, attitude towards computers has the most significant positive impact on adoption intentions. Therefore this study suggests that in order to enhance the intention to adopt and use EMR-SmartCare software, hospitals should strengthen independent impact variables, including Attitude towards Computers, Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Personal Innovativeness in IT.*

In view of the fact that the achieved conceptual framework considers the particular characteristics of the health workers, contributions and implications of this study are significant both at the theoretical level as well as the practical level. This study not only provided some interesting findings and suggestions for practice but also produced a paradigm for scholars who are interested in the behavior of technology adoption for health care sectors.

CHAPTER ONE

1. INTRODUCTION:

1.1 Background

Traditionally, medicine is an information– intensive branch where patient treatment is triggered by the availability of diagnostic knowledge (1). Patient records have been stored in paper form for centuries and, over this period of time; they have consumed increasing space and notably delayed access to efficient medical care. As we move into the 21st century, the way we live is undergoing substantial transformation due to the rapid evolution of information and communication technologies (ICT). The health care system is undergoing substantial change, and access, adoption, acceptance and use of ICT is gaining increasing importance with advances in information systems and e-health technologies. Today, healthcare computing or medical informatics is one of the fastest growing areas of Information and Communication Technology (ICT) applications (2). It is a multifaceted application concerned with Electronic Medical Record(EMR), performance indicators, paramedical support, emergency service, computer aided diagnosis, clinical governance, research support, and hospital management (ibid). A health care industry without information and communication technology cannot provide efficient and effective health care service. In the past decade, EMR has become an important tool for healthcare providers (3, 4).

Use of an EMR is shown to produce more complete clinical documentation than the paper record, leading to more appropriate clinical decisions (4-6). In addition, EMR is recognized for its potential to implement guideline–based healthcare and to identify and limit medical errors (7-9).

The importance of technological change in the health sector is a widely discussed topic in the economic literature (10). Among these changes is the introduction of Electronic Medical Records (EMR). The benefits of using an EMR includes, increasing the quality, lower costs, and increased patient and clinician satisfaction. Electronic Medical Records (EMRs) are computerized medical information systems that collect, store and display patient information. They are a means to create legible and organized recordings to access clinical information about individual patients. In health informatics, an EMR is considered by some to be one of several types of EHRs (electronic health records), but in general usage EMR and EHR are synonymous (11).

The usage of IT is a necessary condition to ensure the productivity payoffs from IT investments (12-13). It is common knowledge that a number of projects fail (14). The main reason to this failure is that when a new technology is implemented, it changes the work practices of the organization members

and consequently they may not accept its usage (15-16).Therefore, understanding why people use a technology and investigating the factors influencing the new technology adoption, helps to ensure effective deployment of IT resources in organizations and ensure a successful implementation (17). Availing quality and timely health information at various levels of decision points throughout the country's Health system is very essential for the improvement of Health Care and overall Health System in Ethiopia. The benefits of using an EMR includes, increasing the quality and speed of access to Health Information and the effectiveness of the Health System. In Ethiopia, the implementation of EMR in public hospitals is through a software called SmartCare. SmartCare software was first developed, tested and deployed in Zambia by CDC for HIV/AIDS care and treatment. Besides the rich and advanced functionality and features, SmartCare software has also been proven to work in limited resources environment of developing countries particularly in Africa (18). SmartCare software possesses numerous advantages and features. Ethiopia thus adapted SmartCare software as the preferred EMR application. However, its adoption rate is very low & it is important to identify and address factors influencing the successful adoption & utilization of SmartCare software (19).

1.2 Statements of the Problem

Proper and correct adoption of IT can significantly affect the quality and performance of medical services provided by a hospital (20). EMR adoption refers to health workers psychological state with regard to his/her intention to use EMR in his/her practice (21). An individual's intention to use EMR is considered as an appropriate measure of his/her actual use of the technology (22). Moreover, meta–analysis on the use of psychosocial models in the study of healthcare professionals' behaviors has found high correlation between the intention to perform a given behavior and the actual behavior (23).

SmartCare software has been chosen as one HMIS tool in Ethiopia. The software is currently implemented in all public hospitals of Addis Ababa city administration, however the adoption & utilization of the software by health workers is not studied so far and from my perspective of observational assessment, health workers have not fully accepted & are not seen utilizing the system adequately while useful as already mentioned above. Factors influencing successful acceptance and use arise, in part, due to the complex individual, technical and social/organizational interplay between people and technology (24). Therefore, factors that contribute to the success and failure of information systems and technologies will be compromised during the first few years of implementation.

This study is an attempt to understand how the health workers, those directly involved in the care and treatment of patients, accept and utilize the new technology in this case, the SmartCare software. The study will investigate and analyze varying degrees of challenges which are recognized to be factors influencing the utilization of SmartCare software in Addis Ababa city administration public hospitals. It should be noted that this study will not focus on the applications or how daily routines linked to patient treatment or care is affected but how the technology is viewed.

1.3 Research Questions:

At this point the researcher will articulate the basic and the peripheral research question that is expected to be answered throughout the study.

Therefore, the research question is to investigate:

- ✓ *What are the factors affecting the actual usage behavior among health workers?*
- ✓ *What are the factors that determine the intention of the health workers to use SmartCare Software in the Addis Ababa city administrative public hospitals?*
- ✓ *To use technology acceptance theory as a theoretical framework to examine the determinants associated with healthcare industry?*
- ✓ *Do demographic characteristics of health workers make a difference in the behavioral intention and actual utilization of SmartCare Software?*

1.4 Rationale of the Study

The health care system is undergoing substantial change, and access, adoption, acceptance and use of ICT is gaining increasing importance with advances in information systems and e-health technologies. As, it is the health workers who decide whether or not to use a new technology, finding out about the determinants of their decision to use a specific technology is of great importance.

Among these technologies, SmartCare software in Ethiopia is one key tool to quality improvement in healthcare sector. Unfortunately, although all of the hospitals in Addis Ababa Region City Administration have implemented HMIS supporting SmartCare software; the software is not well accepted by the health workers.

Therefore, the need to understand the factors influencing IT adoption in healthcare sector, the various effects of using SmartCare software on healthcare quality, and the role that health workers play in this context, brings great importance to this study.

CHAPTER TWO

2. LITERATURE REVIEW:

This chapter reviews the relevant literature and establishes the components of the research model. It will conclude with the development of the hypotheses that will link the theories and models discussed herein.

2.1 Information and Communication Technology (ICT)

ICT is a key area for improving service delivery, promoting easier information exchange, assisting in decision making processes, and improving the effectiveness of operations. Governments and organizations around the world are mainstreaming ICT as a tool in all sectors of activities. In this regard, organizations need to invest a lot of resources to use ICT as a supportive tool for the effective and efficient delivery of services. ICT is a cross cutting area which supports all function and operation areas by facilitating the automation of various processes. The Ministry of Health (MOH) has recognized the benefits of Information and Communication Technology (ICT) as a tool to support the health sector.

2.2 Health Management Information Systems (HMIS)

HMIS: is defined as " An organized system of record keeping, reporting, processing analysis, use and feed back of information which is designed to provide different level of beneficiaries (clients, community, service providers, managers, planners and policy makers) with timely and relevant information necessary to formulate policy, plan, implement, monitor, supervise and evaluate health programmers"(25). Like any other system based on ICT, the introduction of HMIS has an effect on the entire organization, and the organization in this case being an entire hospital.

If it is believed that information is indispensable for effective management and development of health services and that, furthermore, it has to be meaningful, reliable, accurate, and timely. Health system managers should be 'keeping an eye' on the information system and its performance (26). Health information systems generate information in order to inform health planners and decision-makers on what is happening at health delivery facilities. Health information systems improve health management and health management is a pre-requisite for good health care service delivery. Thus, health information systems are there to bridge the gap between disease occurrence and the response of health workers to fight against diseases (27).

2.3 HMIS in Ethiopia

Ethiopia is working toward fulfilling a comprehensive 20-year program, the *Health Sector Development Program* (HSDP). The HSDP timeline is divided into five-year phases, and is currently in its fourth five-year phase (2010/11 through 2014/15). HSDP-IV is focusing on a comprehensive and continuous quality monitoring mechanism that will enable all levels of the health system (including both management and service delivery) to look at all aspects of performance and quality of services. In this phase among the use of ICT application for health is e-HMIS, which will include appropriate ICT at Health Extension Package (HEP) level, electronic health information transfer, & EMR (28). The Ethiopian HMIS is implemented by the FMOH while the Central Statistical Agency (CSA), a division of the Ethiopian government, manages population–based health information sources, i.e. censuses, ad hoc surveys, and registering vital events (18).

The HMIS was established to "support informed strategic decision-making by providing quality data that help managers and health workers plan and manage the health service system" (29).

2.4 Electronic Medical Record (EMR)

The Electronic Medical Record is a computerized patient tracking and Patient caring system. In health informatics, an EMR is considered by some to be one of several types of EHRs (electronic health records), but in general usage EMR and EHR are synonymous. The term has sometimes included other systems which keep track of medical information, such as the practice management system which supports the electronic medical record. EHR is an essential technology for health care and a necessary tool for improving patient safety and the quality of care.

Availing quality and timely Health Information at various levels of decision points throughout the country's Health system is very essential for the improvement of Health Care and overall Health System in Ethiopia. The benefits of using an EMR includes, increasing the quality and speed of access to Health Information and the effectiveness of the Health System.

2.4.1 SmartCare Software in Ethiopia

SmartCare software development in Ethiopia happened in collaboration with the SmartCare team in Zambia and the United States of America. The SmartCare software application was adapted according to the recent Ethiopian HMIS reform conducted by the FMOH. All customizations of the software are conducted by Tulane University's Technical Assistance Program for Ethiopia (TUTAPE's) software developers in collaborations with Federal Ministry of Health (FMoH), Zambia's SmartCare team and consultants from the United States of America (18).

SmartCare gained recognition as the Electronic Health System Application for Ethiopia followed by a presentation and live demo of the customized SmartCare. To improve the performance of the HMIS, Ethiopia contracted with the consulting firm John Snow, Inc. (JSI) in 2006 to perform an evaluation and redesign of the HMIS. As of 2008, a comprehensive electronic HMIS has been developed in conjunction with doctors associated with Tulane University and is now being deployed to health facilities in several regions of the country (29).

2.4.2 SmartCare Deployment in Ethiopia

The deployment of SmartCare includes building/strengthening ICT infrastructure (Hardware, Software, & Networking components) and the Installation and Training of SmartCare software application at the Health Facilities. SmartCare is used by Clinicians, the Health Facility Heads, Data Entry Clerks, & the HMIS officers. Patient information is encoded in SmartCare by either Clinicians or Data Entry Clerks depending on their allowed role security which defines the module, they get access to. Data could be encoded and/or viewed either while the Patient is within the health facility or after the patent has left (30).

2.4.3 SmartCare Current Status in Ethiopia

More recently, Ethiopia has seen a significant deployment of the SmartCare system used in Zambia. This electronic health record system supports longitudinal recordkeeping for a clinical care, especially for HIV/AIDS treatment, TB care, VCT, and antenatal care.

The system is being rolled out nationally and provides clinical decision support and data portability via the use of smart cards (31).

2.4.4 Why SmartCare in Ethiopia?

The reason why Ministry of Health decided SmartCare to be an official Patient Registration System in Ethiopia is because of the following benefits (28):

- Simultaneous, remote access to patient data
- Legibility of record
- Safer data
- Patient data confidentiality
- Flexible data layout
- Integration with other information resources
- Incorporation of electronic data
- Continuous data processing
- Assisted search
- Greater range of data output modalities
- Tailored paper output
- Availability of up to date patient information

2.4.5 SmartCare Modules and Components

SmartCare electronic health record system in Ethiopia is made up of five main modules and three main components:

1. Disease prevention and control (CDC) module
2. Family health module
3. Registration module
4. Laboratory module
5. Pharmacy module

These modules have the following components:-

- Individual Patient Data Entry (Clinical Interactions)
- Data Aggregation (Analysis, Reporting & Use)
- System Administration (integrity, security, confidentiality)

These components can be seen in three different categories based on their application and importance, these are:

- **Epidemiological & Public health importance** of the software includes those features such as: Integrated Smart Card Function, Data Mapping /GIS, Processing & Outputs and Computations & Graphing
- **Clinical importance** of the software includes those features such as:

Service Integration within the facility (laboratory, pharmacy, prescription & scheduling)

Record Summaries for each individual clinical visit; Incorporated Dictionaries such as prebuilt clinical templates for documenting, diagnosis, procedure, history & assessment; Referral management, Clinical Decision Support, and;

- **Administration Features** include: Assisted Searching, Simultaneous & Remote Data Access Data Merge & Aggregation

The following screenshots are taken for the system that is customized for Ras Desta Hospital in Addis Ababa, Ethiopia

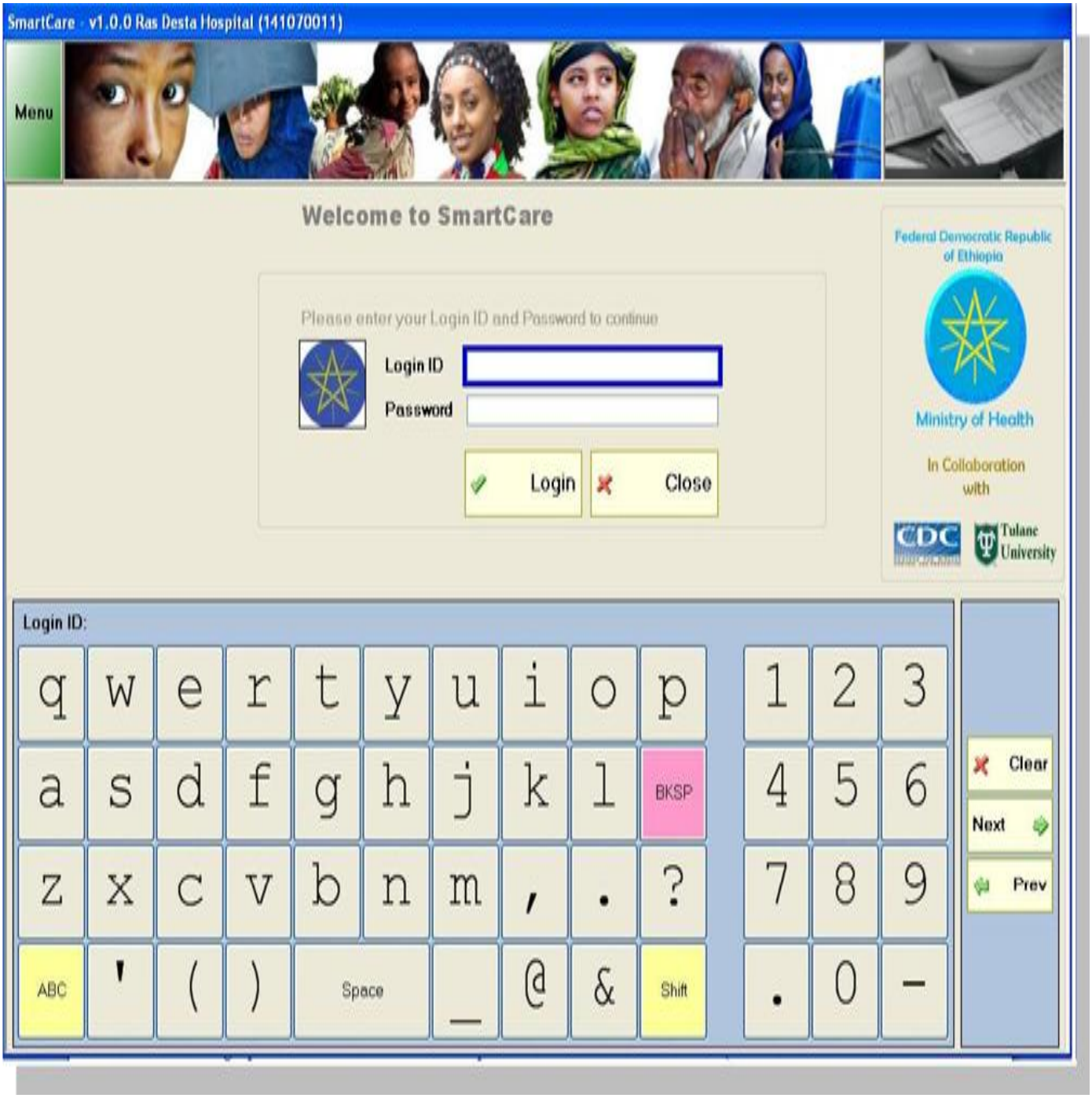


Fig. 2.1 Login Screen. This is the main page for users' login. Inputs can be entered with touch screen, mouse and keyboard.

Fig.2.2.**Modules**: The main screen with menus that helps to navigate through the entire system.

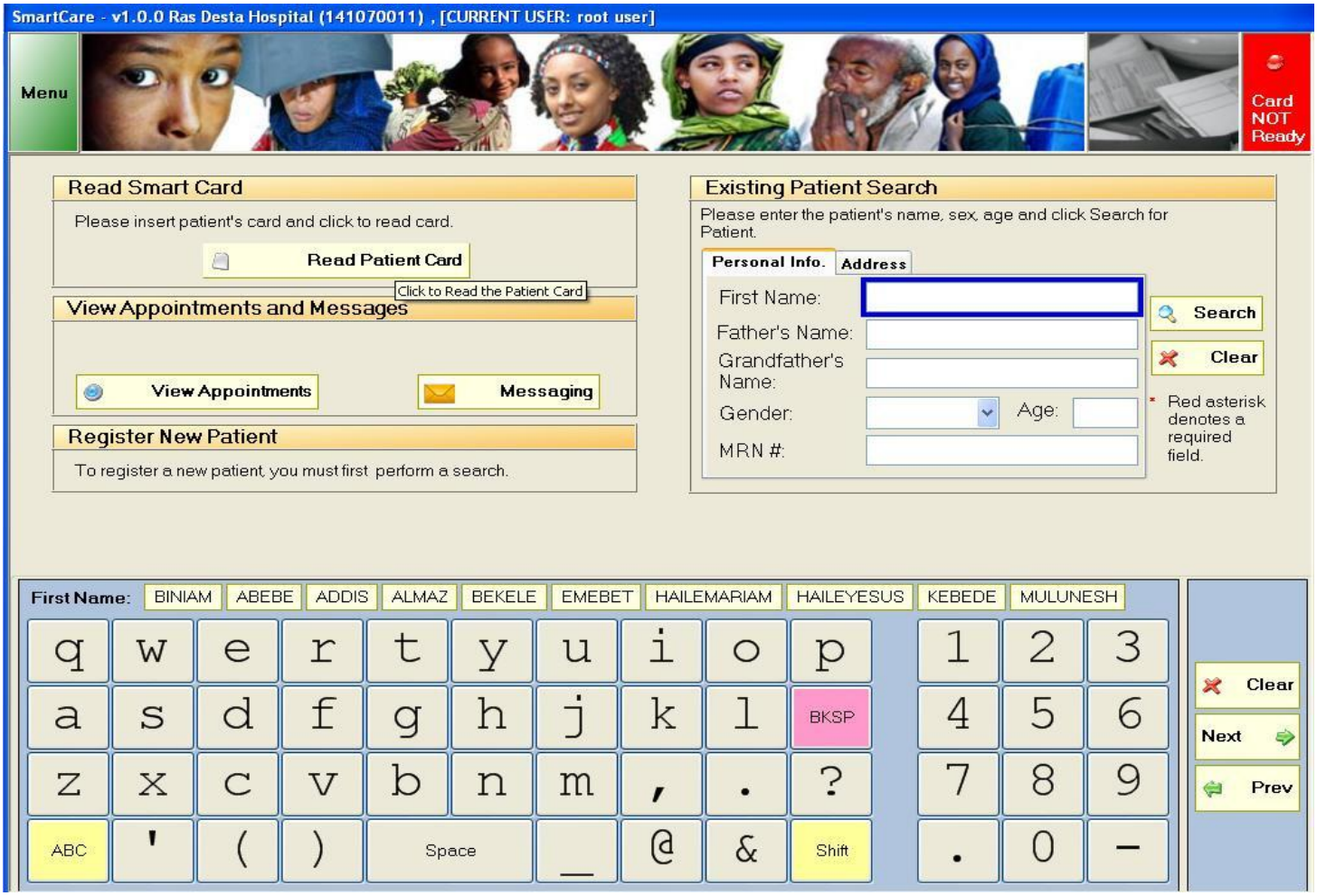


Fig.2.3 **Search/Register Patient form**. This window helps to search existing patient either with their smartcard or using name as a search term. It is also possible to register a new patient.

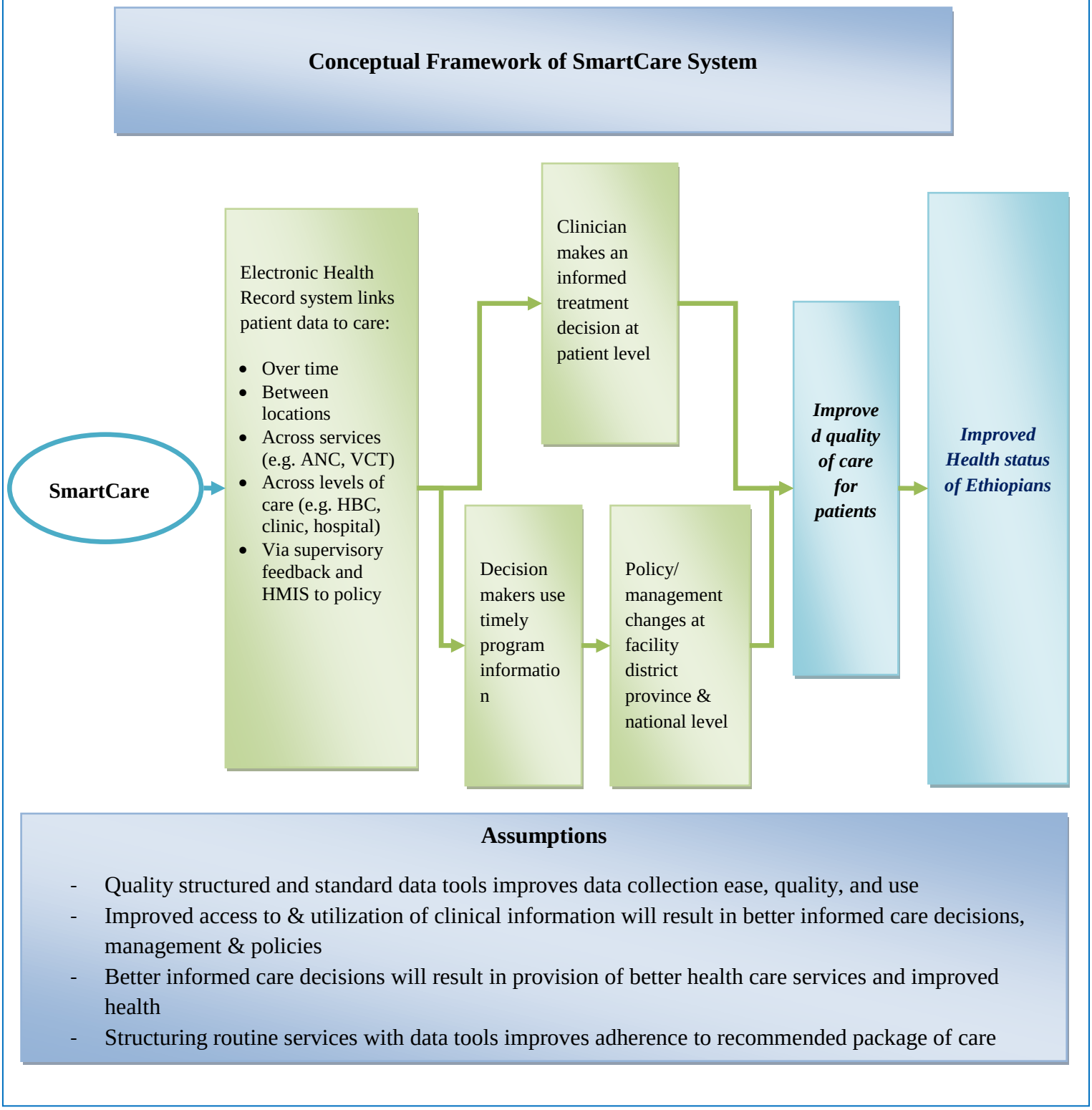


Figure 2.4 SmartCare Conceptual Framework

Courtesy: SmartCare Procedures Manual (17th August, 2007), Ministry of Health, Zambia

2.4 Theoretical Background of Technology Adoption

This section provides the necessary justification: the theory and previous research for this analysis will conclude with the development of the hypotheses that will link the theories and models discussed herein.

Researchers in the field of Information Systems and Technology have for long been interested in investigating the theories and models that have the power in predicting and explaining behavior. Several researches have focused on identifying the determinants of intention to use a technology and therefore employed intention–based theories, using behavioral intention to predict usage (34).

The following sections briefly introduce each of the theories most employed in the studies of technology adoption by healthcare professionals.

Various models were developed, such as the Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM). Each model has its own independent and dependent factors for user acceptance and there are some overlaps (32-33).

TAM has received extensive support through validations, applications and replications for its power to predict use of Information Systems (IS) and is considered to be the most robust and influential model explaining IS adoption behavior (34). On the other hand, it has been found that TAM excludes some important sources of variance and does not consider challenges such as time or money constraints as factors that would prevent an individual from using an information system. Also, TAM has failed to provide meaningful information about the user acceptance of a particular technology due to its generality (35). Accordingly; a number of modified TAM models were proposed which are applicable to contemporary technologies (36-37). However, researchers are confronted with a choice among a multitude of models. Hence, a new model was developed to address these limitations, which is named as the Unified Theory of Acceptance and Use of Technology (UTAUT) model and the aim of the model was to understand intention/usage as the dependent variable (32).As mentioned above numerous studies have examined technology acceptance and adoption since this area of research emerged during the 1970s, with researchers building on the results of others, and culminating in the development of the Unified Theory of Acceptance and Usage of technology (UTAUT).

The UTAUT model consists of eight theoretical models: the theory of reasoned action, the technology acceptance model (34), the motivational model (38), the theory of planned behavior (39), a model combining the technology acceptance model and the theory of planned behavior (40), the model of PC utilization (41), the innovation diffusion theory (42), & social cognitive theory (43). Combining the insights from the literature, these eight models which are used to analyze user's acceptance of or intention to use technology are summarized in the table below.

Technology Acceptance Models and Theories of Individual Acceptance

Table 2.1 Theory of Reasoned Action (TRA)

Drawn from social psychology, been used to predict wide range of behaviors, one of most fundamental and influential theories of human behavior (33)

Core constructs		Definition
	Attitude Toward Behavior	"An individual's positive or negative feelings (evaluative affect) about performing the target behavior".
	Subjective Norm	"The person's perception that most people who are important to her/ him think s/he should or should not perform the behavior in question".

Table 2.2 Technology Acceptance Model (TAM/TAM2)

Tailored towards information systems context, designed to predict information technology acceptance and usage on the job, TAM2 extended TAM by including subjective norm as an additional predictor of intention in case of mandatory settings (34)

core constructs	Perceived Usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance" .
	Perceived Ease of Use	"The degree to which a person believes that using particular system would be free of effort".
	Subjective Norm	Adapted from TRA/TPB. Included in TAM2 only.

Table 2.3 Motivational Model

Applies motivational theory to understand new technology adoption and use within information systems domain (38)

Core constructs	Extrinsic Motivation	The perception that users will want to perform an activity "because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, Such as improved job performance, pay, or promotions" ibid.
	Intrinsic Motivation	The perception that users will want to perform an activity "for no apparent reinforcement other than process of performing the activity per se" ibid.

Table 2.4 Theory of Planned Behavior (TPB)

Adds construct, perceived behavioral control, to TRA, to predict intention and behavior, has been successfully applied to understanding of individual acceptance and usage of many different technologies (39)

Core constructs	Attitude Toward Behavior	Adapted from TRA.
	Subjective Norm	Adapted from TRA.
	Perceived Behavioral Control	"The perceived ease or difficulty of performing the behavior". In the context of IS research, "perceptions of internal and external constraints on behavior" (40).

Table 2.5 Combined TAM and TPB (C-TAM-TPB)

Combines predictors of TPB with perceived usefulness from TAM to provide a hybrid model (40)

Table 2.6 Model of PC Utilization (MPCU)

Used for information systems contexts, used to predict PC utilization, individual acceptance, and use of a range of information technologies (41)

Core constructs	Job–fit	"The extent to which an individual believes that using [a technology] can enhance the performance of his or her job".
	Complexity	Based on Rogers and Shoemaker (44), "the degree to which an innovation is perceived as relatively difficult to understand and use".
	Long–term Consequences	"Outcomes that have a pay–off in the future".
	Affect Toward Use	Based on Triandis (45), affect toward use is "feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act".

	Social Factors	Derived from Triandis (45), social factors are "the individual's internationalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations" (46).
	Facilitating Conditions	Objective factors in the environment that observers agree make an act easy to accomplish. In an IS context, "provision of support for users of PCs may be one type of facilitating condition that can influence system utilization" (47).

Table 2.7 Innovation Diffusion Theory (IDT)

Core constructs	Used to study individual technology acceptance (48)	
	Relative Advantage	"The degree to which an innovation is perceived to be better than the idea it supersedes".
	Compatibility	"The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters".
	Complexity	"The degree to which an innovation is perceived as relatively difficult to understand and use" .
	Trialability	"The degree to which an innovation may be experimented with on a limited basis".
	Observability	"The degree to which the results of an innovation are visible to others".

Table 2.8 Social Cognitive Theory (SCT)

Core constructs	Used to study performance, acceptance, and use of information technology in context of computer utilization (43)	
	Outcome Expectations–Performance	The performance–related consequence of the behavior. Specifically, performance expectations deal with job–related outcomes.
	Outcome Expectations – Personal	The personal consequence of the behavior. Specifically personal expectations deal with the individual esteem & sense of accomplishment.
	Self–efficacy	Judgment of one's ability to use a technology (e.g., computer) to accomplish a particular job or task.
	Affect	An individual likes for a particular behavior.
	Anxiety	Evoking anxious or emotional reactions when it comes to performing a behavior.

The UTAUT model combines the previous eight theoretical models and is made up of four key factors that act as determinants of behavioral intentions and usage behavior. Also, UTAUT posits the role of four key moderator variables (Age, Sex, Experience, and Voluntariness of use). Moreover, UTAUT model has been found to be preferred to the aforementioned theoretical models as it is able to account for a high percentage of the variance (R2) in usage intention (32).

Venkatesh et al. (32) have tested the unified theoretical model in four different organizational settings for a period of six months and the study showed significant predicts intention (performance expectancy, effort expectancy, social influence, and facilitating conditions).

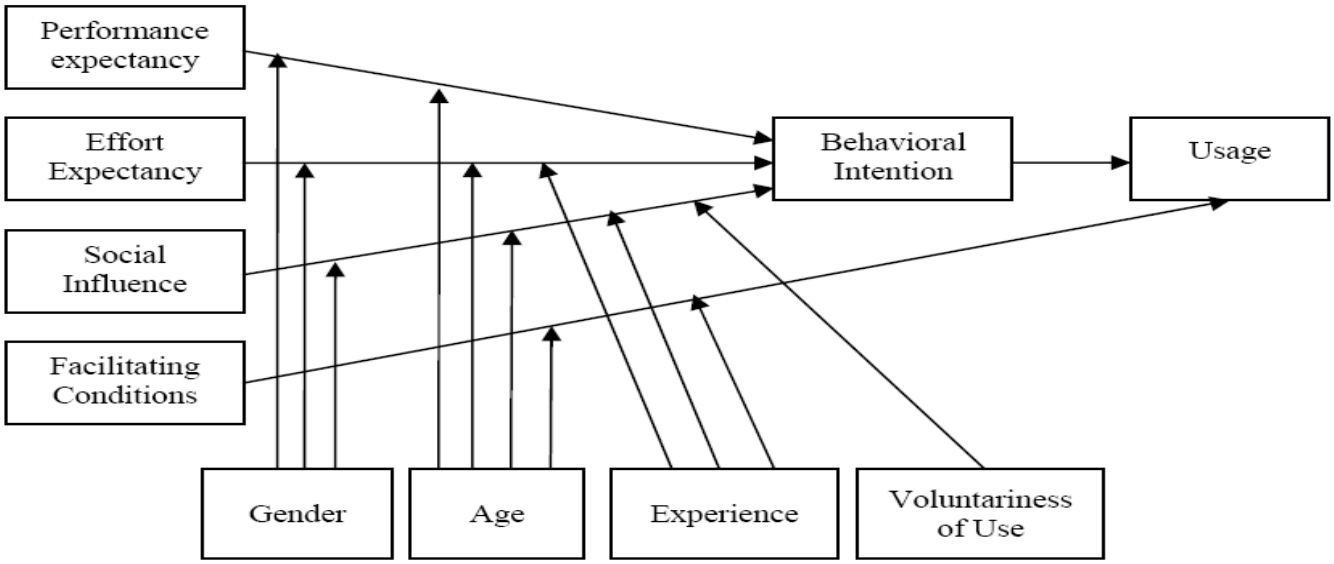


Figure 2.5 UTAUT (32)

According to Venkatesh et al. (32), UTAUT is a definitive model that synthesizes what is known. By encompassing the combined explanatory power of the individual models and considering key moderating influences, UTAUT advances cumulative theory while retaining a parsimonious structure (ibid). The definition and core constructs of UTAUT are explained in Table 2.9.

Schaper and Pervan (49) have empirically tested UTAUT for examining the technology acceptance and utilization by occupational therapists. Chang et al. (50) also used UTAUT to explore the factors affecting Physicians' acceptance of pharmacokinetics–based clinical decision support systems.

Table 2.9 UTAUT

Unified Theory of acceptance and Use of Technology (UTAUT)	
Venkatesh et al. (32) combined the views of user acceptance from eight previously established theoretical models to formulate four core determinants of key relationship and proposed a unified model called Unified Theory of Acceptance and Use of Technology (UTAUT) to predict user intentions to use IT. This model has been successfully employed in many technology adoption studies and has provided a useful tool for managers to assess the success of new IT introductions (50).	
Core Constructs	**Definitions**
Performance Expectancy	"The degree to which an individual believes that using the system will help him or her to attain gains in job performance" (32).
Effort Expectancy	"The degree of ease associated with the use of the system" (32).
Social Influence	"The degree to which an individual perceives that important others believe he or she should use the new system" (32).
Facilitating Conditions	"The degree to which an Individual believes that an organizational and technical infrastructure exists to support use of the system" (32).

Table 2.10 UTAUT Model Constructs(32)

New Construct Name	Model	Old Construct Name
Performance Expectancy	TAM, Combined TAM-TPB, Motivation Model	Perceived Usefulness
	PC Utilization Job Fit	Job Fit
	Innovation Diffusion Theory Relative Advantage	Relative Advantage
	Social Cognitive Theory Outcome Expectations	Outcome Expectations
Effort Expectancy	TAM, Combined TAM-TPB, Motivation Model	Perceived Ease of Use
	PC Utilization	Complexity
	Innovation Diffusion Theory	Ease of Use
Social Influence	Theory of Reasoned Action, TPB, Combined TAM-PB	Subjective Norm
	PC Utilization	Social Factors
	Innovation Diffusion Theory	Image
Facilitating Conditions	TPB & Combined TAM-TPB	Perceived Behavioral Control
	PC Utilization	Facilitating Conditions
	Innovation Diffusion Theory	Compatibility
Attitude	Theory of Reasoned Action, TPB, & Combined TAM-TPB	Attitude Toward Behavior
	Motivation Model	Intrinsic Motivation
	PC Utilization	Affect Toward Use

2.5 Conceptual Model and Research Hypothesis

Based on the aforementioned literature, this study proposes the following hypothesis and conceptual model.

Prior research primarily based on the UTAUT model (32) by Hu et al. (22) stated that technology acceptance has three dimensions: 1) characteristics of the individual; 2) characteristics of the technology and 3) characteristics of organizational context. Following this concept, Chau & Hu (51) proposed a framework suggesting that an individual's acceptance behavior is influenced by factors pertaining to the individual context, the technological context and the implementation context. The characteristics of individual users are grouped within the individual context; the technological context refers to the characteristics of the technology itself; while the implementation context refers to the specific professional environment of the user. Chau & Hu's (51) framework was applied to the acceptance of telemedicine amongst physicians and was adapted for this research due to its applicability to acceptance within the health sector.

2.5.1 Rationale for the Theoretical Model

There are several reasons for using the UTAUT model instead of other user acceptance theories. The major one is the fact that the UTAUT model is a multi-dimensional theory. Most of the other user acceptance theories explain particular constructs and do not take into account several other important constructs (32). This issue was clearly identified in the Venkatesh et al.'s study and the reasons for creating a unified theory were justified. The strength of UTAUT in explaining variance also gives favorable support to this theory. In general, user acceptance theories explain between 15 to 50% of the variance in intention by the independent variables, whereas UTAUT explains up to 70% of the variance in intention by independent variables (46).Therefore, the UTAUT includes more factors affecting the intention of the behavior. It comes to fill the deficiencies of the other models and theories and combines them. Yet, UTAUT is the most all-encompassing IT adoption theory.

In order to identify the factors influencing the intention to adopt SmartCare Software, this study enriched UTAUT by adding two other constructs as direct antecedents of behavioral intention which were: Attitude towards Computer and Personal Innovativeness in IT. Figure 2-6 shows the graphical model of the proposed research model.

The proposed model posits that performance expectancy, effort expectancy and social influence all have a significant impact on intention to use SmartCare software. Furthermore, intention to use and facilitating conditions both have significant influence on use behavior (SmartCare software utilization). In this study, demographic variables sex and age are used to explain the differences between adopters and non-adopters of technology, in this case SmartCare software. The following subsections provide descriptions of each construct along with the theoretical justification for including them in the conceptual model and the associated hypotheses. Hypotheses 1, 2,3,4 and 7-14 were proposed based on UTAUT model (32), While Hypotheses 5 and 6 were the contributions of this study, which were chosen based on the results of previous empirical studies and literature review (48, 52).

➢ **Performance expectancy** is defined as the degree to which individuals believe that using a system will help them improve their job performance and contains five variables: Performance Expectancy, extrinsic motivation, job-fit, relative advantage, and outcome expectations (32). To explain performance expectancy toward intention to use SmartCare software, the following hypothesis is proposed:

H1: *Performance expectancy will have a positive influence on behavioral intentions to use SmartCare Software.*

➢ **Effort expectancy** is the degree of ease associated with the use of the system (32). Venkatesh et al., identify three constructs from the eight models that make up the concept of effort expectancy: perceived ease of use, complexity, and ease of use. Additionally, Marchewka et. al., (53) claimed that this construct can be significant in determining user acceptance of information technology. In this research, effort expectancy is measured by the perceptions of ease of use of SmartCare software as well as ease of learning how to use these services. Therefore, the researcher proposes the following hypothesis:

H2: *Effort expectancy will have a positive influence on behavioral intentions to use SmartCare Software*

➢ **Social influence** is "the degree to which peers influence use of the system, whether positive or negative, it is a very main factor in many aspects of the lives of young people and is likely to be powerful (32). Relevant references, such as citizen's family, colleagues and friends may have an influence on individuals' decisions (45). Venkatesh *et al., (ibid)* integrated subjective

norms in TRA, TAM2, and TPB, social factors in MPCU, and image in IDT into the social influence factor. This study assumes that if SmartCare software adopters are influenced with positive messages by their social networks, they are more likely to have a strong behavioral intention to adopt the SmartCare software. Thus, the investigator proposes the following hypothesis:

H3*: Social Influence will have a positive influence on behavioral intentions to use SmartCare Software.*

- **Facilitating conditions**

Organizational facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system (32). This incorporates objective factors in the implementation context such as management support, training, and the provision of computer support.

The UTAUT model revealed the insignificance of facilitating conditions in predicting behavioral intention when both performance expectancy and effort expectancy constructs are present in the model (32). However, the latter's findings indicate the influence of organizational facilitating conditions on actual usage and not on behavioral intention. Facilitating factors may be an important factor in developing countries for behavioral intention in developing countries as less support resources are available in this environment.

To explain facilitating conditions toward behavior of *SmartCare Software*, the following hypothesis is proposed:

H4*: Facilitating conditions will have a positive influence on SmartCare Software usage behavior.*

- **Attitude towards SmartCare Software.**

Attitude toward a behavior is defined as an individual's positive or negative evaluation of performing the behavior. It involves an individual's judgment that performing a behavior is good or bad and also a general evaluation that an individual is inclined or disinclined to perform the behavior (54).

The relationship between an individuals' attitude towards certain behavior and one's intention to perform that behavior originates from Fishbein and Ajzen's Theory of Reasoned Action (33), in which it was defined as "an individual's positive or negative feelings about performing the target

behavior" (33). The attitude construct has later also been included in the Theory of Planned Behavior (39) and in the first version of TAM (34). It was expected that the more favorable the attitude towards the target behavior, the stronger the intention will be.

According to Fishbein and Ajzen (54), "attitude is a learned predisposition to respond in a consistently favorable or unfavorable manner with a given object." Attitude is directly related to behavioral intention and adoption because people will only intend to perform behavior for which they have positive feelings (ibid).

Attitude towards computers was found to play a critical role in the technology acceptance decisions of physicians (55), acting as the second most important determinant of acceptance. Attitude was also found to be a direct predictor of behavioral intent in nursing staff. Measuring attitudes toward an information system can predict individual reactions toward the new system Thus, considering the abovementioned findings; the investigator proposes the following hypothesis:

H5: *Attitude towards computers will positively affect the intensity of health workers' behavioral intention to use SmartCare Software.*

- **Personal Innovativeness in IT**

The concept of personal innovativeness is derived from Rogers' Innovation Diffusion Theory (1995) and is seen as a person's tendency to innovate, which is strongly related to one's willingness to adopt an innovation. Being sensitive to new products or services determines whether someone is socially active and is more highly connected through social and professional networks. Based on the strength of this tendency, Rogers defined five different adopter categories. The first and fastest group of adopters contains innovators, followed by early adopters, the early majority, the late majority, and laggards. Innovation adoption and diffusion is extremely relevant in the field of I(C)T, since the success of a product or service depends on the extent to which it is accepted by the community. Agarwal and Prasad (1998) translated Rogers' ideas into the concept "Personal Innovativeness in IT", or PIIT. According to Rogers, individuals with high personal innovativeness are not only more likely to experiment with new things, they also have a greater ability to control uncertainty and deal with risk. Consequently, these individuals might find it easier to perform certain behavior than those who are less eager to experiment.

In general innovation diffusion research, it has long been recognized that highly innovative individuals are active information seekers about new ideas (56). They are able to cope with

high levels of uncertainty and develop more positive intentions toward acceptance (48). Over the years, only a few studies really integrated personal traits into technology acceptance research and even fewer into intention to adopt IT/IS innovations.

Agarwal and Prasad (57) believe that most proximate influence on an individual's cognitive interpretations of IT is factors related to the individual. They described personal innovativeness as symbolizing the risk–taking propensity that exists in certain individuals and not in others. They named this influential personal trait variable on technology innovation adoption behaviors Personal Innovativeness in Information Technology (PIIT) or simply Personal Innovativeness (PI).

Lu et al. (56) note that, for adoption of an IT/IS innovation such as SmartCare software, most people do not have any or much knowledge and experience to help them form clear perception beliefs. Sheer boldness and curiosity in their characters may not only strongly amplify their perception of potential benefits, but also heighten their confidence in their capabilities to handle the technology under adoption (56). Meanwhile, because individuals with higher PIIT tend to be more risk–taking, it is also reasonable to expect them to develop more positive intentions toward the use of SmartCare software. Therefore this study enhanced the understanding of the factors affecting the adoption of SmartCare software by using an extended model of UTAUT and taking into consideration the important concept of personal innovativeness in IT. The theoretical justification for testing this concept came from the statement that "Individuals with high PIIT are likely to be impulsive by nature and may not think through the reasons and implications for their actions. In other words, they may "dive in" and try the technology due to their curious and risk–taking nature, and not necessarily base their decision on the concrete advantages for doing so" (57). This suggested that PIIT as a construct was as important as relative advantage (performance expectancy) and other perceptions (effort expectancy) in directly predicting behavioral intentions (58).Considering the aforementioned contributions of PIIT; the investigator proposes the following hypothesis:

H6: *Personal innovativeness in IT positively influences health workers' behavioral intention to use SmartCare software.*

Behavioral Intention

Behavioral intention is defined as a customer's intention to adopt and make use of a certain tool in the future (32, 39). According to Irani *et al.*, (45), the majority of technology adoption researches have utilized behavior intention to predict technology adoption. Also, Ajzen (39) suggests that behavioral intention is counted to have a direct influence on adoption. The measurement of behavioral intention includes the intention, and predicted use of, e-government services. To explain behavioral intention toward behavior of *SmartCare software* use, the following hypothesis is proposed:

H7: *Behavioral intentions to use SmartCare software will have a positive influence on SmartCare software usage behavior.*

Individual Characteristics

Venkatesh et al. (59) considered several demographic or individual difference variables in their model development. They found that age, sex and experience moderated the influence of the four primary model components on behavioral intention. Specifically, PE was moderated by sex and age such that the effect was stronger for men and particularly younger men; EE was moderated by sex, age and experience, such that the effect was stronger for women, particularly older women, and particularly at early stages of experience; SI was moderated by sex, age and experience such that effect was stronger for women, particularly older women, and particularly in early stages of experience; and finally, FC was moderated by age and experience.

Hypothesizing the moderating effects of voluntariness and experience was not feasible in this study therefore, among the four moderators included in UTAUT only sex and age were mentioned in the proposed research model. The reason to this was that firstly, as argued previously, in all of the study hospitals which had implemented HMIS supporting SmartCare software, health workers were not forced to use it, thus this research was conducted under voluntary setting. Secondly, this research investigated the factors influencing the health workers intention to use EMR- SmartCare software, only in one period of time, and the effect of experience in using the system could not be verified as the study was cross sectional.

For performance expectancy (PE), effort expectancy (EE) and social influence (SI) which were the antecedents of behavioral intention(BI) both sex and age, and for facilitating conditions(FC), age were hypothesized as moderators, exactly as it was done in UTAUT.

H8: *The influence of performance expectancy on health workers behavioral intention to use SmartCare software will be moderated by sex, such that the effect will be stronger for men.*

H9: *The influence of performance expectancy on health workers behavioral intention to use SmartCare software will be moderated by age, such that the effect will be stronger for younger users.*

H10: *The influence of effort expectancy on health workers behavioral intention to use SmartCare software will be moderated by sex, such that the effect will be stronger for women.*

H11: *The influence of effort expectancy on health workers behavioral intention to use SmartCare software will be moderated by age, such that the effect will be stronger for younger users.*

H12: *The influence of social influence on health workers behavioral intention to use SmartCare software will be moderated by sex, such that the effect will be stronger for women.*

H13: *The influence of social influence on health workers behavioral intention to use SmartCare software will be moderated by age, such that the effect will be stronger for older users.*

H14: *The influence of facilitating conditions on health workers behavioral intention to use SmartCare software will be moderated by age, such that the effect will be stronger for older users.*

To summarize, the factors (domains) proposed in the following model can be categorized as:

Personal Factors/Individual Context

Universal personal factors include cognitive, affective, and biologic variables that may influence a person's behavior or decision to change a behavior. In this study, the following constructs fall into this category: age, gender, education level, work experience, computer experience, attitude, and personal innovativeness in IT.

Environmental Factors/Implementation Context

Environmental factors are defined as social and physical conditions that may influence a person's behavior or decision to change a behavior. In this study Environmental factors include: social influence and facilitating conditions.

Technology Factors/Context

Technology factors are included within environmental factors, but are specific to the influence that the technology has on the person's behavior or decision to change a behavior. Technology was distinguished from environmental factors in an attempt to get a clearer picture of the influence that its various characteristics have on the outcome of behavioral intention and use behavior. In this study, technology factors include: Performance expectancy and effort expectancy

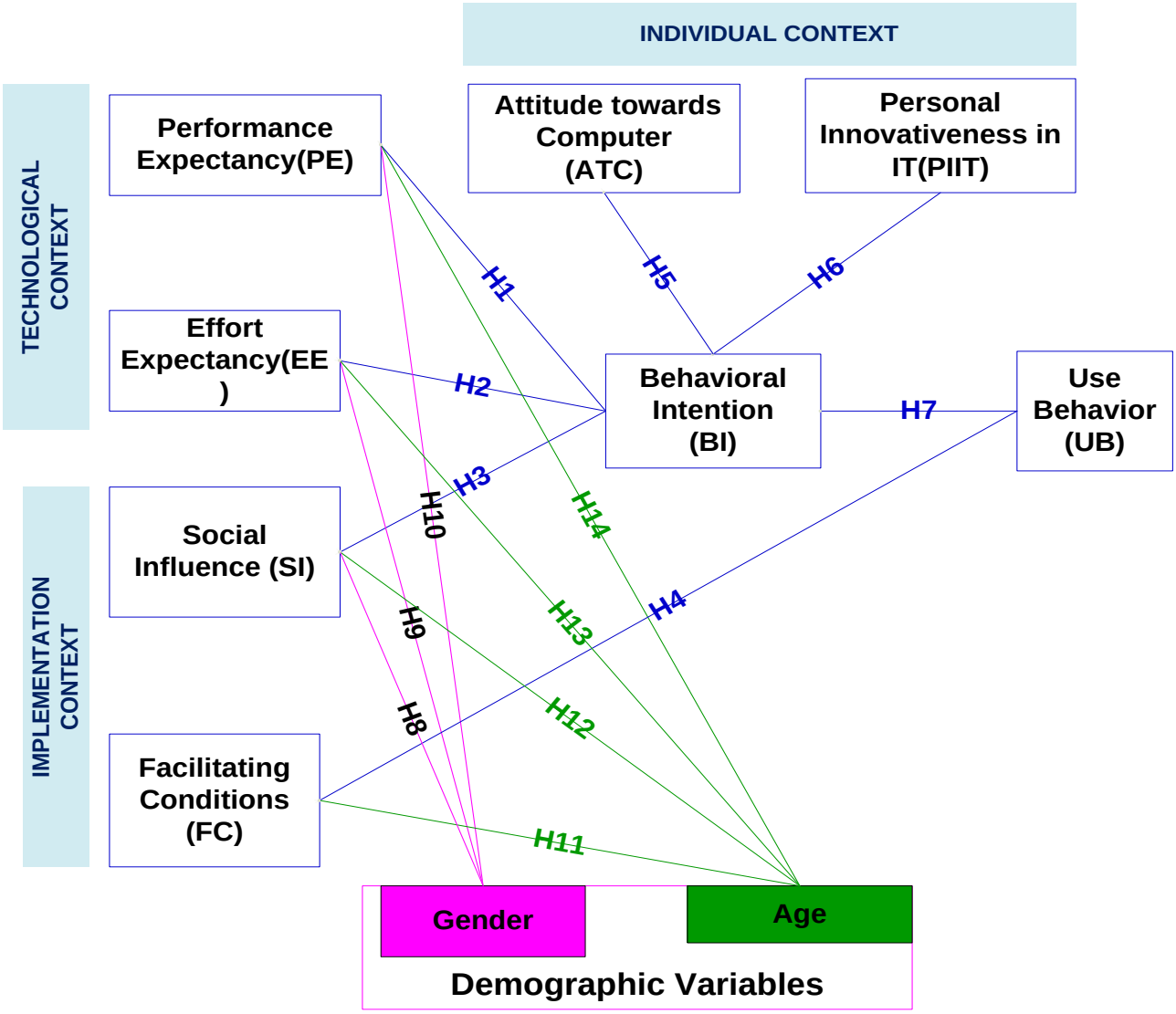


Figure 2.6 Proposed Research Model :

CHAPTER THREE

3. OBJECTIVE OF THE STUDY:

3.1 General Objective

The general objective of this study is to **identify** and **measure** factors that would influence health workers adoption & utilization pattern of SmartCare software in public Hospitals of Addis Ababa City Administration.

3.2 Specific Objectives:

1. To investigate the factors that affects the actual usage behavior among health workers in public hospitals of Addis Ababa City Administration.

2. To examine the level of health workers usage status of SmartCare software in the selected hospitals.

3. To find out the factors influencing health workers **behavioral intention** to accept and utilize SmartCare software in public Hospitals of Addis Ababa City Administration.

4. To test the UTUAT model in the healthcare industry

CHAPTER FOUR

4. METHODOLOGY:

4.1 Study setting

This study was conducted in Addis Ababa public hospitals, namely Menelik II, Ras Desta Memorial, Gandi Memorial, Yekatit 12 and Zewuditu Hospitals.

4.2. Study period

The study was conducted from January - May 2013.

4.3. Study design

The study used was a cross-sectional descriptive study using a quantitative approach. Self-administered questionnaires were employed with health workers working in Addis Ababa public hospitals to see factors affecting the utilization of SmartCare software.

4. 4. Source population

The source population for this study was all health professionals working in Addis Ababa city administrative public hospitals namely Menelik-II, Yekatit-12, Zewuditu, Ras Desta Damtew and Ghandi Memorial hospitals.

4.5 Study population

The study population was health workers who have SmartCare software training (physicians, nurses, health officers, and pharmacy, laboratory & radiography professionals) working in the selected hospitals.

4.5.1 Inclusion criteria

Health workers who have taken SmartCare software utilization trainings, who were willing to participate in the study and who were working in those hospitals having implemented SmartCare software at least for one year.

4.5.2 Exclusive criteria: health workers who haven't taken SmartCare software training and those professionals whose service year is below one year were excluded from the study.

4.6 Sample size Determination

For the quantitative determination factors affecting SmartCare software utilization, the sample size was calculated using single population proportion formula. Since there was no related study conducted on factors influencing SmartCare software adoption in Addis Ababa public hospitals, an assumption of 50 % utilization was taken. An assumption also made any particular outcome to be with 5% marginal error and 95 % confidence interval of certainty (alpha=0.05) and with a contingency of 10%. Based on these assumptions the actual sample size of the study population was computed using the formula depicted below:

$$n = Z_{(\alpha/2)}^2 \frac{P(1-p)}{d^2}$$

n=number of study subject

Z (α/2) =1.96(critical value)

(d) =0.05 precision (marginal error)

P=proportion of SmartCare software adopters

Thus **n**= $\frac{(1.96)^2(0.5)(1-0.5)}{(0.05)^2}$ =  384

But, since the size of the source population was less than 10,000 the sample size was corrected using the formula:

Corrected sample size = $\frac{\mathbf{nxN}}{\mathbf{n+N}}$

Where:

• n is the non-corrected sample size

• N is the size of the source population

Thus = $\frac{384x1253}{384+1253}$  Sample size =294

Non response rate = 10 % x 294 = 29

Total sample size=294+29= **323**

This sample size is further divided among hospitals included based on proportion to population size.

4.7 Sampling method

A simple random sampling method was used to select the study subjects. The list of all health professionals working in the hospitals were used to make the sampling frame. A total 323 health workers from 5 Regional public hospitals in Addis Ababa were included in the study. (Fig.3.1)

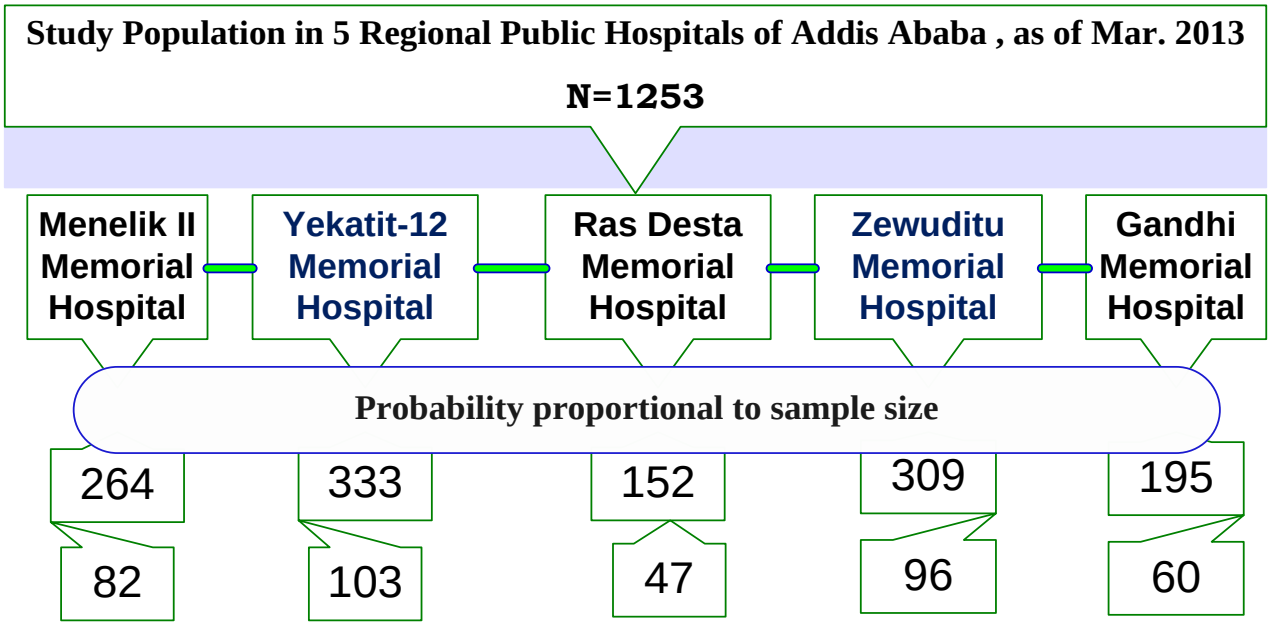


Figure 3.1 Schematic presentation of sampling procedures

4.8. Data Collection

Standard structured questionnaires encompassing all the variables of interest were used. The questionnaire offered a brief explanation of the purpose of the research to the participants and participation was purely on a voluntary basis. Participants were asked to volunteer during the study term and those who consented were given questionnaires. The questionnaires were completed in an environment free from external pressures and at the respondents own pace. The questionnaires were distributed in the English language. The respondents were asked to respond to the questions based on their perceptions and understanding. They were given strict guarantees of anonymity regarding the collected data, and an assurance that their responses were for academic research purposes only.323 copies of the questionnaires were randomly distributed on different wards in the five public hospitals of Addis Ababa city administration. Questionnaires were handpicked from the hospitals in-charges over the period.

4.9. Pre-test

Although validated by prior research, the adopted instrument was examined to ensure content validity and reliability within the targeted context. Instrument validation or re-validation is necessary because its validity may not be persistent across different technologies and user groups (61).

The objective of pretesting was to test the adequacy of the research instrument and to uncover potential problems if any for the main study. Comments and suggestions were considered in developing and revising the final copy of the questionnaire used in this survey.

Reliability and validity tests were used as the key determinants for the usefulness of the research instrument. Using SPSS version-20.0, Chronbach's alpha reliability coefficients were computed to determine internal consistency of all research constructs (latent variable scales). Because reliability should be above .70 (62), the results indicate excellent scale reliability for all constructs and an overall Cronbach's alpha of >0.78 was obtained.

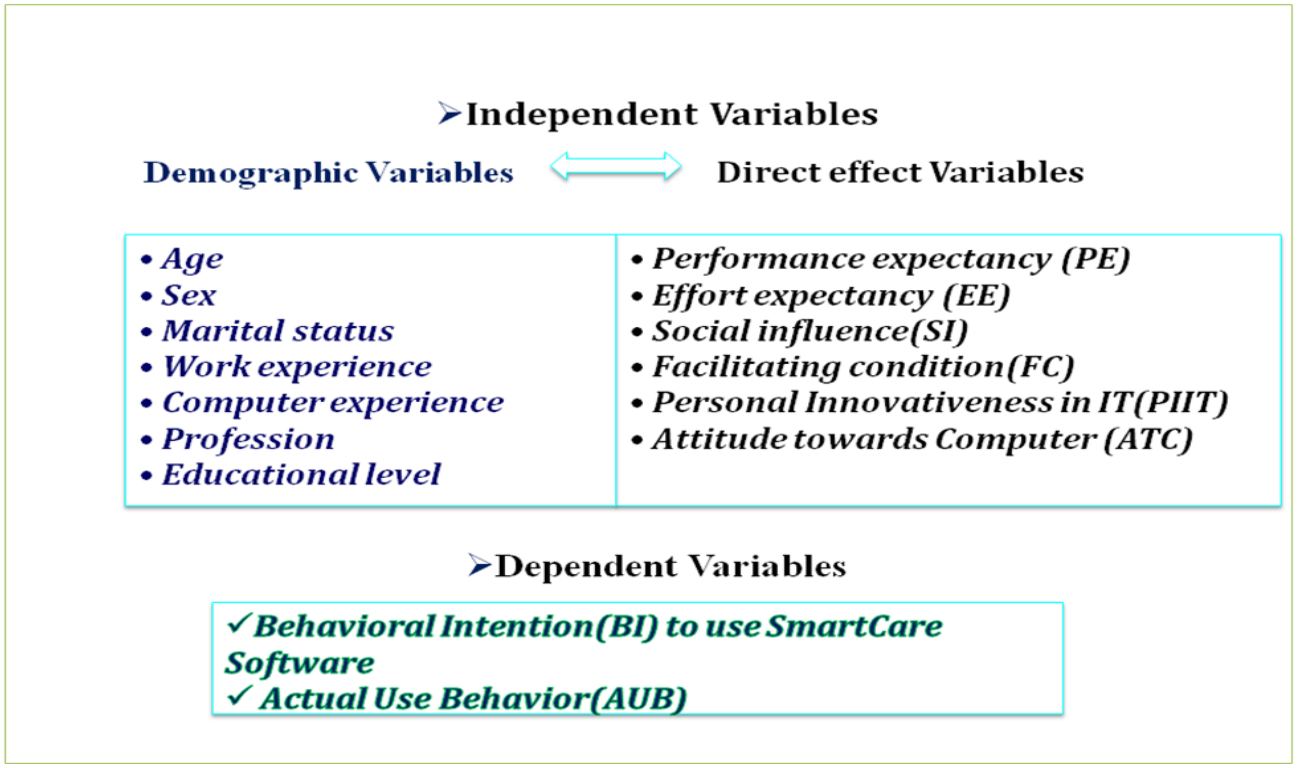
4.10. Data Processing and Presentation

Data were initially entered and cleaned using SPSS version-20.0 for analysis. Frequency tables, proportions and crosstabs were used for the Descriptive analysis. For presentation, tables and different type of graphs were employed.

Association between independent variables such as demographic variables, Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Attitude towards Computer (ATC) ,Personal Innovativeness in IT (PIIT) and outcome variables of **Behavioral Intention** to use SmartCare software and **Actual Usage Behavior**, were examined using logistic regression when it is appropriate. For multivariate analysis, the necessary adjustment was done for the possible confounding (confusing) factors to identify the predicting factor for usage behavior of SmartCare software. Hence, internal comparison was done based on the adjusted odds ratio. In line with this the significance level was set at p-value = 0.05.

Five data collectors who had experience on facilitation was selected and trained to assist the principal investigator. They were trained for a half day on how to facilitate the data collection process. The principal investigator guided the data collectors throughout the process and ongoing supervision of the data collection process was undertaken and at the end of each data collection day he holds discussion while taking over and checking filled questionnaires for errors.

4.11 Variables of the study



4.12 Data quality assurance

Training and orientation were provided to the data collectors. The data were checked for completeness and daily supervision of the data collectors and review of the collected data was carried out by the principal investigator.

4.13 Ethical consideration

The study was carried out after getting ethical clearance from AAU School of Public Health ethical Review Board and data were collected after obtaining permission from Addis Ababa City Administrative Health Bureau and letter to each study hospital were addressed and informed about the study. Each respondent were informed about the purpose of the study and privacy was maintained during data collection. To increase confidentiality the questionnaire was self administered and verbal informed consent from the respondents was obtained before administering.

4.14 Dissemination Plan

The research output will be disseminated to the studied hospitals, Addis Ababa City Administration Health Bureau and Addis Ababa University.

4.15 Operational definitions

Behavioral Intention A measure of the strength of a person's intention to perform a specified behavior /in this case SmartCare software

Usage Behavior The degree of use of computers at work and at home / is the actual use behavior of the innovation/ in this case SmartCare software usage.

Electronic Health Record (EHR): an electronic record of health related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one health care organization.

Electronic Medical Record (EMR): the electronic record of health related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization.

Health Information Technology (HIT): the acquisition, storage, retrieval, and use of electronic information in a health care setting

Inter operability: the ability of different information technology systems and software applications to communicate to exchange data accurately, effectively and consistently, and to use the information that has been changed

CHAPTER FIVE

5. ANALYSIS AND RESULTS:

5.1 Data Analysis Procedures

Two main techniques of data analysis namely descriptive and multivariate analysis were employed using SPSS version-20.0. The choice of the software was based on its high descriptive and multivariate statistical power for quantitative data analysis. About 323 questionnaires were distributed among health workers available during the data collection period. From the distributed questionnaires 20 of them were discarded due to incompleteness and 303 complete ones were used for which showed a 93.8 % response rate. The good response rate for this study was attributed to the close and frequent follow ups by the principal investigator. (Table: 5.1)

Hospital	Frequency	Percent	Cumulative Percent
Menelik II Hospital	65	21.5	21.5
Yekatit 12 Hospital	82	27.1	48.5
Ras Desta Hospital	37	12.2	60.7
ZewdituHospital	77	25.4	86.1
Ghandi Memorial Hospital	42	13.9	100.0
Total	**303**	**100.0**	

Table5.1: *Total number of Respondents per each hospital of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia*

5.2 Demographic and Descriptive Statistics

5.2.1 Demographic Findings

From the total 303 usable responses used for this study, the demographic characteristic of the respondents is as follows: 138 (45.5%) were females while 165 (54.5%) were males. Regarding the age distribution, majority of respondents 134 (44.2 %) were found in the age group of 26-30, followed by the age group of 21-25 constituting 85 (28.1%) of the total survey of 303 health workers. Regarding the marital status, most of the respondents 186 (61.4%) were found single followed by 108(35.6) who were married. Regarding the experience of the respondents majority of them 127 (41.9%) were found to have an experience of working in health care settings for 2-6 years, followed by those who had the experience between 7 and 11 years at 90 (29.7%).(Table: 5.2)

Variable	Classification	Frequency	Percent
Age	<= 20 yrs	3	1.0
	21 - 25 yrs	85	28.1
	26-30 yrs	134	44.2
	31-35 yrs	28	9.2
	36-40 yrs	22	7.3
	41-45 yrs	11	3.6
	46-50 yrs	8	2.6
	51-55 yrs	5	1.7
	56+ yrs	7	2.3
	Total	**303**	**100.0**
Sex	Female	138	45.5
	Male	165	54.5
	Total	303	100.0
Marital Status	Single	186	61.4
	Married	108	35.6
	Widowed	5	1.7
	Divorced	4	1.3
	Total	**303**	**100.0**
Experience	<= 1yr	40	13.2
	2 - 6 yrs	127	41.9
	7 - 11 yrs	90	29.7
	12 - 16 yrs	12	4.0
	17 - 21 yrs	16	5.3
	22 - 26 yrs	5	1.7
	27 - 31 yrs	7	2.3
	32 - 36 yrs	4	1.3
	37+ yrs	2	.7
	Total	**303**	**100**

Table 5.2: *Demographic characteristic of Respondents, in five hospitals of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia*

When we see the category of respondents by profession based on the survey result 169(55.8%) were Nurses and 33 (10.9) Medical Doctors, followed by 24 (7.9%) Laboratory Technologists (Fig: 5.1).

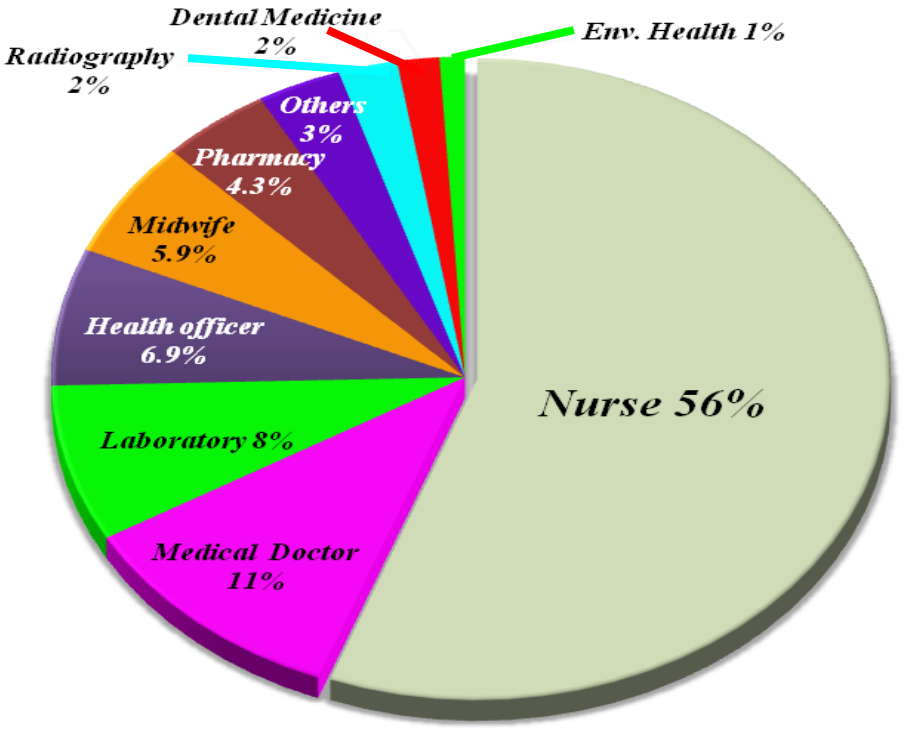


Fig. 5.1: *Distribution of health workers by profession, in five hospitals of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia*

In terms of educational status, the majority of respondents 188 (62%) hold bachelors' degrees, 109 (36%) diplomas and (2%) hold postgraduate degrees /Masters and Specialty Certificate (Fig. 5.2)

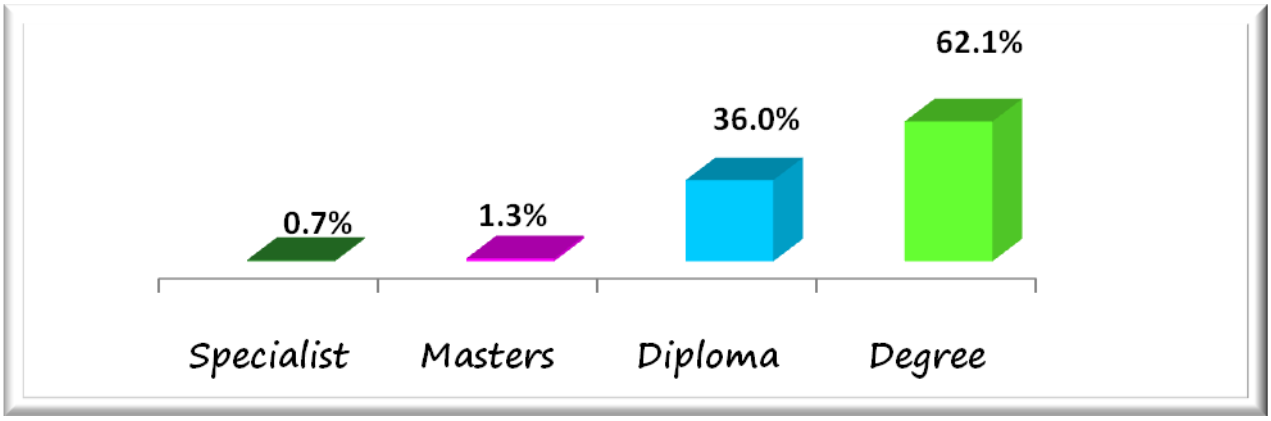


Fig. 5.2: *Distribution of health workers by level of education, in five hospitals of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia*

5.2.2 Work experience with computer use:

The computer using experience of the results revealed that the majority of respondents 248 (81.8%) were found to have the basic computer application (BCA) using experience. This was followed by the internet experience (Email/Face book) group, constituting 210 (69.3%) of the total respondents, and finally the internet experience group of patient medical information (PMI) seeking experience, constituting 162 (53.5 %). On the other hand, the groups with the least internet experience to surf webs (SW) other than the above mentioned purposes consisted of 150 (49.5%) of the total respondents (Table: 5.3).

BCA	***Frequency***	***Percent***
No	55	18.2
Yes	248	**81.8**
Total	*303*	*100.0*
Email/Face book	***Frequency***	***Percent***
No	*93*	*30.7*
Yes	*210*	***69.3***
Total	*303*	*100.0*
PMI	***Frequency***	***Percent***
No	*141*	*46.5*
Yes	*162*	***53.5***
Total	*303*	*100.0*
SW	***Frequency***	***Percent***
No	*153*	*50.5*
Yes	*150*	***49.5***
Total	*303*	*100.0*

Table 5.3: Work experience with computer use: *in five hospitals of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia*

5.3 Socio- Demographic variables with actual usage behavior

In terms of **SmartCare software** adoption behavior in Addis Ababa city administration public hospitals, the results revealed that the majority of respondents 210 (69.3%) were found to be showing use behavior of SmartCare software. In contrast, 93 (30.7%) of the total respondents were non-adopters (Table: 5.4).

use behavior of SmartCare Software by hospitals		Hospital					Total
		Menelik II	Yekatit-12 Memorial	Ras Desta Memorial	Zewditu Memorial	Gandhi Memorial	
No	Count	9	46	5	25	8	93
	% of Total	3.0%	15.2%	1.7%	8.3%	2.6%	30.7%
Yes	Count	56	36	32	52	34	210
	% of Total	**18.5%**	**11.9%**	**10.6%**	**17.2%**	**11.2%**	**69.3%**
Total	Count	65	82	37	77	42	303
	% of Total	21.5%	27.1%	12.2%	25.4%	13.9%	100.0%

Table 5.4: *use behavior of SmartCare Software by hospitals, in five hospitals of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia*

5.3.1 Sex, Age, Education Level and Profession category Vs Adoption status

Of the total adopters 113 (53.8%) were males compared to 97 (46.2%) females. The largest percentage (70%) of the respondents with adoption behavior was between 31 and 40 years. The majority of the respondents with adoption behavior are educated to diploma 131 (69.7%), followed by bachelors' degree of education (36.7%). In comparison to the groups, the majority of non-adopters were reported to have higher levels of education. In regard to professional category majority of the adopters (57.6%) are nurses. (***Tables***: 5.5 - 5.7)

Sex	use behavior of SmartCare Software by sex		Total	percent
	No	Yes		
Female	**41**	**97**	**138**	**45.5**
Male	**52**	**113**	**165**	**54.5%**
Total	**93**	**210**	**303**	100.0%
% within Status of SmartCare Software utilization behavior	30.7%	69.3%	100.0%	
	100.0%	100.0%	100.0%	

Table: 5.5: use behavior of SmartCare Software by sex

Age		use behavior of SmartCare Software by age		**Total**
		No	Yes	
<= 20yrs	Count	1	2	3
	% within Age	33.3%	66.7%	100.0%
21- 30yrs	Count	72	147	219
	% within Age	32.9%	67.1%	100.0%
31- 40yrs	Count	15	35	50
	% within Age	30.0%	70.0%	100.0%
41- 50yrs	Count	5	14	19
	% within Age	26.3%	73.7%	100.0%
51 - 60yrs	Count	0	12	12
	% within Age	0.0%	100.0%	100.0%
Total	**Count**	**93**	**210**	**303**
	% within Age	**30.7%**	**69.3%**	**100.0%**

Table: 5.6: use behavior *of SmartCare software by age*

Education		use behavior of SmartCare Software by education		Total
		No	Yes	
Diploma	Count	32	77	109
	% within Education	29.4%	70.6%	100.0%
	% within Status of SmartCare Software	34.4%	36.7%	36.0%
Degree	Count	57	131	188
	% within Education	30.3%	69.7%	100.0%
	% within Status of SmartCare Software	61.3%	62.4%	62.0%
Post graduate/MSc	Count	2	2	4
	% within Education	50.0%	50.0%	100.0%
	% within Status of SmartCare Software	2.2%	1.0%	1.3%
Specialist	Count	2	0	2
	% within Education	100.0%	0.0%	100.0%
	% within Status of SmartCare Software	2.2%	0.0%	0.7%
Total	Count	93	210	303
	% within Education	30.7%	69.3%	100.0%
	% within Status of SmartCare Software	100.0%	100.0%	100.0%

Table: 5.7: use behavior *of SmartCare software by education*

5.4 Descriptive Statistics

Table 5.8 presents the means and standard deviations of the items related to all 7 constructs included in the study. All the items in the survey were Likert type items with five categories:

Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.

These categories were coded 1, 2, 3, 4 and 5 respectively. As found in the study, the average scores of respondents' for performance expectancy ranged from 3.61 to 3.78, Effort expectancy ranged from 3.61 to 3.74. Concerning social influence, the scores ranged from 3.09 to 3.47, Facilitating conditions ranged from 3.13 to 3.62, Attitude towards Computer ranged from 3.69 to 3.91, and Behavioral intentions to use SmartCare software technology is 3.33.

Predicting Variable	*N*	*Mean*	*Std. Deviation*
Performance Expectancy-1	303	3.78	1.076
Performance Expectancy-2	303	3.61	1.073
Performance Expectancy-3	303	3.63	1.101
Effort Expectancy-1	303	3.61	1.070
Effort Expectancy-2	303	3.74	1.055
Effort Expectancy-3	303	3.71	1.108
Effort Expectancy-4	303	3.68	1.089
Social Influence-1	303	3.09	1.121
Social Influence-2	303	3.47	1.041
Social Influence-3	303	3.10	1.242
Social Influence-4	303	3.27	1.256
Facilitating Condition-1	303	3.14	1.117
Facilitating Condition-2	303	3.62	.962
Facilitating Condition-3	303	3.13	1.052
Facilitating Condition-4	303	3.23	1.118
Personal Innovativeness in IT-1	303	3.67	1.044
Personal Innovativeness in IT-2	303	3.62	.979
Personal Innovativeness in IT-3	303	3.37	1.021
Personal Innovativeness in IT-4	303	3.33	1.021
Attitude towards Computer-1	303	3.82	.987
Attitude towards Computer-2	303	3.69	1.053
Attitude towards Computer-3	303	3.81	.984
Attitude towards Computer-4	303	3.91	.999
Behavioral Intention-1	303	3.33	1.115
Behavioral Intention-2	303	3.33	1.090
Behavioral Intention-3	303	3.33	1.129

Table 5.8: *Descriptive Statistics of the mean scores and standard deviation of each Construct*

Descriptive statistics show that the average score for each construct is high because it is above the neutral score value of **3**.The highest average score was observed for Attitude towards Computer with average score rate of 3.69 to 3.91.These shows the majority of the respondents agreed that Attitude towards Computer strongly affect the BI to use SmartCare software. (Table5.8 above)

The standard deviations of the scores are tabulated below (Table 5.9)

Construct	Minimum	Maximum	Average
Performance Expectancy	1.073	1.101	1.082
Effort Expectancy	1.055	1.108	1.080
Social Influence	1.041	1.256	1.165
Facilitating Conditions	0.962	1.118	1.062
Personal innovativeness in IT	0.979	1.021	1.002
Attitude towards Computer	0.984	1.053	1.006
Behavioral Intentions	1.090	1.129	1.111

Table 5.9: *The standard deviations of the scores*

5.5 Hypothesis Testing

5.5.1 Testing for Direct Effects

Bivariate correlation test was used to determine the effects between the criterion and predictor variables. Five predictor variables: performance expectancy, effort expectancy, social influence, personal innovativeness in IT and Attitude towards Computer, were regressed against behavioral intention.

Regression Analysis I: Examining the Relationship between the overall performance expectancy, effort expectancy, social influence, personal innovativeness in IT and attitude towards computers, were regressed against behavioral intention. The result from this test shows that the correlation is significant to all the factors and the results are shown below (Table: 5.10).

		BI	PE	EE	SI	PIIT	ATC
BI	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	303					
PE	Pearson Correlation	.425**	1				
	Sig. (2-tailed)	.000					
	N	303	303				
EE	Pearson Correlation	.309**	.623**	1			
	Sig. (2-tailed)	.000	.000				
	N	303	303	303			
SI	Pearson Correlation	.264**	.384**	.323**	1		
	Sig. (2-tailed)	.000	.000	.000			
	N	303	303	303	303		
PI IT	Pearson Correlation	.197**	.311**	.282**	.146*	1	
	Sig. (2-tailed)	.001	.000	.000	.011		
	N	303	303	303	303	303	
ATC	Pearson Correlation	.482**	.476**	.382**	.392**	.272**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	303	303	303	303	303	303

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Table 5.10: *Correlation between the explaining factors (Bivariate)*

Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	β	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	**1.513**	**0.153**		**10.054**	.000		
PE	.425	.052	.425	8.148	.000	.323	.528
EE	.304	.054	.309	5.639	.000	.198	.410
SI	.320	.067	.264	4.755	.000	.188	.453
PIIT	.192	.055	.197	3.488	.001	.084	.301
ATC	.504	.053	.482	9.539	.000	.400	.608

Variables in the Equation, Behavioral Intention Vs Actual Usage Behavior

Significant at 5% level

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	BI	.463	.136	11.682	1	.001	1.590
	Constant	-.273	.333	.672	1	.413	.761

Dependent Variable: Behavioral Intention, Significant at 1% level

Variable entered: BI

Variables in the Equation: Facilitating Conditions Vs Actual Usage Behavior

Significant at 5% level

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	FC	.253	.125	4.109	1	.043	1.288
	Constant	.271	.290	.872	1	.350	1.311

Variable entered: FC

Tables 5.11-13: *Results Regressions Analysis on Hypotheses*

As seen in tables: 5.11-13, the results showed that the behavioral intention to use **SmartCare Software** was predicted by attitude towards computers (β =.482) which had the most influential effect on behavioral intention, followed by performance expectancy (β =.425), effort expectancy (β =.309), social influence (β =.264), and personal innovativeness in IT
(β = .197) had the least effect on behavioral intention perceptions compared to the others. Therefore, all hypotheses were statistically highly supported.

Concerning behavioral intension (β =.463) and facilitating conditions (β =.253) both of them are statistically supported with the actual usage behavior, being the BI is stronger determinant for actual usage than facilitating conditions.

Finally, With R Squared = .702 (Adjusted R Squared = .333), the final theoretical model was able to account for 33.3 % of the variance in Addis Ababa City Administrative public hospitals' health workers behavioral intention to adopt SmartCare software

5.5.1.1 Elucidating Performance Expectancy(EE)

Performance expectancy had a significant effect on behavioral intention, with 99% significance level and thereby ***H1: "****Performance expectancy will have a positive influence on behavioral intentions to use SmartCare Software"*-was strongly supported. This was consistent with the findings of Venkatesh et al. (32), who reported the existence of a significant relationship between performance expectancy and behavioral intention in the domain of IT acceptance.

5.5.1.2 Elucidating Effort Expectancy(EE)

Effort Expectancy and behavioral intention was also found to have significant association, with 99% significance level. Consequently ***H2:*** "*Effort expectancy will have a positive influence on behavioral intentions to use SmartCare Software*"- was accepted.

This theoretical assumption is confirmed in the survey findings that are obtained in this research which suggest that the effort expectancy factor has a significant positive influence on the behavioral intention to use *SmartCare Software.*

5.5.1.3 Elucidating Social Influence (SI)

According to the results of this study, social influence has a positive effect on explaining health workers 'behavioral intention to adopt *SmartCare Software*. Regarding the hypotheses tests, social influence was very important in forming the health workers' intention to use SmartCare in their workflow. ***H3: "Social Influence will have a positive influence on behavioral intentions to use SmartCare Software"***– was accepted with 99% significance level, showing that social influence had a significant effect on behavioral intention. This result was consistent with the findings of Venkatesh et al. (32), who reported the existence of a significant relationship between social influence and behavioral intention in the domain of IT acceptance. Thus, the management should encourage health workers to influence their colleagues who have still not adopted the SmartCare software system.

5.5.1.4 Elucidating Facilitating Conditions (FC)

Facilitating conditions had a significant effect on behavioral intention, with95% significance level and thereby ***H4: "Facilitating conditions will have a positive influence on SmartCare software usage behavior*"** – was accepted.

As previously discussed in chapter -two, facilitating conditions is considered to be directly related to usage behavior (32). The inclusion of the aspects of technological and organizational environment that are meant to minimize the challenges and barriers that hinder the system use, directly adds to this relation.

5.5.1.5 Elucidating Attitude Towards Computer (ATC)

Attitude towards Computer had a significant effect on behavioral intention, with 99% significance level and thereby ***H5: "Attitude towards Computer will positively affect the intensity of health workers' behavioral intention to use SmartCare Software"***. – was strongly supported. This was consistent with the findings of Chau & Hu (51), who reported the existence of a significant relationship between Attitude towards Computer and behavioral intention in the technology acceptance decisions of physicians and nursing staff.

5.5.1.6 Elucidating Personal Innovativeness in IT(PIIT)

Personal innovativeness in IT had a significant effect on behavioral intention, with 99% significance level and thus ***H6: "Personal innovativeness in IT positively influences health workers' behavioral intention to use SmartCare software"*** – was accepted.

This result strongly supported Boyle and Ruppel (52) contentions indicating that there was a significant relationship between personal innovativeness in IT and behavioral intention in the domain of IT acceptance.

5.5.1.7 Behavioral Intention (BI)

The findings of this research provided evidence that behavioral intention has a positive influence on *SmartCare Software usage behavior*. Venkatesh *et al.,* (32) suggest that behavior intention affects the adoption and technology usage significantly and positively.

Thus, ***H7: "Behavioral intentions to use SmartCare Software will have a positive influence on SmartCare Software usage behavior" –*** was accepted.

5.5.2 Testing for Moderation Effects:

Moderating influences indicated in the literature review of chapter two particularly sex and age was examined. Sex was coded as 0/1 dummy variable and age was coded as a continuous variable consistent with prior research Venkatesh et al. (32). Regression analysis was used for both the predictor variables and moderator variables. Although the description statistics show variations by age, sex and level of education, the regression analysis show the variations are statistically insignificant. The interaction terms for performance expectancy, effort expectancy, and social influence to behavioral intention and facilitating conditions to accept the usage of SmartCare software, were all rejected with t–statistics equal to-**0.938,(p=0.349),*-1.295,(p=0.196), 1.360,(p=0.175) and -1.378,(p=0.169),*** respectively. This could be explained by the fact that SmartCare software was a different technology than the ones examined in the study of Venkatesh et al. (2003). In addition, the target population of this study was the healthcare providers which differed from the one studied by Venkatesh et al. (32).

The results for some of the moderated mediation analysis are shown below (Tables5.14-17):

FC * Sex, Significant at 1% level

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.452	.191		12.811	.000
	Sex	-.163	.118	-.079	-1.378	.169

Dependent Variable: Facilitating Conditions

PE * Sex, Significant at 1% level

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.995	.179		16.738	.000
	Sex	-.103	.110	-.054	-.938	.349

Dependent Variable: Performance Expectancy

EE * Sex, Significant at 1% level

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.884	.182		15.850	.000
	Sex	-.145	.112	-.074	-1.295	.196

Dependent Variable: Effort Expectancy

S I * Sex, Significant at 1% level

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.195	.147		14.890	.000
	Sex	.124	.091	.078	1.360	.175

Dependent Variable: Social Influence

Tables 5.14-17: *Results of moderation effects at 1% significant level*

Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.	Hypothesis	Effect	Remark
	β	Std. Error	Beta					
1 (Constant)	**1.513**	**0.153**		**10.054**	.000			
PE	.425	.052	.425	8.148	.000		PE → BI	Supported
EE	.304	.054	.309	5.639	.000		EE → BI	Supported
SI	.320	.067	.264	4.755	.000		SI → BI	Supported
PIIT	.192	.055	.197	3.488	.001		PIIT → BI	Supported
A TC	.504	.053	.482	9.539	.000		ATC → BI	Supported
Constructs found Significant at 5% level								
	B	S.E.	Wald	df	Sig.	Exp(B)		
FC	.253	.125	4.109	1	.043	1.288	FC → BI	Supported
Constant	.271	.290	.872	1	.350	1.311		
	B	S.E.	Wald	df	Sig.	Exp(B)		
BI	.463	.136	11.682	1	.001	1.590	BI → UB	Supported
Constant	-.273	.333	.672	1	.413	.761		

Table 5.18: Summary of Hypotheses Testing

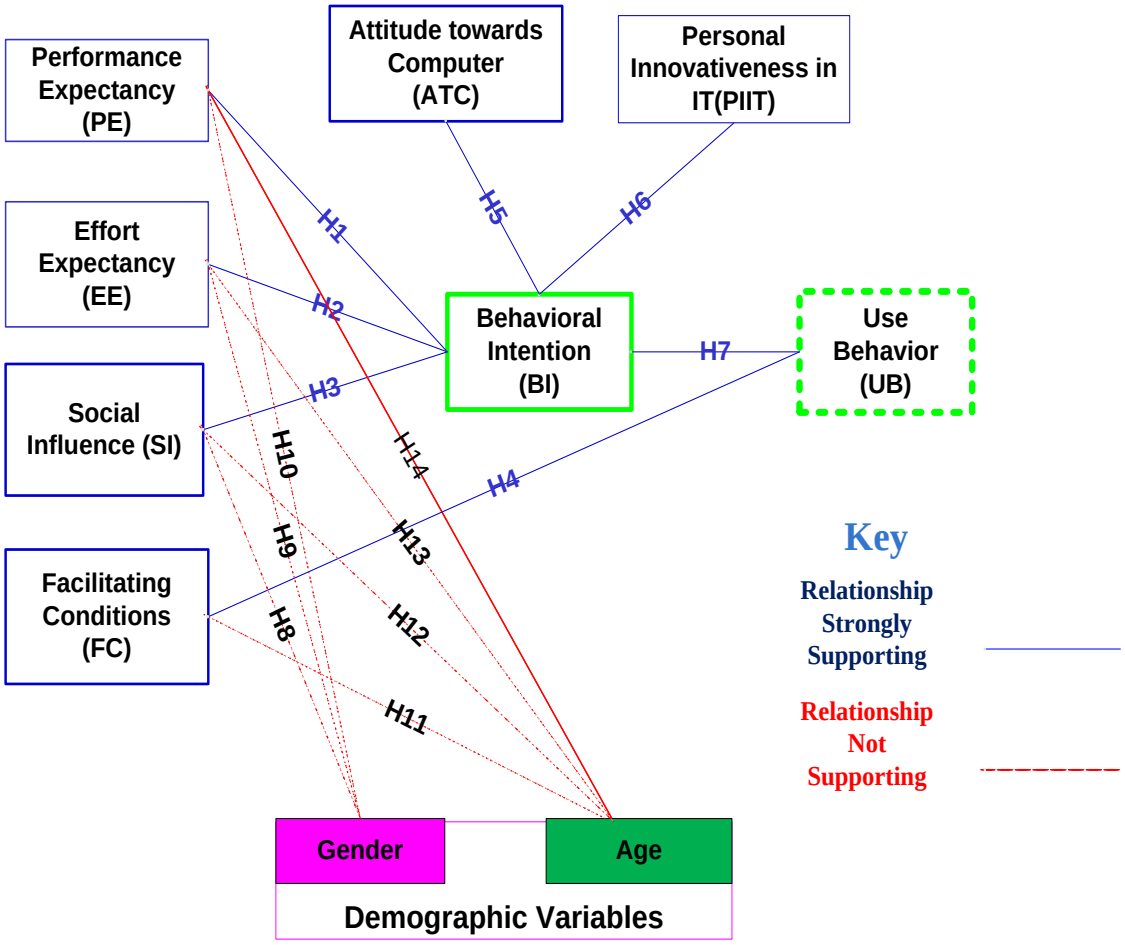


Figure 5-3: *Results of the proposed model*

CHAPTER SIX

6. DISCUSSION:

In order to investigate the factors influencing the implementation and acceptance of SmartCare software among health workers in Addis Ababa public hospitals, the present research set out to propose an extension of the UTAUT model specifically adapted to the particular characteristics of the health care sector, which captured the essential elements of previously established theories and researches on individual's intention to accept IT.

First, different intention based technology adoption theories were discussed. Among these theories, the UTAUT model proposed by Venkatesh et al. (32) appeared to encompass many of the determinants found in other models such as IDT, TPB and TAM. Since UTAUT considered all the cultural, social, and moral factors that are not accounted for in other theories and was one of the latest IT adoption models, it was chosen as the basis of the proposed research model. Therefore the paper by Venkatesh et al. (32) was selected as the supportive article for this study. Among the moderators mentioned in UTAUT, only sex and age were chosen to be included in the proposed research model, because the study was cross sectional and conducted under voluntary setting only, thus the effects of experience and voluntariness could not be measured.

Second, based on literature review on individual's behavioral intention, two determinants of intention that were not included in UTAUT were used to formulate the final proposed research model. These two constructs were: attitude towards computer, and personal innovativeness in IT.

Third, based on the proposed research model, a questionnaire was developed replicating the questions used in Venkatesh et al. (32) and Limayem et al. (60).

Fourth, a cross sectional data collection was conducted through a large sample survey from five hospitals. Data was gathered by distributing questionnaires among health workers who were working in five public hospitals that implemented HMIS supporting SmartCare software.

Fifth, the proposed research model was statistically tested using the sample data. Hence, the adequacy of the proposed research model in explaining behavioral intention to use SmartCare software and actual usage behavior by health workers in the specified hospitals was tested. The results show that all constructs having a significant relationship with behavioral intention to use and actual usage behavior as shown in figure 6-1.

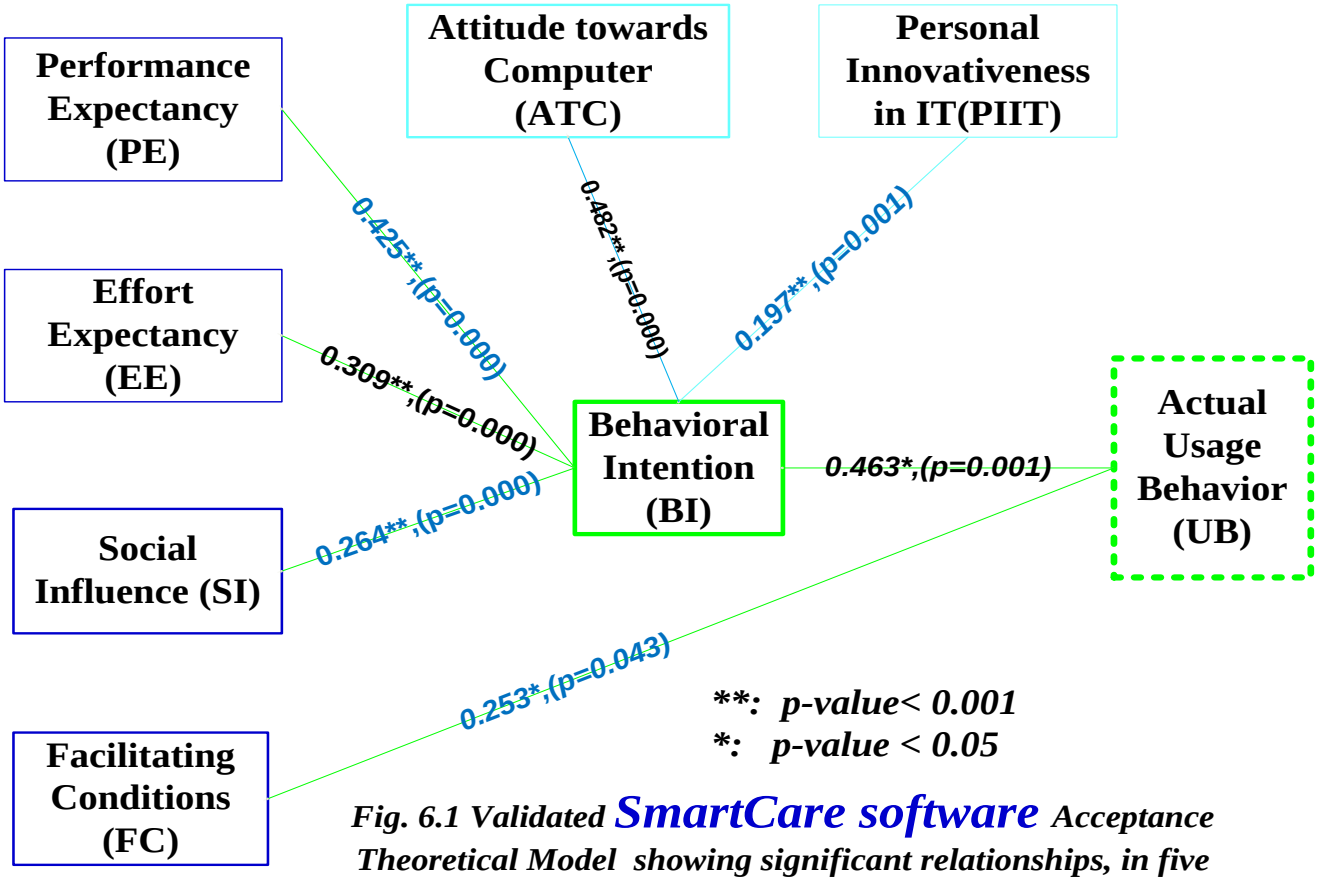


Fig. 6.1 Validated SmartCare software Acceptance Theoretical Model showing significant relationships, in five hospitals of Addis Ababa city Administration, as of march 2013, Addis Ababa, Ethiopia

While each of the existing theories in the domain of IT adoption were quite successful in predicting behavioral intention and actual usage behavior, the presented model in this study considered the particular characteristics of the health workers. The results showed that recognizing both technological and personality traits were important in increasing health workers' behavioral intention to use and actual usage behavior of SmartCare software, each contributing their significant influence on behavioral intention to use and actual usage behavior of the software.

The results indicate that the main factors determining behavioral intention are attitude towards computer (ATC), performance expectancy (PE), effort expectancy (EE), social influence (SI) and personal innovativeness in IT (PIIT). Facilitating conditions (FC) and behavioral intension (BI) act as significant determinants of actual use behavior (AUB). Factors that facilitate the adoption of SmartCare software is discussed below:

Performance Expectancy

Performance expectancy "The degree to which an individual believes that using the system will help him or her to attain gains in job performance. Measured such as accomplish task quickly, improve job performance, increase productivity, enhance effectiveness." Variables of PE includes: System's effectiveness, system's improvement of work performance, system's improvement of productivity, chance to gain transferable skills, and better control of work.

This category was found to have a statistically significant effect on BI to use SmartCare software with a $\beta = 0.425$ (P=0.000). Most respondents seemed to expect SmartCare software to be time saving, convenient, efficient and productive. Health workers will be able to treat patients correctly and quickly with a continuous data processing (Provided that data are structured and coded in an unambiguous fashion. Programs can continuously check and filter the data for errors, summarize and interpret data, and issue alerts and/or reminders to clinicians following the detection of potentially life-threatening events).

The software also provide assisted search (in a small fraction of the time required using a manual system, computers can search free-text as well as structured data to find a specific data value or to determine whether a particular item has ever been recorded). However, unstructured text must be searched with care since clinicians use many different words and phrases to express the same clinical concept).

The other advantage is it supports a greater range of data output modalities (for instance, data can be presented to users via computer-generated voice, two-way pagers, or email). It can also provide tailored paper output (i.e., data can be printed using a variety of fonts, colors, and sizes to help focus the clinician's attention on the most important data. In addition, images can be combined with textual data to create a more complete "picture" of the patient's condition, and it is always up to date. This eliminates the problems associated with several health workers, each keeping a small portion of a patient's health record in their offices and transferring these paper-based records back and forth as they consult (30).

Thus, patients will get well more quickly and will able to return to their lives ordinarily and happily. It increases satisfaction between health workers and patients. Therefore, health workers believe that using SmartCare software will enhance the performance of healthcare services (33).This means the sub scales of PE do have the power to explain BI by 42.5%.

The result is consistent with other research findings with varying magnitude. P.Anne Nuq found that PE can explain BI to use e-Health services in developing countries by 25.1 %(β = 0.251) (64), similarly, Phichitchaisopa and Naenna reported that PE predicted BI significantly (β= 0.26) in Thailand (65). Conradie, Pieter, Huisman, and Magda, in their study of Antecedents for use of Information Systems Development Methodologies in Health Information Systems, based on the UTAUT in South Africa, also found that, PE explained BI by 27% (β=0.270, p<0.001) (68) . Compared with these studies the power of PE in explaining BI in this study is stronger. Therefore it can be said that the health workers in the studied hospitals in Addis Ababa, believe strongly using the SmartCare software can improve their performance.

Effort Expectancy

Effort expectancy: "The degree of ease associated with the use of system, measured such as interaction with system clear and understandable, flexible to interact, easy to use." Variables of EE includes: Easiness of accessing data, clarity of data, ability to identify relevant data, smoothness of interacting with the system, and system's overall presentation and outline.

A key aspect of healthcare technology is its ease of use. In this regard SmartCare software provides the ability to simultaneous remote access to patient data (multiple clinicians can access a patient's record simultaneously from many locations. With the recent advent of secure data transmission over the web, clinicians can now review and edit patient records from anywhere in the world), write orders online, legibility of record, users can have a separate data display and data entry screen, recall data in any order, and create disease or condition specific data review formats. It increases legibility, and can be used to identify patient descriptions, such as aliments or medicines (30). Health workers gain support through SmartCare for an easier, faster, and more accurate process for making decisions carefully. Therefore, information and service quality are also related to perceived ease of use.

Most respondents in this study were familiar enough with computers. They were found to have the experience to use internet and Microsoft packages and social media applications. Those who believed to be familiar with computer usage perceived that, SmartCare software is easy to use.

EE was also found to predict BI to use SmartCare software by 30.9% (β=0.309, p<0.000), the result is consistent with other research findings. EE was found to explain BI in Thailand with a β value of 0.23, in South Africa with a β value of 0.208. (65, 68). In contrast with these findings health workers in Addis Ababa seems to believe that the software is easy to operate.

Social Influence

Social Influence : the degree to which an individual perceives that important others/ other people (i.e. colleagues, friends, boss, superiors etc) believe he or she should/should not use the new system, was also found to be the area of investigation while understanding the health workers'acceptance and use of SmartCare software.

Social influence variables are: organizational encouragement; organizational pressure for change; management communication and involvement in the change process; experience of a demo beforehand; and availability of an "open door" policy to discuss aspects related to change. In case of getting more health workers to use SmartCare software, introducing a rule for mandatory usage might be a good incentive to make people overcome their anxiety and adopt the system.

From this study, when we see the explanatory power of SI to BI, it was found statistically significant to predict the criterion variable BI by 26.4 % (β=0.264, $p<0.000$). The result is consistent with research findings from South Dakota, USA and Canada where SI was found to predict BI with a β value of 0.324 and 0.31 respectively(66,67). However, the effect of SI to explain BI was not supported in the research findings from South Africa and Thailand (64, 65). The main reason for this might be the result of cultural differences among different peoples social influence.

Facilitating Conditions

Facilitating Conditions, the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system, and it is made attractive to them as users by providing any benefits or any penalty.

Variables of FC includes: Comprehensiveness of manual or training session; ability to imagine applying the system to conduct tasks; mention of the extensiveness of search criteria; offer of steps that are logical to use, apply, and recall; and cover of all essentials to perform tasks and overcome difficulty.

Thus in this study, Facilitating Conditions which include constructs like training, also had a significant direct effect on continued use of SmartCare software (β=0.253, $p<0.043$ of P-value <0.05), indicating that aspects of internal resources, external resources and time influences the continued use of SmartCare software.

The impact of facilitating conditions has a positive influence on actual using behavior. This is in line with the results of previous studies from developing and developed nations 64-68). This implies that infrastructures and resources such as computer systems and IT support are necessary. The internal organizations involved in healthcare support should provide technical assistance for using healthcare technology through IT staff which provides technical support and assistance for health workers.

- **Attitude towards Computer**

It is interesting that **Attitude towards Computer**, which was the extended factor in this study was the highest positive indicator related to the health workers behavioral intention to use SmartCare software with β=0.482, p<0.000 of P-value <0.001). This highlights the critical role of attitude in technology acceptance decision making by individual professionals, and therefore singles out the importance of attitude cultivation and management to successful SmartCare software implementation. Similarly, a study conducted in china by Patrick Y.K. Chau, and Paul Jen-Hwa Hu (69) by using an integrated model of TAM and TPB, it is found that attitude towards technology predict physicians' behavioral intension to use telemedicine technology by 34% (β=0.34, P-value <0.001). Therefore the prediction power of attitude towards computer according to this research is stronger than the research finding from China.

- **Personal Innovativeness in IT (PIIT)**

Individuals with more innovativeness in IT are more technically competent than others in using new technology. They tend to be earlier adopters of new technology while compared to later adopters. They consider the complexity of using new technology less troublesome than others. Therefore it is helpful to identify health workers who are more likely to adopt SmartCare software usage and set them as change agents in order to motivate other health workers to use the SmartCare software.

CHAPTER SEVEN

7. CONCLUSION AND RECOMMENDATION:

One of the main reasons SmartCare software implementations fail to achieve their predicted benefits in the hospitals is because the system is not completely accepted by health workers. This research targeted to identify the factors that affect and are related to health workers acceptance of SmartCare software.

The outcomes from this study revealed that the UTAUT model with extension of Attitude towards Computer and Personal Innovativeness in IT could be applied to understand the health workers' behavioral intention to use SmartCare software in Addis Ababa City Administrative Public Hospitals. To use SmartCare software by health workers donors, FMoH, AACAHB and hospital managers should note that Attitude towards Computer, Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Personal Innovativeness in IT are the important determinants. Using an extension of widely popularized UTAUT model, the researcher investigated and found that the intention to use and SmartCare software usage behaviors of the health workers were higher when they believe that the implemented SmartCare software in their contexts are to support them providing better patient care and raise their performance. Further to this Performance Expectancy, Effort Expectancy, the critical importance of Social Influence, Facilitating Conditions and Personal Innovativeness in IT to SmartCare acceptance among health workers was also signified by this research results.

Management and administrators of hospitals, FMoH, AACARHB as well as SmartCare software designers or vendors (donors) are alerted to key factors that could hasten SmartCare software acceptance among health workers in Addis Ababa City Administrative Health Bureau.

These research findings indicate that the UTAUT core constructs were the basis for this study. Additional valuable and insightful SmartCare software acceptance related factors were identified using this basic structure and these variables significantly and positively impact the behavioral intention and actual use behavior to adopt SmartCare software. Among these, attitude towards computers has the most significant positive impact on adoption intentions. Therefore this study suggests that in order to enhance the intention to adopt and use SmartCare software, hospitals should strengthen independent impact variables including Attitude towards Computers, Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Personal Innovativeness in IT.

Attitude towards Computer (ATC) and Performance Expectancy (PE) were found to be the stronger modifiers predicting the behavioral intention to use SmartCare software by 48.2% and 42.5% respectively. Therefore to increase the behavioral intention and the actual use of the software by the health workers in the studied hospitals, attention should be given to improve the constructs related to Attitude towards Computer and Performance Expectancy of the health care workers. Effort Expectancy and Social Influence were also found to predict Behavioral Intention by 30.9% and 26.4% respectively, and when we see Facilitating Conditions and Behavioral Intention against Actual Usage Behavior, these constructs predicted Actual Usage Behavior by 25.3% and 46.3% respectively. Therefore improving the constructs related to these modifiers of BI can also play a great role in improving the BI and Actual Use Behavior (AUB) of the software. These results maintain enough explanatory power R^2 =.702 (Adjusted R squared=.333) to help explain the intentions and actual use behavior of health workers in adopting EMR- SmartCare software.

7.1 Key Findings of the study

In this study, the researcher examined a number of questions and suggested some hypotheses and the study came out with results that may contribute to increase SmartCare software adoption. The main results are:

- ***There is a significant statistical effect of Performance Expectancy (PE) on Behavioral Intension (BI) to use SmartCare software at level β =0.425 (p=0.000) of p-value <0.01.***

Since there was a direct relationship between the degree to which the health workers perceived the system to improve their performance and speed up their workflow and the degree that they intended to use the system, it is suggested to equip the health workers with portable IT facilities such as laptops so that they could immediately enter the data into the system instead of using papers to document their visits. This can help them to perceive SmartCare software as a useful tool to their daily job which quickens their documentation and research process and consequently motivate them to use the system.

- ***There is a significant statistical effect of Effort Expectancy on Behavioral intension to use SmartCare software at level β =0.309 (p=0.000) of p-value <0.01.***

The results of this study indicates that the more health workers perceived SmartCare software to be easy to learn, the more they intended to use it and thereby the design of the SmartCare software system needs to be carefully paid attention to, so that it would be as easy as possible to interact with.

- ***There is a significant statistical effect of Social Influence (SI) on Behavioral Intension (BI) to use SmartCare software at level β =0.264 (p=0.000) of p-value <0.01.***

From the result, it was seen that the degree to which health workers believed that the healthcare organization and their colleagues thought they should use the system positively motivated them to accept SmartCare software usage, it is very important for the top managers and donors to try to encourage the health workers to use the system and convince them that SmartCare software usage adds to their professional and social image.

- ***There is a significant statistical effect of Personal Innovativeness in IT on Behavioral intension to use SmartCare software at level β =0.197 (p=0.000) of p-value <0.01.***

Concerning the personal innovativeness in IT, it might be helpful to identify health workers who are more likely to adopt SmartCare software usage and set them as change agents in order to motivate other health workers to use the SmartCare software.

- ***There is a significant statistical effect of Attitude towards Computer (CA) on Behavioral Intension (BI) to use SmartCare software at level β =0.482 (p=0.000) of p-value <0.01.***

The result also demonstrated that health workers participated in this study has a high attitude toward computers and toward communicating on computers which might indicate that they might use SmartCare software in their professional life. This also highlights the critical role of attitude in technology acceptance decision making by individual professionals and therefore singles out the importance of attitude cultivation and management to successful SmartCare software implementation.

- ***There is a significant statistical effect of Facilitating Conditions (FC) on health workers' actual Usage Behavior (UB) of SmartCare software at level β =0.253(p=0.043) of p-value <0.05.***

The result findings pointed out the fact that the level of organizational facilitating conditions existing within the hospitals influenced health workers' actual usage behavior in a positive way. Accordingly it is of great importance to offer extensive training to the staff, provide them with sufficient technological resources, improving the IT Infrastructure to overcome technological barrier and arrange for health informaticians.

7.2 Limitation of the Study

- Due to the fact that SmartCare software was a new phenomenon and at its infancy stage in Addis Ababa city administrative public hospitals, the study did not included non governmental and private hospitals.
- The study is cross-sectional. Conducting a longitudinal study was not feasible. Therefore verifying the moderating influence of experience on SmartCare software adoption was not possible.
- This study was conducted using quantitative method; hence the gaps which were not covered in the quantitative were not covered. Moreover, opinions of top managers, stake holders and key informants about the status of the software were not addressed.
- Since the study was conducted under voluntary setting, testing the moderating effect of voluntariness on SmartCare software adoption was not feasible.

7.3 Recommendations

The following recommendations are forwarded to the Addis Ababa health bureau, studied hospitals and researchers based on the findings of this study.

- Trainings and on job trainings designed to increase the Attitude towards Computerin using the SmartCare software should be given to the health workers emphasizing on the role of the software in providing better patient care and increasing performance
- Trainings designed to modify the performance expectancy should be designed and given to the health workers emphasizing on the usefulness of the software in increasing productivity and efficiency in providing health care services
- Trainings designed to increase the skill of the health workers in using the software so as to make the software easy to operate and use it by health workers should be available.
- Longitudinal research should be conducted to investigate the factors affecting the health workers‟ actual use of SmartCare software with both qualitative and quantitative approach.
- Future research may consider adding personal and organizational factors such as habit, self-efficacy, training, and computer anxiety to further increase the model explanatory power.

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Appendix- I: Information Sheet

1.1. Participant information sheet

School of Public Health and Information Science, Department of Health Informatics, Addis Ababa University, Addis Ababa, Ethiopia.

Title: ***"Factors Affecting the Adoption of Health Management Information Systems (HMIS) Among Health Workers: The case of Smart Care Software utilization in Addis Ababa City Administration Public Hospitals".***

First of all we would like to thank you in advance for your cooperation and consent in participation in this study. Please read about the general information of the stud. If you have any question regarding the study please ask freely

1.2. Back ground information

A health care industry without information communication technology is impossible to provide efficient and effective health care service. In Ethiopia, the implementation of Electronic Medical Record (EMR) is through software called SmartCare. SmartCare software possesses numerous advantages and features. However, its adoption rate is very low & it is important to investigate and analyze varying degrees of challenges which are recognized to be factors influencing the adoption & utilization of SmartCare software in Addis Ababa city administration public hospitals.

1.3. Aim of the study

The purpose of this study is to identify and measure the factors that would influence the **behavioral intention** and **usage behavior** of health workers SmartCare software adoption & utilization pattern in public Hospitals of Addis Ababa City Administration.

1.4. Benefits for the participants

Study participants will not have any financial incentives or other inducements from participating on this study. However, participations of health workers in this study with honest response to the questions stated in the survey questionnaire is important to improve the adoption and utilization of SmartCare software so as to improve the patient care and safety.

1.5 Risk and complication

There is no any risk and hidden idea on the study subjects due to participating. No other than the investigator and responsible advisors can access the collected data. No need of writing participants' name to secure the confidentiality of the data or study participants. It also gets ethical clearance from Addis Ababa University Medical Faculty research ethical reviewing board (RERB).

1.6 Assurance of principal Investigator (PI)

I put my signature below to confirm you that I take over the responsibility for the scientific ethical and technical conduct of the research project and for provision of progress reports for all stakeholder of the research project.

Dereje Teshager Belay (PI)

Signature ----------Date ----------

Note: If you have any questions about this study, Please feel free to ask any time throughout the study phase by contacting through the following address:

PI Adress: ***Dereje Teshager Belay***: Addis Ababa University School of Public Health and Information Science, Department of Health Informatics, Addis Ababa, Ethiopia.

E-mail: *derejeteshager@yahoo.com*

Cell Phone: *+251 913350513*

Appendix -II: Consent Form

Addis Ababa University School of Public Health and School of Information Science Health Informatics program Self administer questionnaire to study factors affecting the utilization of SmartCare software among health workers in public hospitals of Addis Ababa, Ethiopia, 2013

Consent form: That certifies the Respondent's Agreement

1. Name of the Hospital ----------

2. Questionnaire Identification number (ID No.) ----------Date----------Month----------/2013

Introduction: Hello. My name is----------and I am here to collect SmartCare software related data for the purpose of a research being conducted in public hospitals which are governed under Addis Ababa City Administration Health Bureau. I would like to ask you to fill this questionnaire that is related to your perception and status of usage on SmartCare software. The information you provide will help us improve the adoption and Utilization of SmartCare software, which is vital in this hospital and other hospitals that have implemented the SmartCare software as well as for those hospital which are preparing to implement. You are selected to be one of the participants in this study .The study will be conducted through self administer questionnaires. The information you give us is confidential and will be used only for this study purpose. A code number will identify every participant and no name will be documented .Your participation is on voluntary basis. If you choose not to answer a particular question, that is your right. You have a full right to withdraw from the study at any time without any problem. However, your participation is important to fulfill the study and design mechanism to develop good implementation model of SmartCare software.

Are you willing to participate in the study?

1. ***Yes*** ***2. No*** *signature*----------

Facilitator ----------*signature*----------

Thank you!

Appendix-III: Self Administered Questionnaire

Electronic Medical Record-Smart care software survey questionnaire

Questionnaire on SmartCare software for health professionals working in Menelik II, Yekatit-12, Ras Desta Damtew, Zewditu, and Gandhi Memorial Hospitals. Please fill in the following questionnaires, your comments are very important for further improvements in effective adoption of SmartCare software. Thank you in advance for your time.

Hospital Name _____

ADDIS ABABA UNIVERSITY SCHOOL OF GRADUATE STUDIES SCHOOL OF INFORMATION SCIENCE AND SCHOOL OF PUBLIC HEALTH, HEALTH INFORMATICS JOINT PROGRAMME

Self Administered Survey Questionnaire

PART- A: Respondent's Characteristics:

S.No.	Question	Answer
1	Sex	Female Male
2	Age in Years	☐
3	Marital Status	Single ☐ Divorced ☐ Married ☐ Widowed ☐
4	Work experience in Years	
5	Profession	**1.** Medical doctor ☐ **7.** Laboratory ☐ **2.** Nurse ☐ **8.** Radiography ☐ **3.** Midwife ☐ **9.** Occupational health ☐ **4.** Health officer ☐ **10**. Environmental Health ☐ **5.** Pharmacy ☐ **11.** Other (specify)---------- **6.** Dental Medicine ☐
6	Educational level	**1.** Diploma ☐ **2.** degree ☐ **3.** post graduate /masters ☐ **4.** specialist ☐ **5.** other (specify) ----------
7	Work experience with computer use:	1. Basic computer application Yes ☐ No ☐ 2. Email face book Yes ☐ No ☐ 3. Surfing web site for different use Yes ☐ No ☐ 4. Patients medical information Yes ☐ No ☐ 5. others (specify)----------

PART- B: Respondent's Perception about SmartCare software:

Please read each statement below regarding the use of **SmartCare software**. You will rate each statement by following a scale of 1 through 5. **1** is that you ***strongly disagree*** and **5** is that you ***strongly agree*** with the statement. (***1= strongly disagree 2=Disagree 3=Neutral 4=Agree 5= strongly agree***)

Performance Expectancy						
Indicator	**Question**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
PE1	I would find the system useful in my job.	☐	☐	☐	☐	☐
PE2	Using the system enables me to accomplish tasks more quickly.	☐	☐	☐	☐	☐
PE3	Using the system increases my productivity.	☐	☐	☐	☐	☐
Effort Expectancy						
Indicator	**Question**	**Strongly Disagree**	**Disagre**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
EE1	My interaction with the system would be clear and understandable.	☐	☐	☐	☐	☐
EE2	It would be easy for me to become skillful at using the system.	☐	☐	☐	☐	☐
EE3	I would find the system easy to use.	☐	☐	☐	☐	☐
EE4	Learning to operate the system is easy for me.	☐	☐	☐	☐	☐
Social Influence						
Indicator	**Question**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
SI1	People who influence my behavior think that I should use the system.	☐	☐	☐	☐	☐
SI2	People who are important to me think that I should use the system.	☐	☐	☐	☐	☐
SI3	The hospital manager has been helpful in the use of the system.	☐	☐	☐	☐	☐
SI4	In general, the healthcare organization has supported the use of the system.	☐	☐	☐	☐	☐

Facilitating Conditions						
Indicator	**Question**	**Strongly**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
FC1	I have the resources necessary to use the system.	☐	☐	☐	☐	☐
FC2	I have the knowledge necessary to use the system.	☐	☐	☐	☐	☐
FC3	The system is not compatible with other systems I use.	☐	☐	☐	☐	☐
FC4	A specific person (or group) is available for assistance with system difficulties.	☐	☐	☐	☐	☐
Personal Innovativeness in Information Technology						
Indicator	**Question**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
PIIT1	I am generally cautious about accepting new ideas.	☐	☐	☐	☐	☐
PIIT2	I find it stimulating to be original in my thinking and behavior.	☐	☐	☐	☐	☐
PIIT3	I am challenged by ambiguities and unsolved problems.	☐	☐	☐	☐	☐
PIIT4	I must see other people using innovations before I will consider them.	☐	☐	☐	☐	☐
Attitude towards Computer						
Indicator	**Question**	**Strongly Disagre**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
CA 1	SmartCare software, technology support the health worker to providing better patient care	☐	☐	☐	☐	☐
CA2	I prefer to use SmartCare software, because it raises my performance	☐	☐	☐	☐	☐
CA3	I am interested in an SmartCare software implementation	☐	☐	☐	☐	☐
CA4	Generally, my attitude about SmartCare software, usage is positive	☐	☐	☐	☐	☐

Behavioral Intention						
Indicator	**Question**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
BI1	I intend to use the system in the next 3 months.	☐	☐	☐	☐	☐
BI2	I predict I would use the system in the next 3 months.	☐	☐	☐	☐	☐
BI3	I plan to use the system in the next 3 months.	☐	☐	☐	☐	☐

PART- C: Status of SmartCare software usage in the Hospital among Health Workers:

No.	Question	Answer
1	Does the Hospital Information System support SmartCare Software in this hospital?	Yes
		No
2	Is it mandatory to use SmartCare Software in this hospital?	Yes
		No
3	If your answer to the previous question is no, have you ever tried using SmartCare Software voluntarily?	Yes
		No

***Thank you for your participation*!**

DECLARATION

I the undersigned, declare that this thesis is my own original work, and that all resources and materials for this thesis have been properly acknowledged.

Investigator's Name:

Dereje Teshager, Signature _____Date_____

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

Advisors' Name:

Dereje Teferi (PhD), Signature _____Date_____

Assefa Seme (MD, MPH, PhD fellow), Signature _____Date_____