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Assessing the use of smartphones among health professionals in Ghana: A case study 37 Military Hospital.

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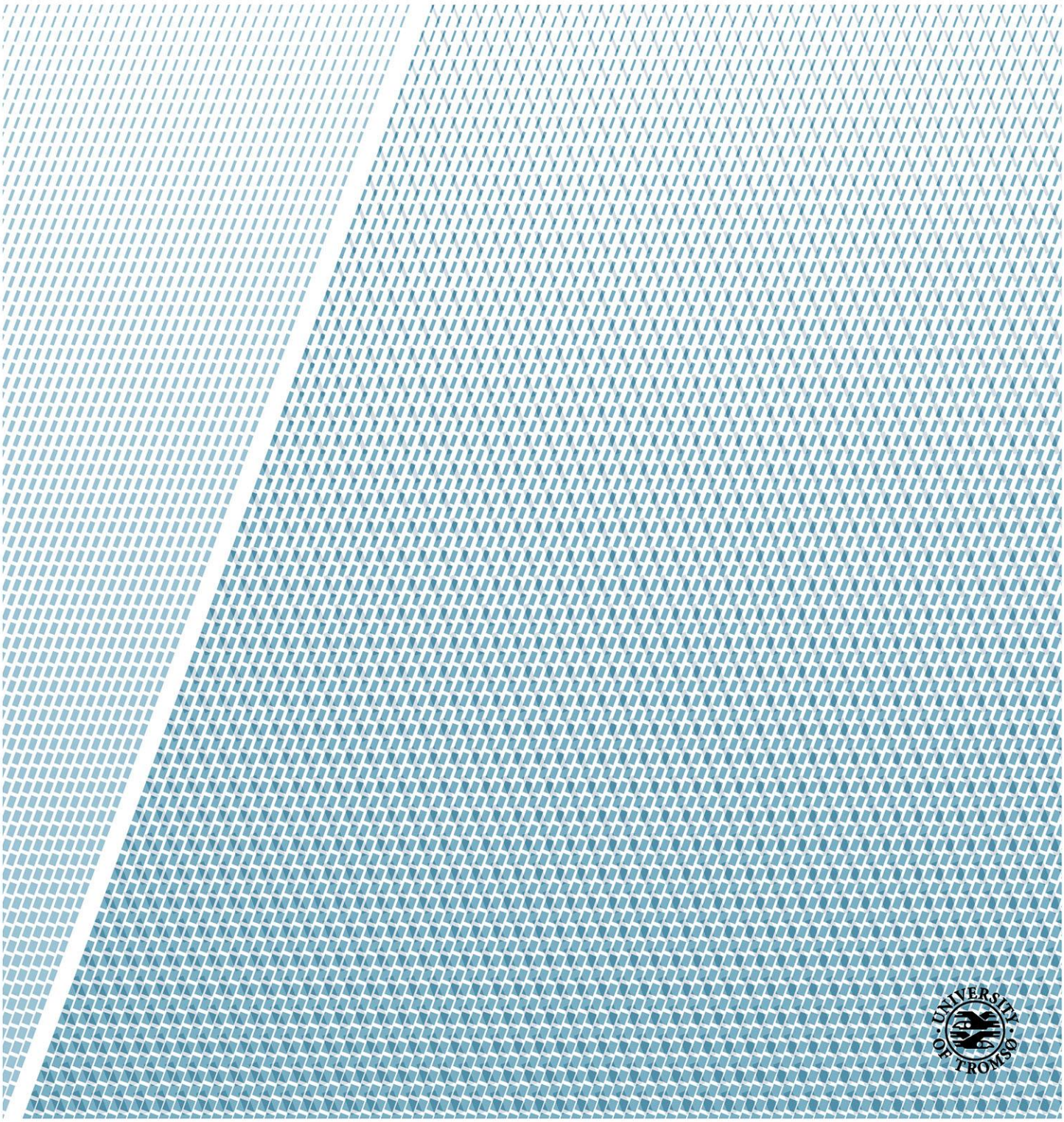

DEDICATION

I dedicate this thesis to my Parents, Mr. Kwabena Osei Agyeman (May your soul rest in peace, daddy) and Ms. Asare Bema Florence. My siblings and Portia Mensah for their enormous support and prayers throughout my stay in Norway. I also dedicate this work to my dear uncle Mr. Felix Owusu Bonsu.

Your thoughtfulness will always be remembered. Someday I will give back what you have given me. Thank You.

PREFACE

This thesis was submitted in partial fulfilment of the requirements for the degree of Master of Science (MSc) at the Faculty of Medicine, Department of Telemedicine and eHealth, University of Tromsø, Norway.

The thesis was intended for researchers, health experts, policy makers, health managers and politicians who are interested in the use of Information Communication Technology tools such as the smartphones to address the health needs of the people. The thesis shall also be a benefit to the telemedicine and eHealth initiatives of the World Bank, World Health Organization, UNICEF and African Union Commission (AUC). It is also envisioned to serve as a reference material to the Ministry of Health, the Ghana Health Service (GHS) and all health institutions in Ghana.

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ABSTRACT

Background: Mobile phone has been one of the most technologically ubiquitous influences over the past decade. Mobile phone use has changed from a perceived item of luxury to an everyday necessity for many people. Given the widespread availability of mobile technology, there is increasing interest in the potential of interventions utilising these technologies to enhance medical treatment. Smartphones are therefore changing many industries, including the medical industry. Africa as a whole lags far behind compared to the richer regions of the world. Africa often have challenges in medical information, access to healthcare, treatment excellence and affordability. However, the speedy spread of mobile phones in so many of its countries is an extraordinary phenomenon, exclusively in the framework of their enormous economic and social challenges. Mobile technology is an example of such technologies that are readily available, accessible and affordable worldwide that can help African countries to solve their healthcare delivery challenges. This study explored and addressed the possible use of smartphones in providing basic health services in Ghana using health professionals at the 37 Military Hospital as a reference group.

Method: A cross-sectional survey was conducted involving 101 healthcare professionals at the 37 Military Hospital**.** The study used primary data, however, secondary data were also employed where necessary. Data was gathered by administering structured closed-ended questionnaires to respondents who were sampled using convenience sampling technique.

Findings: It was found that all the participants owned and used their smartphones for health purposes. It was particularly found that majority of the participants used their smartphones to communicate with patients. Specifically, applications (like whatsapp, imo, viber) was the most used medium of communication by the nurses, SMS was the most used medium the doctors and pharmacist use to communicate with patients according to the result. The radiologist/laboratory technicians preferred communicating with patients through two or more of the listed options as provided in the questionnaire. The data also revealed that it is only the doctors who admitted that their smartphones helped them in the diagnosis of diseases although majority said otherwise. The study also revealed that majority of the health professionals searched for health information using search engines like google, medline and pubmed. Moreso, internet access problems was the major challenge health professionals at the 37 Military Hospital faced in using their smartphones for health purposes.

Conclusion: The use of smartphones by health care professionals is rising in popularity especially in less financially advanced countries). The use of mobile technologies to support the achievement of health objectives (mHealth) has the potential to transform the face of health service delivery. The Government and health policy makers in Ghana can make use of the potentials of this technology in the health care delivery of Ghana.

Keywords: smartphones, health purposes, healthcare professionals, mHealth, developing countries, Africa, Ghana.

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CHAPTER ONE

INTRODUCTION

1.0. Introduction

Developing nations (both low-and middle-income) often have challenges in medical information, access to healthcare, treatment excellence and affordability as well as behavioural norms (Qiang et al., 2011). These challenges stem from gaps in resources, mainly financing, physical capital, and skilled health professionals (Qiang et al., 2011). To attain better health in an economical and maintainable way, developing countries need to utilize ideas and technologies that are readily available and affordable. Mobile technology is an example of such technologies that are readily available, accessible and affordable worldwide. Numerous evidence have proven the proliferation of mobile technology in recent years. According to the Mobile Economy (2014) "at the end of 2003, there were a little over one billion unique subscribers, meaning that just under one in six people had subscribed to a mobile service". This figure had risen to 3.4 billion distinct subscribers at the end of the year 2013, and also there were 6.9 billion SIM connections with an average of 1.8 active cards per unique subscribers in the same year (The Mobile Economy, 2014).

Interestingly, most people in developing countries have access to mobile technology than basic amenities like power grids, road systems, water works, or fiber optic networks (Qiang et al., 2011). Mobile phones and mobile technologies have now moved past its simple functions of calls, simple short messaging service (SMS) text and voice messaging, to include more diverse functions like mobile Internet browsing, voice over Internet protocol services (example Skype), instant messaging services, photographic capabilities, and a wide variety of device-based software applications (Hall et al., 2014.). Smartphones are potent devices that syndicate the conservative roles of mobile phones with advanced computing proficiencies allowing users to access software applications (commonly referred to as "apps") (Koehler et al., 2013).

The usage of mobile devices by health care professionals (HCPs) has revolutionised several aspects of clinical practice. Mobile devices have become conventional in health care settings, resulting in quick progression in the development of medical software applications (apps) for these platforms. Many apps are now reachable to assist HCPs with many important tasks, like: information and time management, health record maintenance and access, communications and consulting, reference and information gathering, patient management and monitoring, clinical decision-making, and medical education and training (Ventola, 2014). Some of these apps are specially designed for healthcare professionals such as medical calculators, logbooks, medical reference tools, medical protocols such as resuscitation algorithms, and drug guidelines. The use of apps, as well as other function on smartphones allow events such as viewing patients' radiological images and communicating with colleagues, permit healthcare professionals to execute several tasks at point-of care. (Koehler et al., 2013).

Currently, there are more than 250,000 apps in existence for the iPhone4, more than 30,0005 of such apps for smartphones are on running android, and various for those who have blackberry devices (Pew Research Center, 2010). There are apps for counting calories and nutrition information, apps for grouping of fitness workouts, apps to monitor vital signs, apps providing health tips, apps to calculate disease risks, apps to calculate body mass index, apps for keeping personal health records and for providing users' health information to physicians and emergency workers, apps to study about medicines, apps for smoking cessation, and apps for yoga stretching exercises people can perform at their desks at work (Pew Research Center, 2010). Despite the accessibility of numerous medical apps there is little known in respects to healthcare professionals' use of and attitudes towards using smartphones in clinical practice (Koehler et al., 2013).

Africa as a whole lags far behind compared to the richer regions of the world. However, the speedy spread of mobile phones in so many of its countries is an extraordinary phenomenon, exclusively in the framework of their enormous economic and social challenges (The Vodafone Policy Paper Series, 2005). According to industry approximations, there are more than 500 million mobile phone subscribers in Africa currently, up from 246 million in 2008. The four principal mobile phone markets in Africa are Nigeria, South Africa, Kenya, and Ghana (Mobile Africa Report, 2011). Presently, cell phones are as common in South Africa and Nigeria as they are in the United States. Smartphones (those that can access the Internet and applications)

are less generally used, though substantial sections own these devices in several nations, including 34% of South Africans (Pew Research, 2010).

Data gathered from the National communication Agency (NCA) of Ghana put forward that, of about 24.97 million population, 24.4 million are mobile phone users (IT New Africa, 2012). Testament from the Mobile Data Market Trends gathered by the National Communication Agency (NCA) at the end of August 2014 showed that Ghana has a total subscriber base (mobile phone users) of 14,615,048 (NCA, 2014). This basically implies that smart phones are in proliferation in Ghana and could be utilized purposely for health purposes by health professionals in Ghana.

1.1. Statement of Problem

Governments and stakeholders across the continent are expressing interest in mHealth as a harmonising strategy for strengthening health systems and attaining the health-related Millennium Development Goals (MDGs) in low and middle-income countries (WHO, 2011). This interest has been established into a sequence of mHealth deployments globally that are providing early proof of the potential for mobile technologies. mHealth applications are being tested in such various developments as improving timely access to emergency and general health services and information, managing patient care, reducing drug shortages at health clinics, enhancing clinical diagnosis and treatment adherence, among others (WHO, 2011).

According to the Vodafone Policy Paper, mobile phone and health studies have been recent and largely focused on the prospective benefits of the technology within the health sector and on their use in advanced, rather than developing countries (WHO, 2007)). Many of the present studies look at the voice and text functions as contributing to improved access and proficiency within health care as well as the means by which young people can access confidential health-related information (WHO, 2007) (see Juen et al., 2015; Miward et al., 2015; Train et al., 2014). While some studies have been conducted on smartphones among some African countries see (Oyeyemi & Wynn, 2015: Jennings et al., 2013), the study by Medhanyie et al. (2015) and Crankshaw et al. (2010) appeared to be the only studies that has been conducted on smartphones for health purposes. Some studies have been conducted on smartphone usage in Ghana. For instance the study conducted by Kwakwa (2012) was on mobile phone usage by micro and small scale enterprises in semi-rural Ghana. The study conducted by Akanlisikum

et al. (2014) was also on mobile phone usage among adults in Ghana from the viewpoint of university students. Addo (2013) also conducted a survey on the adoption of mobile phone but also limited it to how mobile phones has changed us socially. Only few studies have been conducted on the use of smartphones for health purposes by health professionals. For example the study conducted Velez et al. (2014) was on mobile application for rural Ghanaian midwives. Another study on smartphones for health purposes among health professionals in Ghana was conducted by Kaonga et al. (2013). They also limited their study to examining a closed user group in rural Ghana. The current study, therefore, seeks to contribute to the literature by examining the use of smartphones for health purposes among health professionals in Ghana. It is hoped that this study will give important data about how health care staff in Ghana use smartphones to the best of their patients and about the potential of this technology in healthcare delivery using 37 Military hospital health professionals as a reference group.

1.2. Objective of the study

Without a doubt, medicine is one of the disciplines that have been intensely affected by the accessibility of mobile devices. This is apparent in many surveys of health care professionals that divulge a high ownership level of these tools, which HCPs use in both clinical practice and education. Health care professionals at present use smartphone or tablet computers for tasks they used to need a pager, cell phone, and PDA to undertake (Ventola, 2014). The purpose of this study is to primarily analyse the health professional's reasons for using the smartphone, assess how effective the use of smartphones is to clinical practice, assess how health professionals search for health information using their smartphones and the problems they encounter in using the smartphones. The study is also to be conducted in partial fulfilment of the researchers master's degree programme in Telemedicine and E-health.

The specific objectives of the study are;

- To determine the health professionals reasons for using the smartphones at the 37 Military Hospital.
- To assess how effective the use of smartphones is to clinical practice by the health professionals.
- To determine the problems health professionals encounter in using smartphones for health purposes at the 37 Military Hospital.

- To assess how health professionals search for health information using their smartphones at the 37 Military Hospital.

1.3. Research questions

The specific questions of the study include;

- What are the reasons for the use of smartphones by the health professionals?
- How effective is the use of smartphones to clinical practice by the health professionals?
- What problems do health professionals encounter in using smartphones for health purposes?
- How does the health professionals search for health information using your smartphones at the 37 Military hospital?

1.4. Significance of the study

As one of the a small number of studies on assessing the use of smartphones among health professionals in the Ghanaian context; if not the first of its kind, this study is anticipated to divulge the reasons, the effectiveness and challenges of using smartphones by health professionals in healthcare institution in Ghana, and how such findings relate to findings of other studies conducted in other developed and developing countries. It will also serve as a basis on which health experts, researchers, and other health managers can develop calculated policies in addressing the health needs of health professionals. Likewise, it can serve as a reference material to all stakeholders in the health sector of Ghana. Additionally, it would also serve as an information resource to various international bodies in health, including the World Health Organization (W.H.O) and International Monetary Fund (IMF) as well as add up to literature already available in the body of academia. The study will also serve as a guide to others who will want to conduct further studies on this topic. Finally, the study will add up to literature already available in the body of academia.

1.5. Organization of the Study

The study is organized into seven chapters. Chapter one looks at the general introduction to the study, chapter two looks at the review of occupational health and safety. Chapter three covers on the approaches to data management, Chapter three contains the theoretical perspective, Chapter four includes the methodology, Chapter five looks the analysis of the data gathered. Chapter six contains the discussion and limitation. Chapter seven contains a summary, recommendations and conclusion.

CHAPTER TWO

INTRODUCTION TO THE TOPIC OF SMARTHONES FOR HEALTH PURPOSES

2.0 Introduction

This chapter presents an overview of the literature on smartphones for health purposes. It first of all talks about the background of smartphones as well as smartphone users across the world. The chapter also briefly discusses the concept of mobile health and focus areas of mobile health. The potential benefits and barriers of smartphones for health purposes are also looked at.

The literature was extensively searched in order to identify related and suitable articles to the research topic. The research topic is interdisciplinary in nature as it has different aspects spanning through several fields such as telemedicine, ehealth, mhealth, information and communication technology and public health. The search was carried on the following electronic databases: Medline, Cochrane, National Library of medicine (NLM) PubMed and Google Scholar. The keywords used comprised: Smartphones subscriptions, health purposes, developing countries, smartphones usage worldwide, health information, health net services, healthcare delivery and healthcare issues.

2.1. Background of Smartphones

The present day‘s smartphones have been around since Apple presented the smartphone to the mass consumer market, but in veracity the smartphone has been on the market since 1993. The distinction between the contemporary smartphone and the initial smartphone is that the initial smartphones were mainly intended for corporate consumers and used as enterprise devices and also those phones were too affluent for the common customers. The smartphone age can be described into three main stages. The first stage was mainly preordained for enterprises. During this stage all the smartphones were devised according to the needs corporations. This age commenced with the initiation of the very foremost smartphone the Simon from IBM, in 1993. Blackberry was the ground-breaking device of this age, it came with a lot of features

comprising Email, Internet, fax, Web browsing and a camera. The second stage of the smartphone era started with the introduction of the iPhone, the major revolution of the smartphone market in 2007. This was the time when first time ever that the industry presented the smartphone device for a general users market. At the end of 2007 Google divulged its Android Operating System with the aim to approach the smartphone market. The prominence during this period was to make known features that the broad-spectrum users require and simultaneously keep the cost on the lower side to entice more customers. Features like, email, social website amalgamation, audio/video, Internet access, chatting along with general features of the phone were part of these all-inclusive phones. The third stage of the smartphone was the bridging of the gap between enterprise centric and general consumer centric smartphones. This stage also aimed to advance the display eminence, display technology and on top of that to stabilize the mobile operating system, introduce more powerful batteries and enhance the user interface and many more features within these smart devices. This stage started in 2008 with the advancements in the mobile operating systems and within the last five years there have been numerous upgrades in Apple iOS, Android and Blackberry OS. The most popular mobile Operating systems (iOS, Android, Blackberry OS, Windows Mobile) and key smartphone vendors (Apple, Samsung, HTC, Motorola, Nokia, LG, Sony etc.) are focused on bringing features both in operating systems and devices that will provide electrifying features to enterprises and to general consumers.

2.2 Smartphone Users across the world

As the world becomes progressively connected, both economically and socially, technology implementation remains one of the crucial elements in human progress. From that score, there has been a conspicuous upsurge over the past two years in the proportion of people in the evolving and developing nations who say that they use the Internet and own a smartphone (Pew Research Center, 2016; Oyeyemi et al., 2014). For smartphone possession, the digital divide between emerging and advanced economies was 31 percentage points in 2015. But smartphone ownership rates in emerging and developing nations are escalating at an astonishing rate, climbing from a median of 21% in 2013 to 37% in 2015 (Pew Research Center, 2016). A survey conducted by Pew Research Center (2016) on smartphone ownership in 40 nations among 45,435 respondents from March 25 to May 27, 2015 showed that the topmost rates of smartphone ownership were among the advanced economies surveyed. This comprises 88% of South Koreans, 77% of Australians, 74% of Israelis, 72% of Americans and 71% of Spaniards.

Apart from the advanced economies surveyed, smartphone ownership is also comparatively high in Malaysia (65%), Chile (65%), Turkey (59%) and the world's leading smartphone market, China (58%). The bottommost levels of smartphone ownership were in the developing nations in sub-Saharan Africa and South Asia. This consist of smartphone ownership rates of two-in-ten or less in Senegal (19%), India (17%), Burkina Faso (14%), Tanzania (11%), Pakistan (11%), Uganda (4%) and Ethiopia (4%) (Pew Research Center, 2016).

Universal mobile subscriptions are growing by 1.5 percent quarter-on-quarter and around 5 percent year-on-year (Ericsson Mobility Report, 2015). India grew the most in terms of net additions (+26 million), followed by China (+8 million), Myanmar (+5 million), Indonesia (+4 million) and Japan (+4 million). Global mobile penetration reached 99 percent in quarter 1 of 2015. Smartphones accounted for nearly 75 percent of all mobile phones sold in quarter 1 of 2015, matched to about 65 percent during in quarter 1 of 2014 (Ericsson Mobility Report, 2015).

Sub-Saharan Africa (SSA) has been the fastest growing region over the last five years, in terms of both unique subscribers and connections. By June 2014, there were 329 million exclusive subscribers, comparable to a penetration rate of 38%. Customers, governments and businesses across SSA are speedily accepting mobile, not only as a simple communication device, but also to access information and an upsurging range of new applications and services (The Mobile Economy, 2014). As of June 2014, there were 608 million connections in SSA. The region is now seeing a swift technology migration to advanced speed networks, aided by the growing variety of lower-cost mobile devices and ongoing network deployments by the operators. 3G connections accounted for only 15% of the total base at the end of 2013. The increasing proportion of 3G connections essentially echoes the hastening rate of smartphone acceptance (The Mobile Economy, 2014). Smartphone usage is set to more than double by 2020. By that time, 70 percent of the world´s population will have a smartphone (Ericsson Mobility Report, 2015).

2.3 The concept of mobile health

The use of mobile devices to reach health goals has the prospect of revolutionizing the face of health service delivery worldwide. A prevailing combination of elements is motivating this revolution. These comprise quick improvement in mobile technologies and applications, a growth in new prospects for the incorporation of mobile health into prevailing eHealth services, and the continual progression in coverage of mobile cellular networks (WHO Global Observatory for eHealth, 2011). The exceptional spread of mobile technologies as well as developments in their inventive application to address health concerns has developed into a new field of eHealth, referred to as mHealth. The Global Observatory for eHealth (GOe) defined mHealth or mobile health as "medical and public practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless". mHealth can also be defined as "using mobile communications—such as PDAs and mobile phones—for health services and information" (Vital Wave Consulting, 2009). mHealth largely covers the use of mobile telecommunication and multimedia technologies as they are incorporated within progressively mobile and wireless health care delivery systems (WHO, 2007). In 2011, the US Secretary of Health and Human Services Kathleen Sebelius denoted mHealth as "the biggest technology breakthrough of our time"(Dehzad et al., 2014).

mHealth comprise of the use and capitalization on a mobile phone's primary function of voice and short messaging service (SMS) as well as more intricate functionalities and applications containing general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G systems), global positioning system (GPS), and Bluetooth technology (WHO Global Observatory for eHealth, 2011). Mobile health promises to enhance patients' care, treatment and safety for instance through early disease diagnosis enriched patient compliance and upgraded disease testing. It also promises to realise viable healthcare system using present technological infrastructure such as smartphones to treat diseases and observe chronically sick patients better and decrease hospital admissions. (ATkearney, 2013). It also comprises applications (such as lifestyle and wellbeing apps) that may link to medical devices or sensors (e.g. bracelets or watches) as well as personal guidance systems, health information and medication reminders provided by SMS and telemedicine provided wirelessly. mHealth solutions encompass various technological solutions, that among others measure essential signs like heart rate, blood glucose level, blood pressure, body temperature and brain activities (European Commission, 2014).

2.3.1 mHealth and Ehealth

mHealth has lately evolved as an integral part of the electronic health (eHealth). mHealth and eHealth are inseparably connected—both are used to enhance health results and their technologies work in juxtaposition. For instance, many eHealth innovations include digitizing patient records and creating an electronic system that will regulate access to patient data within a national system. mHealth programs can function as the entry point for entering patient data into national health information systems, and as remote information tools that deliver information to healthcare clinics, home providers, and health workers in the field (Vital Wave Consulting, 2009). Of immediate significance to mHealth are uprising drifts towards various pre-existing eHealth systems onto mobile technologies. For instance, several disease surveillance systems are progressively becoming a shared system of computer databases, PDAs, and mobile phones networked towards observing and managing disease outbreaks (WHO, 2007).

2.4 Focus Areas of mHealth

The mHealth field is extraordinarily robust, and the range of applications being designed is continually increasing. Evolving developments of interest within mHealth include the use of mobile technologies in the following abilities; communication and training for healthcare workers, diagnostic and treatment support, remote monitoring, education and awareness, patient monitoring, public health emergencies (WHO Global Observatory for eHealth, 2011; WHO, 2007).

2.4.1 Education and Awareness

One of the most distinguishing areas mHealth focuses on is education and awareness. In education and awareness applications, SMS messages are sent directly to users' phones to offer information about testing and treatment methods, availability of health services, and disease controlling. Studies have shown that SMS alerts have a considerable impact on and a better capability to influence behaviour than radio and television campaigns (Vital Wave Consulting, 2009). SMS alerts provide the extra gain of being comparatively inconspicuous, offering recipients privacy in settings where disease (particularly HIV/AIDS) is often taboo. Health information through mobile tools is particularly convenient for diseases such as HIV/AIDS and

other sexually transmitted infections, which are very sensitive topics (WHO Global Observatory for eHealth, 2011; Gabarron et al., 2015; Gabarron et al., 2014). In the less financially advanced countries, SMS alerts have demonstrated predominantly effective in targeting hard to reach populations and remote areas, where the absence of healthcare facilities, inadequate of healthcare workers, and limited access to health-related information may thwart people from making learned decisions about their health (Vital Wave Consulting, 2009; Oyeyemi & Wynn, 2014). Several projects have been undertaken on education and awareness using mobile technologies. For instance, projects Masiluleke and Text to Change use SMS message campaigns to promote HIV/AIDS education in South Africa and Uganda, respectively. Project Masiluleke takes advantage of the 120 spare characters on free 'please call me' SMS messages to promote HIV/AIDS education and awareness, whereas Text to Change employs an SMS-based quiz to test users' HIV/AIDS knowledge and encourage testing and advise (Vital Wave Consulting, 2009). Again, Ghana has adopted an educational mhealth project known as "mPedigree". The purpose of this project is to primarily educate consumers about the authenticity of some pharmaceutical products they purchase (especially malaria drugs). The mPedigree system assigns distinct codes to original versions of malaria medicines. Customers send a text message with the code inscribed on the drug. If the number is verified, a confirmation text will be sent back to the consumer.

2.4.2 Patient Monitoring

One of the remarkable area's most exceptionally suitable to grow in tandem with mobile technology is the remote monitoring of patients. In respect of mHealth, patient monitoring is "defined as using technology to manage, monitor, and treat a patient's illness from a distance (e.g. diabetes and cardiac patients)" (WHO Global Observatory for eHealth, 2011). Remote monitoring unlocks new opportunities for treating patients in an outpatient setting, an essential proficiency in less advanced countries where access to hospital beds and healthcare facilities is limited. This group of applications entails one or two-way communications to monitor health conditions, maintain caregiver appointments, or guarantee medication regimen adherence. Remote sensors installed in households or imaging devices connected to mobile phones are frequently used to expedite data transmission to the health service provider. This can reduce the need for visits to a health centre for check-ups (WHO Global Observatory for eHealth, 2011). Also, monitoring patients at home for chronic illnesses vividly enhances survival rates. Remote monitoring applications are being instigated on a rather limited basis in evolving

countries, but they are gaining grip in the advanced world, above all for chronic diseases (Vital Wave Consulting, 2009). Mobile phones are also important in that they make it easier for patients to get support from their family or peers. This type of support may be especially important in chronic conditions where the family of the patient may play a central role, such as heart disease or diabetes (Bergvik & Wynn, 2012).

2.4.3 Diagnostics and Treatment Support

Diagnostics and treatment support are essential in healthcare since the inability to diagnose a condition could have serious consequences. mHealth applications in this area are intended to make available diagnosis and treatment guidance to remote healthcare workers via wireless access to medical information databases or medical staff. With mHealth-enabled diagnostics and treatment support, patients are able to obtain treatment in their rural communities and homes, preventing expensive hospital visits, which may be far away from their reach. Diagnostic and treatment applications use the phone as a point-of-care tool. Health workers' phones may be fortified with specialized tools, such as built-in software that leads the worker through a step-by step diagnostic process. Once data are entered into the system (e.g., symptoms and an image of a patient's injury captured on the mobile phone), remote medical professionals can diagnose the illness and prescribe treatment. By eradicating the need for patient travel, these applications have the possibility to radically increase access to care (Vital Wave Consulting, 2009).

2.4.4 Communication for Healthcare Workers

mHealth can enhance provider-to-provider, and provider-to-client communication. Short message system (SMS) or voice-based provider-to-client or provider-to-provider communication initiatives can eradicate communication barriers, by means of enhancing connections to care, enhancing counselling and adherence to treatment procedures, and decreasing loss to follow-up (Mehl et al., 2014). Also as noted by Labrique et al. (2013) voice communication is one of the basic purposes of mobile phones. Thus mobile technologies can enhance communication, allowing healthcare workers to communicate with one another and share ideas on the treatment procedures for diseases (especially complicated diseases) within their facilities or with physicians in other facilities. Mobile technology can also enhance the patient to provider communications. For instance instead of a patient going to a health institution to book an appointment to see a specialist, mobile technology can help him or her

book the appointment without necessarily going to the health institution in person. Some developing countries have initiated some health projects in this regard. The Chipatala Cha Pa Foni hotline of Malawi is an example of such project. Chipatala Cha Pa Foni (CCPF) is a hotline and voice/text centred tips and reminders service providing women and guardians of children in rural and remote locations with access to health advice and referrals on reproductive, maternal and child health matters. The project's toll-free hotline offer patients with advice on issues across the continuum of care, and refers callers showing dangerous symptoms for immediate care at a clinic, health centre, or any hospital nearer to the caller. Nigeria has also adopted a mhealth project called the "Abiye project". With the high maternal death rates in Nigeria, the goal of the project was to primarily reduce maternal death, neonatal mortality as well increase facility utilization. Pregnant women visiting any Abiye designed health institution for the first time were given free cell phone. Through these cell phones, women communicate free of charge to the healthcare facility (Oyeyemi and Wynn, 2014). The Medicareline project of Ghana is also an example of a project that enhances provider to provider communication. It is a program presently offering free calls and text messages between any registered physicians within Ghana. Its present concentration has been on decreasing logistical and economic obstacles to mobile phone use rather than on technological innovation. A physician is able to call a specialist in the capital or a friend in the countryside to seek advice or engage in a medical discussion free of charge (Luk et al., 2008). Mobile technologies present an opportunity by connecting patients, community health workers and physicians in urban and rural areas to improve quality of care at the point of care and reduce unnecessary referrals. (WHO Global Observatory for eHealth, 2011).

2.4.5. Training of Healthcare Workers

Also, another remarkable mHealth focus is the training of healthcare professionals. Continuing medical training has been the backbone of excellent healthcare delivery in developed countries (Labrique et al., 2013). Connecting health workers with sources of information via mobile technology is a strong basis for empowerment, as it provides the support they need to perform their functions effectively and self-sufficiently. There is also a pressing need to improve communication among different health units to facilitate more efficient patient care (Vital Wave Consulting, 2009). Contrary to that, a lack of training of health professionals has led to the delivery of poor healthcare to patients in developing countries. Mobile technologies could be used to offer training to health workers through educational videos as well as sending text

messages to health professionals about currents practices in their respective fields. For instance countries like Uganda, Colombia, Panama, India and El Salvador have adopted Emocha (Electronic Mobile Open-source Comprehensive Health Application) mobile health software. A safe, highly elastic and pliable, open-source mHealth software platform designed to clout mobile devices to aid health programs, researchers, educators, providers, and patients enhance communication. eMOCHA synergizes the power of mobile technology, android-supported devices, video and audio files, and a server-based application to analyse data and GPS-map large amounts of data, implement interactive multimedia training, and streamline data collection and analyses.

2.5. Potential benefits of smartphones for health purposes

One of the main reasons for using mobile technology in the health sector is to enhance the quality of and access to care (Qiang et al., 2011). Ideally, healthcare professionals need access to many types of resources in a clinical setting, including: Communication capabilities—voice calling, video conferencing, text, and e-mail Hospital information systems —electronic health records, electronic medical records (EMRs), clinical decision support systems, picture archiving and communication systems (PACSs), and laboratory information systems Informational resources—textbooks, guidelines, medical literature, drug references Clinical software applications—disease diagnosis aids, medical calculators (Mosa & Yoo, 2014). Preceding the development of mobile devices, these resources were predominantly provided by stationary computers, which do not support the need for mobility in health care settings. With the disposal of mobile devices however, healthcare professionals now have access to a wellspring of information at their fingertips, through their smartphones (Murfin, 2013)

2.5.1 Communication and Consulting

Health care systems are more often than not extremely dispersed, incorporating multiple locations such as clinics, inpatient wards, outpatient services, emergency departments, operating theaters, intensive care units, and labs. Accordingly, healthcare professionals not only need to be mobile themselves, they also need to be able to communicate and collaborate with people in different locations (Ventola, 2014). Provider-to-provider communication by mobile phone can be used to coordinate care and provide expert assistance to health staff, when and where it is needed (Labrique et al., 2013). Mobile tools gratify this need by offering various means of communication, including: voice and video calling; text, e-mail, and multimedia

messaging; and video conferencing. Additionally, communication is not restricted only to the above mentioned. Mobile phones allow the transmission of images between clinicians or even sounds (for example, through digital auscultation, extending the reach of the traditional stethoscope) for instant remote consultation (Labrique et al., 2013). Mobile devices have been confirmed to enhance contact between HCPs and their colleagues (Wallace et al., 2012; Ozdalga et al., 2012). In one study, mobile tools were shown to enhance communication between doctors and nurses on inpatient wards. In a study involving medical school HCPs and students, more than 80% of participants admitted using mobile devices to communicate with colleagues about patient care through e-mail, telephone, and text messages. They labelled texting as a more effective means of communication than telephone calls or in-person meetings. Mobile devices also allow rapid response to e-mail, allowing users to keep up with communication. (Ventola, 2014). A study conducted by Tran et al. (2014) on the use of smartphones on general internal medicine wards also showed that clinicians used their personal devices to communicate with their medical teams and with other medical specialties and healthcare professionals. From the study responses, 39% of the residents reported using their personal cell phones to email or text patient information that may have contained patient identifiers. Also another study conducted by Tran et al. (2014) on medical students and personal smartphones in the clinical environment revealed that majority (86%, 85/99) of respondents used their personal phones for patient-oriented communication in the course clinical rotations. Also, another study conducted by Moon & Chang (2014) showed that phone calls consisted of 51.4% of work-related purposes, while other functions, such as text message, web browser, and scheduling, were mostly used for personal purposes. It is also evident from the study of Koehler et al. (2013) that smartphones have improved contacts between health care professionals. They found that 22 (51%) of the participants said they accessed emails through their smartphones, 27 (63%) of the respondents said they made and/ or received phone calls with their smartphones from healthcare colleagues. Also 16 (37%) of the respondents said they made and/ or received phone calls from patients using their smartphones. Moreso, 22 (51%) of the respondents sent and/or received text messages from healthcare colleagues. 6(14%) also said that they sent and/ or received text messages from patients. A study conducted by D4 (2010) on mobile phone usage by health professionals in the UK, revealed that 82% used a mobile phone for communicating with colleagues while 18% did so for communicating with patients.

2.5.2 Reference and Information Gathering

Mobile tools are vital tools for health care professionals to search or access medical information and data. One survey of medical school health care professionals and students found that mobile devices were often used to access medical journal websites (60%) or medical news online (74%) (Wallace et al., 2012). A number of medical journals, such as the *New England Journal of Medicine*, *The Lancet*, and *BMJ* (previously the *British Medical Journal*), run apps that allow papers to be viewed on mobile devices (Yoo, 2013). Search applications for healthcare professionals, like PubMed/MEDLINE, are available as mobile apps and expedite searches of medical literature databases to find published medical literature. Mobile medical literature search application used by health care professionals comprise: PubSearch, PubMed on Tap, Medscape, MEDLINE Database on Tap (MD on Tap or MDoT), Docphin, Docwise, Read by QxMD, askMEDLINE, PICO, and Disease Associations (Mosa & Yoo, 2012). A study conducted by Patel et al. (2015) found that a total of 341 participants were surveyed with a complete response rate: 93.5% of which owned a smartphone, with 54.2% of those owning medical apps and 86.2% using their device to access online medical resources. Junior doctors were more likely to use medical apps over their senior colleagues ($p < 0.001$) as well as access the Internet on their smartphones for medical information ($p < 0.001$). A study conducted by D4 (2010) on mobile phone usage by health professionals in the UK revealed that 46% used smartphones for accessing information on the Intranet/Internet 18% used them for running work related software/applications

2.5.3 Clinical Decision-Making

Mobile devices provide health care professionals with appropriate and quick access to evidence-based information, supporting clinical decision-making at the point of clinical care. Health care professionals augmented dependence on electronic resources for this purpose was acknowledged in the Manhattan Research/Physician Channel Adoption Study, which revealed that physicians use the majority (64%) of their online time looking for information to make or support clinical decisions (Chase, 2013). Printed medical references often used in disease diagnosis are now accessible as mobile device apps that provide information on diagnosis, treatment, differential diagnosis, infectious diseases, pathogens, and other areas. These apps comprise: Johns Hopkins Antibiotic Guide (JHABx), Dynamed, UpToDate, 5-Minute Clinical Consult (5MCC), 5-Minute Infectious Diseases Consult (5MIDC), Sanford Guide to Antimicrobial Therapy (SG), ePocrates ID, Infectious Disease Notes (ID Notes), Pocket

Medicine Infectious Diseases (PMID), and IDdx. Diagnosaurus, a popular, low-cost mobile differential diagnosis app for the iPhone, iPad, and iTouch, can help ensure that alternative diagnoses are not overlooked (Chase, 2013).

2.5.4 Increased Efficiency

It has been suggested that mobile devices enables healthcare professionals to be more effective in their work practices. One study of physicians found that most doctors believed that significant adoption of health information technology (EHRs, e-prescribing, health information exchange, analytics/decision support, patient support tools [websites, mobile apps, tools to track and manage health and wellness], and mobile health technologies [tablets, smartphones]) could increase the effectiveness of clinical practice (Deloitte Center for Health Solutions, 2013). Also, a study conducted by Tran et al. (2014) on the use of smartphones on general internal medicine wards also showed that participants understood the risks associated with communicating confidential health information via their personal smartphones, but appear to favor efficiency over privacy issues. Again, a study conducted by Tran et al. (2014) on medical students and personal smartphones in the clinical environment revealed that a total of 26% (26/99) of participants reported not having any type of security feature on their personal phone, 94% (90/96) of participants agreed that using their personal phone for clinical work makes them more efficient, and 86% (82/95) agreed that their personal phone allows them to provide better patient care. The use of mobile tools has been shown to provide health care professionals with numerous enhanced efficiencies, comprising: improved quality of patient documentation through less errors and more comprehensive records, more quick access to new information, and enhanced workflow designs. Health workers working in health care organizations have cited enhanced care harmonization, as well as rapid and more effective access to clinical support resources (guidelines, lab tests, and reports) as primary importance related with mobile device use (Ventola, 2014).

2.6. Potential barriers to the use of smartphones for health purposes

Unfortunately, mHealth has somewhat failed to reach the scale of acceptance that many stakeholders anticipated. This can be ascribed to a range of reasons. Reasons range from macro-level systemic barriers (like lack of benign healthcare policy) to micro level individual barriers (like perceived difficulty and resistance from physicians). Also, the health sector in itself is a disreputably late adopter of information technologies, particularly mHealth as a disruptive

invention is confronted with a challenging and slow adoption in healthcare. To date, however, few studies have focused on the barriers of mHealth from a multi-stakeholder direction (Dehzad et al., 2014). Dehzad et al. (2014) in their paper "Adopting Health Apps, What's Hindering Doctors and Patients?" identified several barriers to the use of mobile devices for health purposes. Some barriers were, a difficulty for physician to adopt new technologies in their current work-environment, privacy and security, not enough central control and steering from the government, insufficient evidence of clinical outcomes, effectiveness and efficiency, technological obstacles (connectivity and battery lacks performance), high degree of technological knowledge and cost intensive, as well as too high and unrealistic expectations of integration and interoperability of all technological devices. The study by Koehler et al. (2013) also revealed that mobile phones were perceived negatively in regard to confidentiality. Furthermore, healthcare professionals' also had the perception that patients might think that they were using their mobile for non-medical purposes. A study by PWC (2012) about the opportunities and challenges of mobile health from the perspective of patients, payers and providers revealed doctors' resistance to disruption of their traditional roles. Only 27% encouraged patients to use mHealth applications in order to become more active in managing their health; 13% actively discouraged this. 42% of doctors surveyed were worried that mHealth would make patients too independent. Privacy, confidentiality, and data security are critical matters pertaining to any mHealth intervention, protecting users' personal health information, keeping public health records secure, and facilitating private consultation about sensitive health issues (Mechael et al., 2010).

A survey by the WHO Global Observatory for eHealth (2011) in member countries showed that upper-middle income countries had similar concerns as high-income countries: conflicting health systems priorities on where to allocate funds. These countries cited, however, the need for more information on the available mHealth options, which could be a reason mHealth policies are still not in place in many of these countries. Lower-middle income countries have the following needs with respect to mHealth: policy, knowledge, and managing conflicting health priorities. Cost-effectiveness of solutions is not considered a barrier, as countries in this group have other critical health concerns to address before they can institute mHealth programmes. Countries from the low-income group identified operating costs and lack of infrastructure as top barriers, illustrating that handset, voice, data, and text pricing for wireless services in the poorest countries is still relatively high and infrastructure is far from ubiquitous.

CHAPTER THREE

THEORETICAL FRAMEWORK

3.0. Introduction

This chapter introduces the theoretical framework on which the study is conducted. The main theory, which is the Technology Acceptance Model, is presented and discussed, including its background, evolution and extensions. The Task Technology Fit Model is also briefly presented. The study has been carried out in one of the emerging areas of eHealth in Africa (see Mechael, 2009; Deloitte, 2014, Mendoza et al., 2013; Cargo, 2013). mHealth has demonstrated the potential to enhance health service delivery in the developing world (WHO Global Observatory for eHealth, 2011). In spite of the robust and positive effects of mobile health on clinical outcomes, studies on the acceptance and usage of mobile phones for healthcare have been few. The topic for the present study, which emphasises assessing health professionals' use of smartphones for health purposes is tailored towards adding important data about how health care staff in Ghana use smartphones to the best of their patients and about the potential of this technology in healthcare. From the technical point of view, the use of smartphones by health professionals at the 37 Military Hospital could be viewed as the application of a new technology. From that view, the Technology Acceptable Model will be the appropriate framework for discussing its usage. In order to achieve this, the Unified Theory of Acceptance and Use of Technology (UTAUT) model proposed by Venkatesh et al. (2003) has been espoused and employed in the study.

3.1. The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical framework from the field Information Systems (IS). The Technology Acceptance Model (TAM) was proposed by Davis in 1986. The Technology Acceptance Model is a theory modelled from the Theory of Reasoned Action (TRA) and argued to be one of the established models when it comes to technology acceptance and use (Park, 2009).

In industries outside of health care, TAM is rather of a gold standard, if not an example on its own. As much as 10% of the space allotted to Information Systems journals are claimed by

TAM research. Reviews of the utmost simple version of the theory consistently find that it accounts for 30 to 40% of IT acceptance, in spite of its relative simplicity (Holden and Karsh, 2010). The TAM states that peoples' decision to use specific technology is subjective to their purpose to use the technology, which ultimately influence the actual use (Gammon et al., 2008; Wynn et al., 2012). The Technology Acceptance Model has advanced into a leading model in explaining and predicting system use. The TAM has become so common that it has been referred to in much of the research that deals with user acceptance. Rose and Forgarty (2006) used TAM to predict senior consumers' acceptance and use of self-service banking technologies. Legris et al. (2003) also used TAM to assess why people use information technology. Park (2009) used TAM to explain university students' behavioural intentions to use e-learning. Moreover, Nair and Das (2012) also used TAM to assess teacher's attitude towards the use of technology as a teaching tool.

3.2. History/ Background of TAM

With increasing technology needs in the 1970's and amassed failures of system adoption in organizations, predicting system use became a field of interest for many researchers. However most of the research carried out failed to yield dependable measures that could explain system acceptance or rejection (Davis, 1989).

In 1985, Fred Davis proposed the Technology Acceptance Model in his doctoral thesis at MIT Sloan School of Management. According to him, system use is a response that can be explained or predicted by user motivation, which in turn is openly influenced by an external stimulus comprising of the actual system's features and abilities (Chuttur, 2009). Davis built the Technology Acceptance Model on the Theory of Reasoned Action (TRA), described by Fishbein and Ajzen in 1975. Fishbein and Ajzen's (1975) model was established on an attitude paradigm from psychology, which stipulates how to measure the behaviour relevant component of attitudes, which differentiates between beliefs and attitudes and states how external stimuli, such as objective features of an attitude object are informally connected to beliefs attitudes and behaviour. They draw the difference between two attitude constructs: attitude towards the objects which refers to a person's affective appraisal of a specified attitude object, and attitude toward the behaviour, which refers to a person's assessment of a specified behaviour comprising the object (Davis, 1993).

In his proposal, Davis (1985), conjectured that the attitude of a user towards a system is a key factor of whether the user will essentially use or reject the system. The attitude of the user, was essentially influenced by two major beliefs: perceived usefulness and perceived ease of use, with perceived ease of use having a direct influence on perceived usefulness (Chuttur, 2009). Perceived usefulness is defined here as the extent to which a person believes that using a specific system would improve his or her job performance (Davis, 1989). Perceived ease of use, on the other hand, refers to the extent to which a person believes that using a precise system would be free of effort. All things being equal, David stipulated that an application perceived to be easier to use than another is more likely to be accepted by users. Actual system use is determined by the person's attitude (A) and intention (B1) to use the system, as well as the connection between A and B1. If anything else is equal, people's intentions are to behave in a way that gives a positive effect (B1=A+U). The most significant assumption is the behavioural intention to use B1, and this is what is usually meant when mentioning acceptance (Davis et al., 1989). The construct external variables might influence the beliefs of a person towards a system since it includes characteristics, user training, user, participation in design, and the nature of the implementation process (Venkatesh and Davis, 1996).

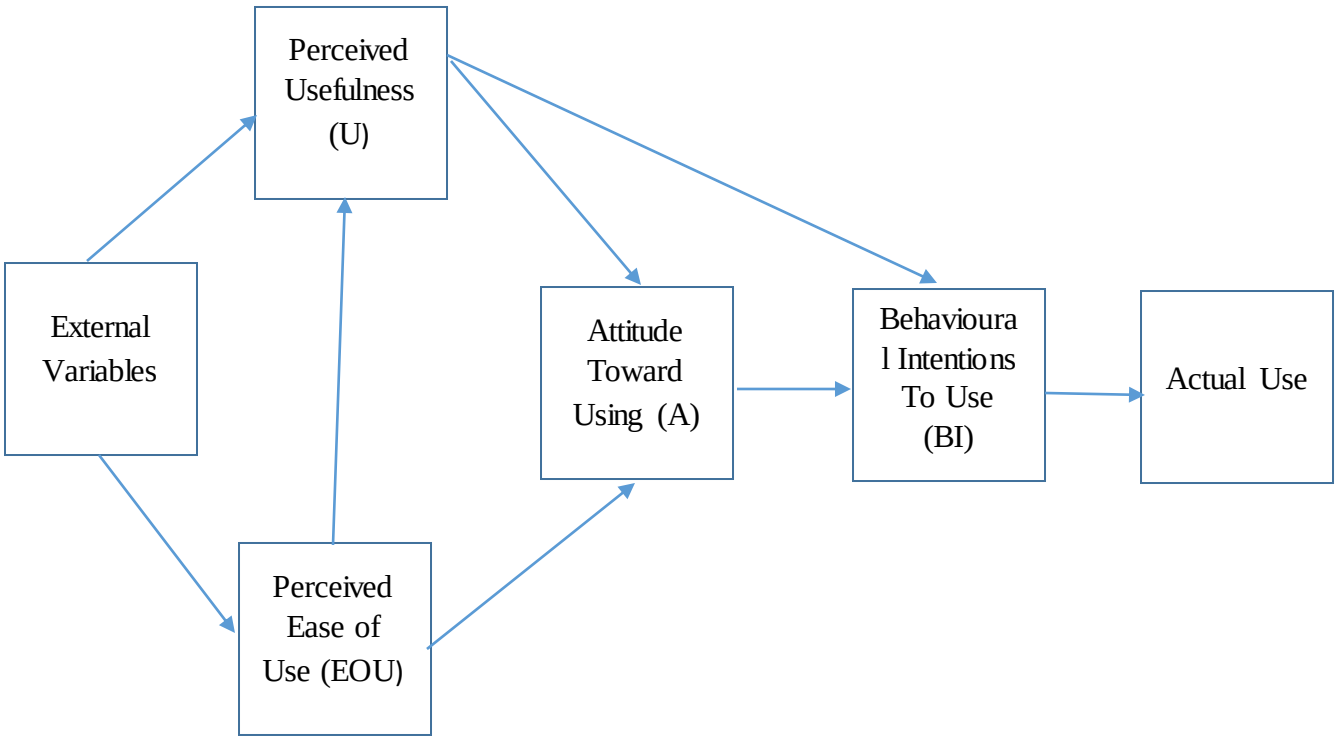

Figure 1: A diagram depicting TAM as proposed by Davis, et al. 1989

The major reason of the design of the TAM was the need to comprehend why people accept or reject computers. Another crucial reason was to find out the impact of external factors on internal beliefs, attitudes, and intentions (Davis et al., 1998; Davis, 1989). Davis worked on with TAM, and progressed till the ultimate version was presented in 1996 (Venkatesh and Davis, 1996). This revised version differed from the original by eliminating the construct attitude towards using, because both perceived usefulness and perceived ease of use were found to have direct influence on the behavioural intention which led to actual use of a system.

3.3. Evolution and extensions of the TAM

The TAM may be useful as a predictive method, in order to assess the likelihood that people and organisations adopt a particular new technology and as an assessment method to appraise the acceptance of technology already in use (Mojtahed, 2011).

As time advanced, Davis subjected his model for reviews and to comprise other components (External) in amending the relations in the model he initially proposed due to concerns raised by fellow researchers in the field. Venkatesh and Davis, (2000) found some weaknesses with the TAM proposed by Davis (1989) after carefully scrutinizing its usage. They pointed out that the first TAM could not go beyond the general items that evaluated perceived usefulness and

perceived ease of use, making it extremely challenging to find out the reasons behind the perceived ease of use or the perceived usefulness variables used in the model. Davis later proposed the TAM2 model, with a number of components added as antecedents to perceived usefulness, and later Venkatesh proposed two groups of antecedents to perceived ease of use (Venkatesh and Davis, 2000)

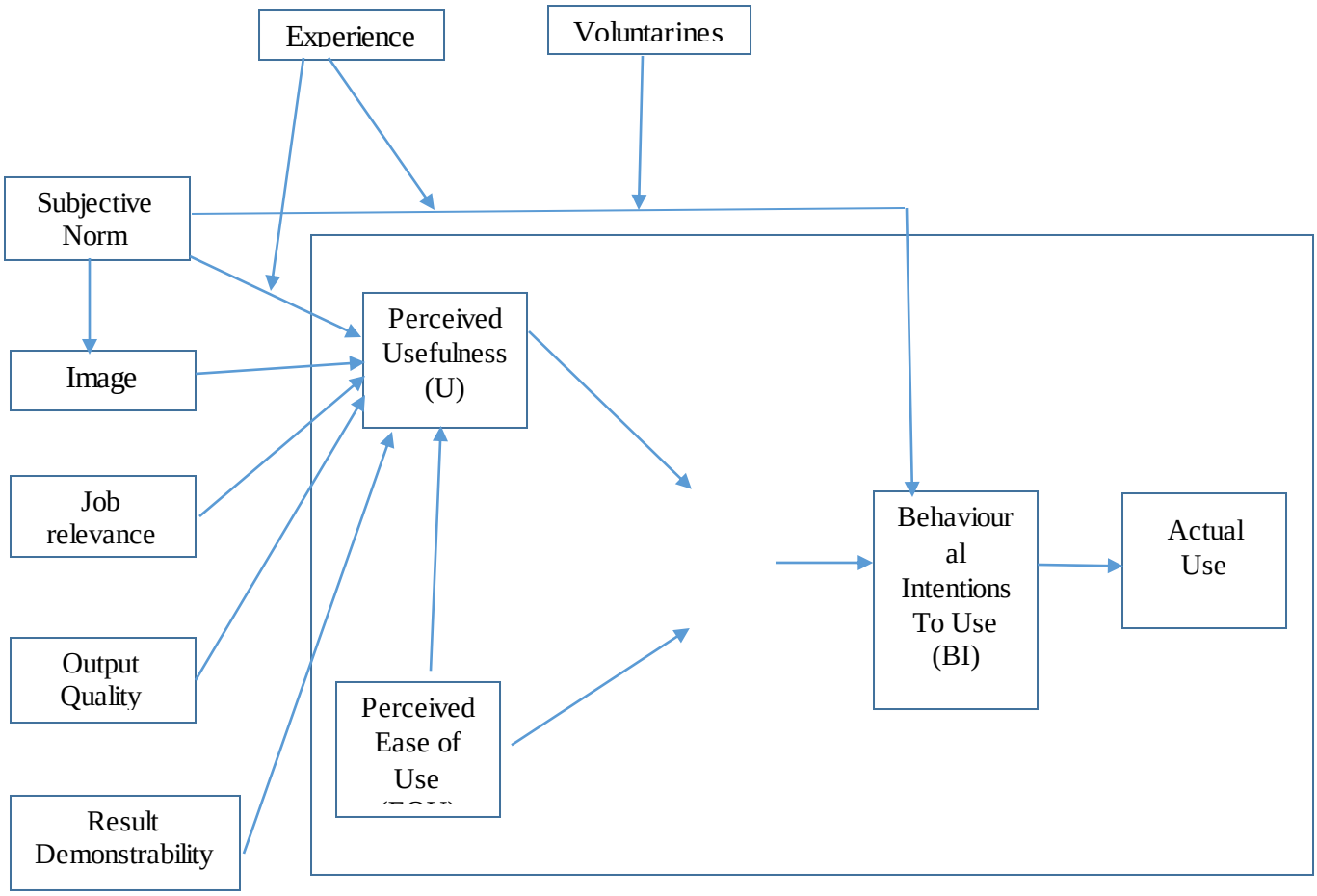

Figure 2: A diagram depicting TAM 2 (by Venkatesh & Davis, 2000)

3.4 The Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al., gathered in a unifying paper about the TAM in 2003. This paper is comprehensive and significant in the further expansion and comprehension of the TAM model. They presented a literature review and compared models, and consequently formulated a unified model which was empirically authenticated by testing the original data from the eight models that were unified and by further adding two more datasets. The Unified Theory of

Acceptance and Use of Technology (UTAUT), was framed with four core elements (facilitating conditions, social influence, effort expectancy and performance expectancy) of intention and usage, and up to four moderators of key relationships (experience, voluntariness, gender, and age). Facilitating conditions are referred to as the extent to which an individual believes that an organizational and technical infrastructure exists to support use of the system (Venkatesh et al., 2003; Venkatesh and Zhang, 2010). The social influence is that variable which captures attitudes and influence from colleagues, leaders and company or institution cultures that forces end users to use or accept the system in question. (Venkatesh et al., 2003). Performance expectancy is defined as the degree to which an individual believes that using the system will aid him or her to achieve advances in job performance. Effort expectancy is defined as the degree of comfort related to the use of the system. (Venkatesh and Zhang, 2010).

When UTAUT was tested using the original data, it was discovered to be better than the eight individual models. UTAUT is envisioned to be used to evaluate the possibility of success when introducing new technology. This model could be expedient for managers as it could assist them realise what actions are required to work out in order to reach a high level of acceptance. The unified model presents the elementary theoretical framework that can explain individual acceptance of information technology (Venkatesh et al., 2003) see Figure 3. Regardless of being an extension of the Technology Acceptance Model, UTAUT does not deepen the understanding of perceived usefulness or perceived ease of use but presents additional predicators of intentions (Grønbek, 2012).

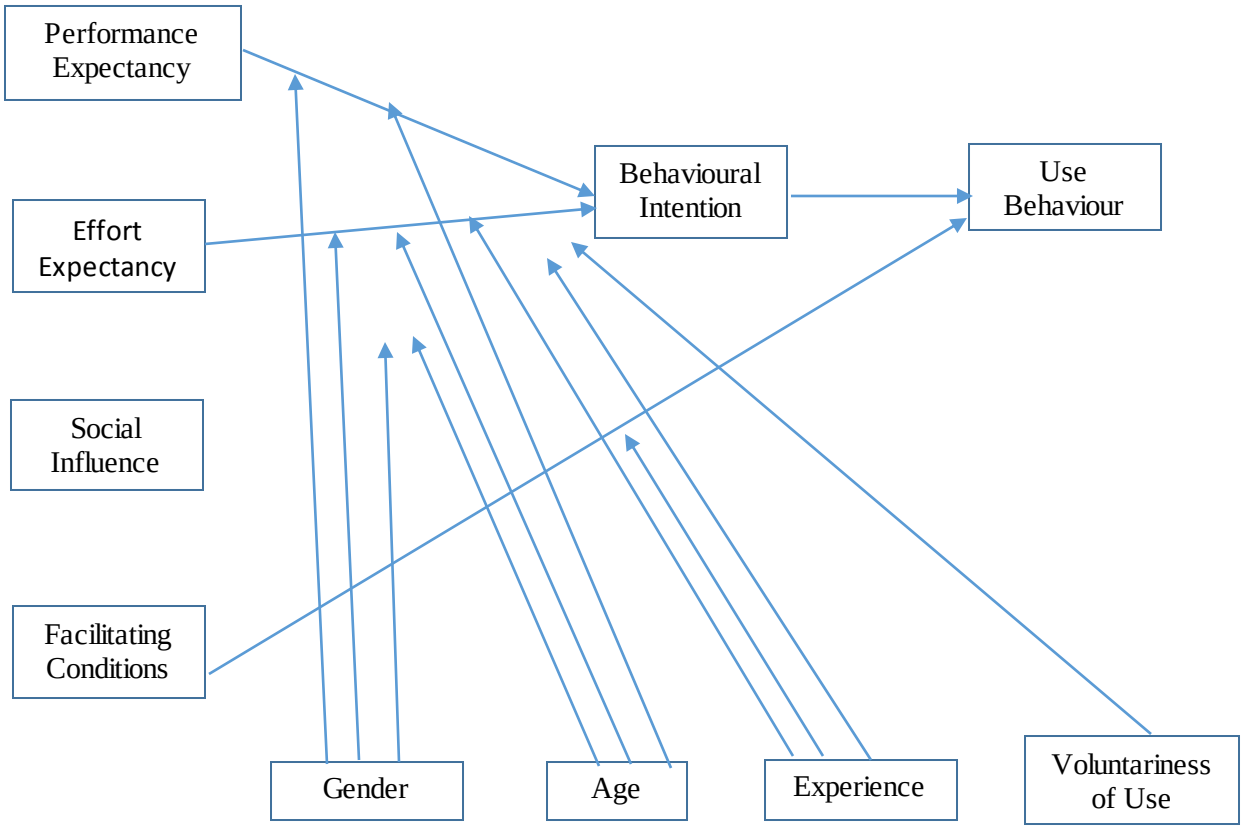

Figure 3: A diagram depicting the UTAUT Research model by Venkatesh et al. (2003)

3.5. The Task Technology Fit Model

The Task-Technology Fit [TTF] model is extensively used for the prediction and explanation of technology use. The Task-Technology Fit was proposed by Goodhue and Thompson (1995), and advocates that individual performance upsurges when a good task-technology fit exists. (Gorretti and Namisango, 2014). ACEC (2010) states that when the users of technology think that the technology is capable of supporting the job at hand, they are likely to perform well. The ability of the technology to support the task means that the functionalities of the technology enable a smooth performance of the task, decrease the cost of performing the task, and simplify its performance. The Task-Technology Fit model is essential to provide finer and more focused design advice in precise contexts. It upsurges performance therefore it is a vital antecedent of adoption and a crucial predictor of perceived usefulness (Gorretti and Namisango, 2014).

The TTF is a comprehensive technology-to-performance model that encompassed characteristics of information technology, tasks, and of the individual user as explanatory components for technology use and for individual performance. A simpler version of the Technology-Top Performance Model, often referred to as the TTF model, found reasonable empirical support for the direct relations between task and technology characteristics and user-perceived TTF. TTF models have four key constructs, Task Characteristics, Technology Characteristics, which together affect the third construct Task-Technology Fit, which in turn affects the outcome variable, which is either Performance or Utilization. TTF models suggest that IT will be used only if, the functions available to the user fit the activities of the user. Realistically, experienced users will select those tools and methods that allow them to complete the task with the utmost net benefit. Information Technology that does not offer satisfactory benefit will not be used. A common addition to a TTF model is Individual Abilities (Goodhue 1988, Goodhue and Thompson 1995). Results established that TTF and usage together better explained the effect of information technology on individual performance (i.e., user-perceived accomplishment of individual tasks) than usage alone (Dishaw and Strong, 2002).

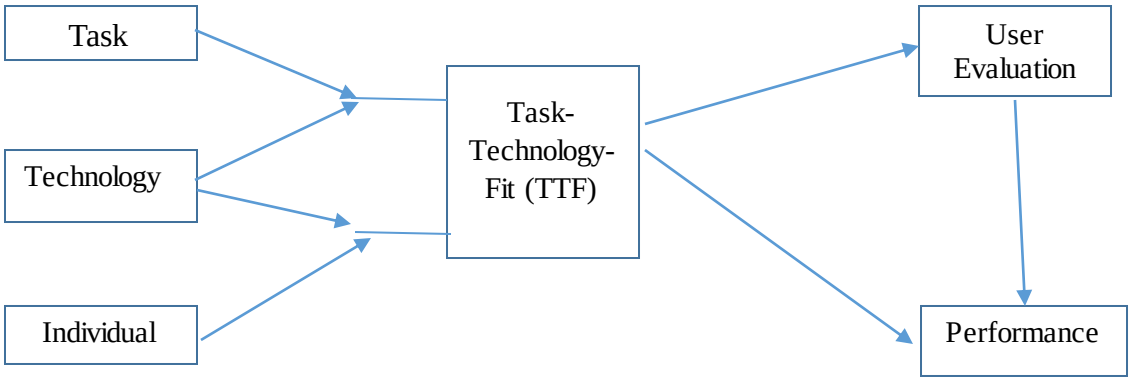

Figure 4: A diagram depicting (by Goodhue and Thompson, 1995)

CHAPTER FOUR

APPROACHES TO DATA COLLECTION AND MANAGEMENT

4.0. Introduction

This chapter primarily deals with the approaches to data collection and data management. It begins with a brief overview of the profile of Ghana and the research setting. The chapter goes on to highlight the Ghana healthcare system as well as E-health in Ghana. It also describes the research design, methods, population, sampling and selection of participants. This chapter ends with the data analysis strategy.

4.1 The profile of Ghana

The study was carried out in Ghana, among health professionals working at the 37 Military Hospital. Ghana is located in West Africa, flanked by Cote D'Ivoire on the west, Togo on the east, Burkina Faso on the North, and the Atlantic Ocean on its' south. Ghana occupies an area of 238,537 square kilometres which is nearly the size of the United Kingdom, Uganda, and Romania. Ghana has a population of 27,868,877 (Worldometers, 2016). Ghana has a relatively low landscape with tropical and savannah sections split into ten regions: the Ashanti region, the Brong-Ahafo region, the Central region, the Eastern region, the Greater Accra region, the Northern region, the Upper East region, the Upper West region, the Volta region, and the Western region. The regions are divided into 170 districts. The capital is Accra and the other major cities of Ghana are Kumasi, Tema, and Sekondi-Takoradi (African Union, 2012).

Climatically, Ghana has two main seasons; the rainy season and the dry season. There are two rainy seasons in the south; May-June and August-September; in the north, the rainy seasons tend to merge. The southern part of Ghana is much wetter, has high temperatures all year round, and has a very short dry season. The harmattan, a dry desert wind, blows from the northeast from December to March, lowering the humidity and creating hot days and cool nights in the

north. The main branches of government in Ghana comprise the Executive, the Legislature and the Judiciary. The executive branch is made up of the President who is elected by popular vote for a four-year term, which is renewable once. He is also the head of government and commander in chief of the Ghana armed forces. The vice President is elected together with the president as a running mate. The president has the prerogative of appointing the ministers with the consent of the Parliament. The legislature is unicameral, consisting of 230 members, each member elected for a four year term to represent their constituencies. At the top of the Ghana's judicial structure are the Supreme Court, the High court, the Court of Appeals and ten Regional Tribunals established for each region. These courts are recognised as the 'superior courts', below are the inferior courts and traditional courts.

Agriculture remains a backbone of the economy of Ghana, contributing more than one-third of GDP and about 55% of formal employment (African Union, 2012). According the World Bank (2016) Ghana's GDP was 38.62 billion dollars as at 2014. Ghana's major cash crop is cocoa, which characteristically provides about one-third of all export revenues. Other products include timber, coconuts and other palm products, shea nuts, and coffee. A major oil discovery off the coast of Ghana in 2007 has led to substantial international commercial interest in Ghana (African Union, 2012).

4.2 The Ghana healthcare system

Healthcare administration in Ghana is divided into three (3) main administrative levels namely; the national, the regional and the districts levels. All the levels of administration are structured as Budget and Management Centres (BMCs) for the purpose of managing funds by the Government and other stakeholders. There are a total of two hundred and twenty three (223) well-designed BMCs and 110 sub-districts BMCs. With the headquarters of the Ghana Health Service (GHS) also managed as a BMC, there are 10 Regional Healthcare Administrations, 8 Regional Hospitals, 110 District Health Administrations, and 95 District Hospitals (Austrian Red Cross Accord, 2009). Healthcare delivery in Ghana is primarily delivered by two actors; the public and the private institutions (private commercial and faith-based institutions). The Ministry of Health (MOH); with its different departments and agencies, functions as a supervisory regulatory body that controls the undertakings of the various public and private healthcare institutions in Ghana (IICD, 2014).

Healthcare financing in Ghana is largely by the National Health Insurance Scheme (NHIS), out-of-pocket payments (cash-and-carry), and Government and other donor budget support. The NHIS covers about 35% of Ghana's population and calls for people to pre-register to enjoy the benefits provided by the scheme (National Health Insurance Authority, 2012). Most hospitals; both private and public facilities, are accredited by the scheme to provide services to pre-registered clients.

4.2.1. E-Health in Ghana

The health-care system in Ghana is comparable to those in other less advanced countries and access to health services for inaccessible communities is tremendously limited. In July, 2010, the Government of Ghana launched a national e-health strategy. The main strategies under the national e-health strategy are; reforming the governing structure for health data and information management, building sector capacity for broader application of eHealth solutions in the health sector, increasing access and narrowing the equity gap in the health sector through the use of Information and Communication Technology, and working towards a paperless records and reporting system (Afarikumah, 2014). The implementation of e-health solutions provides new openings for making advancement in the sector performance. Such change will lead to an essential shift in the way information is accessed and shared across the health system. It also requires a new method for patient management and the prolonged use of the current knowledge base in the sector to manage health problems across geographical boundaries (Ghana E-health Strategy, 2010).

In spite of the fact that an e-health strategy has been introduced, the rolling out of the strategy is confronted with some challenging issues that make its implementation somewhat slow. One of the challenges is the lack of integration of the health sector and the apparent inability to use the existing technologies in daily care activities which, which has credited to human practices, work ethics, and culture (IICD, 2014). E-health in Ghana is also confronted with the challenge of interoperability due to the use of ICT from diverse manufacturers and vendors by the numerous health facilities. Also, another challenge to e-health capacity building in Ghana is the inadequate number of qualified, trained health care professionals and training resources (Ghana E-health Strategy, 2010).

4.3. The Research Site

The Military hospital is a 400-bed capacity hospital located about 4 kilometres from the Kotoka International Airport, Accra. The hospital was initially built in 1941 by the British military officer General George Giffard, as a military hospital to provide health services to military personnel who were injured in the Second World War. Giffard also organized the establishment of the 52 Military Hospital at Takoradi, even though this was later relocated to India. The hospital's name during that time was Number 37 General Hospital, which was in 1956 changed to 37 Military Hospital of the Gold Coast. The hospital was later expanded and opened to the general public, though the hospital remains to be operated predominantly by military personnel.

As a military hospital, its main goal is to deliver health care to military personnel and their families, civilian employees of the Ministry of Defence and their families and ex-service personnel, all of whom are considered as entitled personnel. It is however open to the general public, who are categorised as non-entitled, and are treated for a fee. In addition to these responsibilities, it functions as the Government's Emergency and Disaster Hospital and the United Nations Level IV hospital in the West Africa sub-region. It also delivers health care services to numerous international organizations and NGOs functioning in Ghana and West Africa in general. The hospital also provides helicopter services where patients may be transported directly by helicopters from any part of the country. The departments at the hospital comprise; Accident & Emergency, Dental Division, Public Health Division, Medical Division, Medical Reception Stations, Obstetrics & Gynaecology, Paediatric Division, Pathology Division, Pharmacy, Radiography & X-Ray, Surgical Division, and the Veterinary Division. There is also a Military Hospital Nurses' Training College whose role is to train nursing staff for the Ghana Armed Forces Medical Services.

4.4. Ethical considerations and permissions

Before the start of the study, a research proposal was developed and sent to my supervisor in my department (Department of Clinical Medicine) at the University of Tromsø for departmental approval. After attaining the approval from the department, the research proposal was sent to the Ethical Review Committee at the 37 Military Hospital, for ethical clearance.

The objectives of the study were made known to the participants and the procedures were also explained. The benefits and risk for the study was explained and the participants were given

the opportunity to ask any questions about the research. No participant was forced or unduly influenced to partake in the study. They were also informed about their right to withdraw from the study at any point they deemed necessary. The names and contact details of the participants were not requested to maintain that their privacy was highly respected. Also, in the design of the study careful consideration was given to ethics.

4.5. Research Design

The study is a cross sectional descriptive study (the kind of study that gathers quantifiable information that can be used for statistical inference on your target audience through data analysis). The study used techniques to produce data that can be analysed statistically. A structured close-ended questionnaire was designed and administered to participants. The purpose using this type of questions was to ensure easy and quick responses from the respondents as well allowing for coding and statistical analyses. The convenience sampling technique was used in administering the questionnaires to collect the required data. The convenient sampling technique is a statistical method of drawing representation data by selecting people because of the ease of their volunteering or selecting units because of their availability or easy access (Business Dictionnary.com, 2016). This technique was used as a result of the easy access and obtainability of the target group, from which the data could be collected.

4.5.1 Research Method

In conducting my research, the quantitative method was applied due to its ability to create evidence which can be tested and retested for its validity and reliability by different sets of researchers from any part of the world. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon (USC Libraries, 2016).

So as to gain field experience and collect the data for my study, a two-month field trip was embarked on to Accra, Ghana. Upon arriving, I sent the letters which was given to me by my supervisor to the authorities of the 37 Military Hospital to seek their consent for the study and also to the Ethical Review Board of the 37 Military Hospital for ethical clearance. Upon the

attainment of the ethical clearance from the Ethical Review Board of the 37 Military Hospital, a team of five (5) national service personnel who worked at the Paediatrics Department, Ophthalmology Department, Emergency Unit, Radiology Department, and the Records and Public Health Departments were recruited to assist in the data collection. The team members were selected to assist in the administering of my questionnaires based on their knowledge level in electronic health and information technology and also based on good insight and understanding of research. After a day of training, we went straight into the field to gather the data. In order to ensure a high level of acceptance of the study and hence maximize the level of participation, a considerable effort was made to inform potential participants about the survey. In order to achieve this, the health professionals were given a pre-notice through posters on their notice boards.

I visited the various departments selected for the data collection and inquired as to the appropriate time to start collecting the data. I was informed about the schedules of the respondents and the times that was appropriate for my data collection team to come for the data. Before the main data collection started, the designed questionnaire was first pre-tested at the same study setting. In all, five (5) questionnaires were used for this purpose. The exercise was found useful because it provided the researcher and the team with useful information regarding how to do the main data collection. Since the convenience sampling technique was used, subjects were approached by the data collection team and those who were available and willing to participate in the study were given the questionnaire to fill. Once a participant was identified, the purpose of the study was explained to him. Participants were made to understand that participating in this study was exclusively on a voluntary basis and that they also had every right to refuse to take part or withdraw from the study.

4.5.2. Study population and selection of participants

The population for this study were health professionals of 37 Military Hospital. This study involved doctors, nurses, radiologists, pharmacist, and laboratory technicians. The number of relevant health professionals at the hospital were five hundred and eleven (511). Out of this, hundred (100) were doctors, three hundred and fifty nine (359) were nurses, twenty nine (29) were pharmacist ten (10) were laboratory technicians and thirteen (13) were radiologist. Using the Epi Info 7 sample size calculator software with ninety nine (99%) power, a sample size of hundred and one (101) was derived as the sample size for the study.

From the hundred (100) doctors, a sample of twenty (20) was derived with ninety percent (90%) power using the Epi Info 7 sample size calculator. From the three hundred and fifty nine (359) nurses, a sample of fifty one (51) was derived at (90%) power using the Epi Info 7 sample size calculator. From the ten (10) laboratory technicians, a sample of six (6) was derived. Also from the twenty nine (29) pharmacist, a sample of seventeen (17) was derived. Again, from the thirteen (13) radiologist, a sample of seven (7) was derived at using the Epi Info 7 sample size calculator. The selection of the participants cut across the four clinical divisions of the hospital.

4.5.3. Data collection and response

The tool used for the data collection was a designed, structured and close-ended questionnaire. Questionnaires were distributed to the hundred and one (101) respondents and follow ups were made to retrieve those that were completed by the respondents. One (1) respondent could not complete the questionnaires and five (5) others failed to answer the questions because of their busy schedules. In all three (3) questionnaires could not be retrieved. In spite of all these difficulties, most of the respondents co-operated satisfactorily with the study.

4.5.4 The research instrument

I examined some examples of user acceptance questionnaires before the designing the study questionnaire. My supervisor also assisted me in some of the inputs in the questionnaire. I then settled on coming up with closed-ended questionnaires. The reason for using closed ended questionnaires was for easy data quantification and categorisation. The questionnaire was divided into six major sections. The first section sought information on the background of respondents. The second section sought information about the types of smartphones used by the health professionals. The third section sought information about the health professional's reasons for using smartphones. The fourth section sought information about the how the health professionals searched for health information using their smartphones. The fifth section sought information about the how useful smartphones were to their work. The sixth section sought information about the problems health professionals encountered in using their smartphones for health purposes. The questions had the following headings:

1. Demographic data

2. Use of smartphones

3. Reasons for using your smartphones

4. How do you search for health information using your smartphone?

5. How effective is the use of smartphones?

6. What problems do you encounter in using smartphones for health purposes?

Explaining why I asked the above questions, first of all, I sought demographic data like the age and profession of the health professionals in order to find out if demographic variables were of relevance to health professionals' use of the smartphones for health purposes. Again, I wanted to find out if the health professionals' age and profession had any effect on the type of smartphones they used when it came to the use of smartphones. In that regard I asked the question to find out the type of smartphone they used. I then provided them with options of some brands of smartphones commonly used (iPhone, Samsung, Sony, Nokia, Huawei, Alcatel, Techno, LG, HTC). Again, I wanted to find out if the health professionals' age and profession had any effect on their reasons for using your smartphones of which I provided them with some responses to choose from. Furthermore to find out whether the health professionals' age and profession had any effect on how they searched for health information using their smartphones, I provided them with some responses to choose from (Through apps for smartphones, search engines such as Google; Medline, PubMed, Google Scholar, Science Direct, social media such as Facebook and Twitter, Video services such as YouTube). And then finally, I wanted to find out if the health professionals' age and profession had any effect on problems they encountered in using smartphones for health purposes. I provided them with some responses to choose from.

4.5.5. Data analysis

The responses from the administered questionnaires were closely examined and a coding scheme was prepared to facilitate the analysis of the data. To analyze the gathered data, the

Statistical Package for Social Sciences (SPSS) 20 was used. Descriptive statistics (e.g., table, percentages) were used to summarize and categorize the data, while chi square tests was used in to find out whether there was a significance difference between age and sex and the other variables.

CHAPTER FIVE

RESULTS

5.0 Introduction

The questionnaires were administered and all data gathered in the month of August, 2015. The total number of questionnaires administered to the participants amounted to 101. 95 of the questionnaires were however retrieved. The following demographic data were collected from the respondents: age, profession.

Table 1: Background of respondents

VARIABLE	**FREQUENCY**	**PERCENTAGE**
AGE		**%**
30 and below	35	36.8
31 and above	60	63.2
Total	**95**	**100**
PROFESSION		
Nurse	48	50.5
Doctors	18	18.9
Pharmacist	16	16.8
Laboratory Technicians/Radiologist	13	13.7
Total	**95**	**100**

Source: Field Survey (2015)

From table 1, it is obvious that 35 (36.8%) of total respondents are 30 years and below, 60 (63.2%) of the respondents are 31 years and above. The smallest age group in terms of respondents is hence 30 years and below.

The results in the table also shows that of the 95 respondents, the predominant majority representing 48 (50.5%) are nurses. Again 18 (18.9%) of the total respondents are doctors whiles 16 (16.8%) are pharmacists. Finally, the table also indicates that 13 (13.7%) of the total respondents are laboratory technicians/radiologists.

Table 2: Summary Table of Age, Profession and Frequency of Type of Smart Phone Used by Health Professionals

Variable	**Type of Smart Phone Used**										
	Iphone	Samsung	Sony	Nokia	Huawei	Alcatel	Techno	LG	HTC	Two plus phones	Total
Age											
30 and below	9	8	3	3	1	-	1	-	4	6	35
31 plus	7	19	1	4	3	1	6	4	3	12	60
Total	16	27	4	7	4	1	7	4	7	18	95
Profession											
Nurses	8	18	1	4	1	-	4	1	3	8	48
Doctors	4	5	-	-	1	-	2	-	1	5	18
Pharmacists	3	3	2	2	1	1	-	1	1	2	16
LabTechs /Radiologists	1	1	1	1	1	-	1	2	2	3	13
Total	16	27	4	7	4	1	7	4	7	18	95

Source: Field Survey (2015)

5.1 Research Question One:

What are the reasons for the use of smartphones by the health professionals? To find the answer to this question, item No.3Ai, 3Aii, 3Aiii, 3C, on the questionnaire (Do you communicate with patients through smartphones? If yes, by what means? How often do you do this? Does your smartphone help you in diagnosing diseases?), proved helpful.

From the data gathered, 23 (66%) out of the 35 respondents by the ages of 30 and below said yes when asked whether they communicated with patients using smartphones. 12 (34%) of the 35 respondents by the same age range said no when asked the same question. Also, 46 (77%) out of the 60 respondents who are 31 years and above said yes when asked whether they communicated with patients using their smartphones. 14 (23%) out of them the 60 respondents by the same age group said no when asked the same question.

Again, the data revealed that 36 (75%) out of the 48 respondents (nurses) said yes when asked whether they communicated with patients. 12 (25%) out of the 48 respondents of the same group said no when asked the same question. Moreover, 13 (72%) out of the 18 respondents (doctors) said yes when asked whether they communicated with their patients using smartphones. 5 (28%) out of 18 of the same respondents said no when asked the same question. Again, 12 (75%) respondents (pharmacists) said yes when asked whether they communicated with patients using smartphones. 4 (25%) out of 18 of the same group of respondents said no when asked the same question. Also, 8 (62%) out of the 13 respondents (radiologists/laboratory technicians) said when asked whether they communicated with patients through their smartphones. 5 (38%) out of 13 of the same group of respondents said no when asked the same question.

Also from the data gathered, 5 (22%) out of the 23 respondents (who answered this question) between the age range of 30 years and below said they communicated with patients through SMS when asked the means by which they communicated with patients. 9 (39%) out of the 23 respondents (who answered this question) who fall within the same age group said they communicated with patients using applications like Whatsapp, Viber, Imo, etc. 6 (26%) out of 23 respondents (who answered this question) of the same age group said they communicated

with patients using phone calls. 2 (9%) out of 23 respondent each said they communicated with patients using email and Facebook. 1 (4%) also responded that he communicated through two or more of the options listed. Furthermore, from the data gathered 11 (23%) out of 47 respondents within the age range of 31 years and above said they communicated with patients using SMS. 13 (28%) respondents of the same age range said they communicated with patients through phone applications like Whatsapp, Viber, Imo etc. 2 (4%) of the respondents said they communicated with patients through Facebook, 8 (18%) of them said they communicated with patients using phone calls, whiles 10 (21%) of the respondents within the same age communicated with patients through two or more of the options. 3(6%) of the respondents said they communicated with patients through Facebook.

Again, from the data gathered 4 (11%) out of 36 nurses (who answered this question) said they communicated with patients through SMS. 2 (6%) of the nurses said they communicated with patients through email. 2 (6%) also communicated with patients through Facebook. 18 (50%) of them said they communicated with patients through applications like Whatsapp, Viber, Imo, etc. 9 (25%) of the nurses said they communicated with patients through phone calls while only 1 (3%) of them said he communicated with patients using two or more of the options. Also, the data showed that 5 out of 13 (38%) doctors (who answered this question) said they communicated with their patients through SMS. 1 (8%) of them said he communicated with patients through email. 2 (15%) of them said they communicated with patients using applications like Whatsapp, Viber, Imo, etc. 2 (15%) also communicated with patients using phone calls. 1 (8%) of the doctors communicated with patients using email. None of the doctors communicate with patients using Facebook. 3 (23%) of the doctors said they communicated with patients using two or more of the options. Moreover, the data indicated that 5 (42%) out of 12 pharmacists (who answered this question) said they communicated with patients through SMS. None of the pharmacists communicated with patients through email or Facebook. 2 (17%) of the pharmacists communicated with patients through applications like Whatsapp, Viber, Imo etc. 1(8%) of the pharmacists communicated with patients through phone calls whereas 4 (34%) communicated with patients using two or more of the options. Furthermore, the data reveal that 2 (22%) out of 9 radiologists/laboratory technicians communicated with patients through SMS. 1 each of the same respondents communicated with patients through email (11%) and Facebook (11%), respectively. 2 (22%) of them said they communicated with patients through phone calls, none of them however communicated with patients through

applications like Whatsapp, Viber, Imo, etc. 3 (33%) of them communicated with patients through two or more of the options.

It is also clear from the data that 4 (17%) out of 23 respondents (who answered this question) within the ages of 30 and below said they communicate with patients daily when asked how often they communicate with their patients through their smartphones. 19 (83%) of the respondents within the same age range said they communicate with their patients weekly-yearly through their smartphones when asked the same question. Also, 24 (51%) out of 47 respondents (who answered this question) within the age of 31 years and above said they communicate with patients daily through their smartphones when asked how often they communicate with their patients through their smartphones. Also, 23 (49%) of the respondents within the same age range said they communicate with their patients weekly-yearly through their smartphones when asked the same question.

It is again evident from the data that 15 (42%) out of 36 nurses (who answered this question) said they communicate with patients daily through their smartphones when asked how often they communicate with their patients through their smartphones. 21 (58%) of the nurses also said they communicate with patients weekly-yearly through their smartphones when asked the same question. Again, 6 (46%) of the doctors said they communicate with patients daily through their smartphones. 7 (54%) of the doctors said they communicate with patients weekly-yearly using their smartphones. Furthermore, 4 (33%) out of 12 pharmacist (who answered this question) said they communicate with patients daily through smartphones. 8 (67%) of the pharmacist also said they communicate with patients weekly-yearly using their smartphones. Also, 3 (33%) out of 9 Laboratory technician/Radiologist (who answered this question) said they communicate with patients daily through their smartphones whereas 6 (67%) of the same group of respondents said they communicate with patients weekly-yearly using their smartphones when asked how often they communicate with their patients through their smartphones.

It can also be seen from the data that 16 (46%) out of 35 respondents (who answered this question) within the age range of 30 and below said yes when asked whether their smartphones

helped them in diagnosing diseases. Again, 19 (54%) of the respondents between the ages of 30 and below said no when asked the same question. Moreover, 19 (32%) out of 60 respondents (who answered this question) within the age range of 31 years and above said when asked whether their smartphones helped them in diagnosing diseases. 41 (68%) of the same respondents said no when asked the same question.

It is also clear from the data that 18 (36%) out of 48 nurses (who answered this question) acknowledged that their smartphones helps then in diagnosing diseases. 30 (64%) nurses said no when asked whether their smartphones helped them in diagnosing diseases. Moreover, 11 (61%) out of 18 (who answered this question) doctors acknowledged that their smartphones help them in diagnosing diseases. 7 (39%) doctors said no when asked when whether their smartphones helped them in diagnosing diseases. Again, only 1 (6%) out of 16 pharmacists (who answered this question) acknowledged that his smartphone helps him in diagnosing diseases. Furthermore, 15 (94%) pharmacists said no when asked when whether their smartphones helped them in diagnosing diseases. Moreso, 5 (38%) out of 13 laboratory technicians/radiologists acknowledged that their smartphones helps them in diagnosing diseases. Whereas 8 (62%) of the same group of respondents said no when asked whether their smartphones helped them in diagnosing diseases.

5.2 Research Question Two:

How effective is the use of smartphones to clinical practice by the health professionals?

In order to answer the question above, item 5 on the questionnaire was used to generate the needed responses. From the data gathered 34 (97%) out of 35 respondents (who answered this question) within the ages of 30 years and below said their smartphones are highly effective when asked whether their smartphones are effective for health purposes. 1 (3%) of the respondents by the age of 30 years and below said his smartphone is highly ineffective for health purposes. It can also be observed from the data that all respondents (100%, 60/60) by the age of 31 years and above who answered this question said their smartphones are highly effective for health purposes.

Moreover, it is clear from the data that 47 (98%) out of 48 nurses (who answered this question) said their smartphones are highly effective when asked whether their smartphones are effective for health purposes. 1(2%) of the nurses also said his smartphone is highly ineffective for health purposes when asked the same question. It is also evident from the data that, 15 (100%) out of 15 doctors (who answered this question) said their smartphones are highly effective when asked whether their smartphones are effective for health purposes. It is also explicit from the data that 16 (100%) out of 16 respondents (pharmacist) said their smartphones were highly effective when asked whether their smartphones are effective for health purposes. It is also apparent from the data gathered that 12 (92%) out of 13 radiologists/laboratory technicians said their smartphones were very effective when asked whether their smartphones are effective for health purposes. 1 (8%) said his smartphone is highly ineffective for health purposes.

5.3 Research Question Three:

What problems do health professionals encounter in using smartphones for health purpose?

To answer the above question, item 6 on the questionnaire was used to generate the needed response. It is apparent from the data that 16 (46%) out of 35 respondents within the age range of 30 years and below said Internet access problems they encountered in using their smartphones for health purposes in the hospital. 7 (20%) respondents by the same age range said poor electricity supply was their main challenge in the use of smartphones for health purposes. 5 (14%) of the respondents within the same age range said the lack of knowledge on the use of health applications was the major challenge they faced in using their smartphones for health purposes. 7 (20%) of the respondents within the same age range said they face two or more of the problems listed in their use of smartphones for health purposes. It is also clear from the data that 19 (32%) out of 60 respondents by the age range of 31 and above said Internet access problem was their main challenge in the use of smartphones for health purposes in the hospital. 14 (23%) of the respondents within the same age range said poor electricity supply was their main challenge in the use of smartphones for health purposes. 2 (3%) respondents within the same age range said the lack of knowledge on the use of health applications was the major challenge they faced in using their smartphones for health purposes. 25 (42%) of the respondents attributed them problems to two or more of the items.

It is also clear from the data that 21 (44%) out of 48 nurses said Internet access problems is their major challenge in using their smartphones for health purposes. 11 (23%) of the same group said poor electricity supply is the major challenge in using their smartphones for health purposes when asked the same question. 5 (10%) of the same respondents said range said the lack of knowledge on the use of health applications was the major challenge they faced in using their smartphones for health purposes. 11 (23%) of the same respondents attributed their problems to two or more of the items when asked the same question. Also, 10 (56%) out of 18 doctors said Internet access problems is their major challenge in using their smartphones for health purposes. 2 (11%) of the same respondents admitted that poor electricity supply as their main problem. 6 (33%) of the same respondents said they more than one of the out listed challenges. None of doctors said they lacked knowledge of the use of health application on their smartphones for health purposes. Moreover, 1 (6%) out of 16 of pharmacists said Internet access problems is their major challenge in using their smartphones for health purposes. 5 (31%) of the same group said poor electricity supply is the major challenge in using their smartphones for health purposes when asked the same question. 2 (13%) of the same respondents said range said the lack of knowledge on the use of health applications was the major challenge they faced in using their smartphones for health purposes. 8 (50%) of the same respondents said they more than one of the out listed challenges. Furthermore, 3 (23%) out of 13 radiologists/laboratory technicians said Internet access problems is their major challenge in using their smartphones for health purposes. 3 (23%) of the same group of respondents said that poor electricity supply as their main problem. 7 (54%) of them said they face two or more of the challenges whereas none of them said they lacked knowledge on the use of health applications on their smartphones for health purposes.

5.4 Research Question Four:

How does the health professionals search for health information using your smartphones at the 37 Military hospital?

To answer the question above, item 4 on the questionnaire was used to generate the needed response. From the data gathered 2 (6%) out of 35 respondents by the age 30 and below said the search for health information through health applications on smartphones when asked how they searched for health information using their smartphones. 22 (63%) respondents of the same age range said they searched for health information using search engines like Google,

Medline and PubMed. 6 (6.3%) respondents of the same age range said they searched for health information through video services such as YouTube whereas 5 (14%) respondents of the same age range said they search for health information using more than one of the listed items. It can also be observed from the data that 4 (7%) out of 60 respondents by the age 31 years and above search for information through health applications on smartphones. 30 (50%) of the respondents within the same age range they search for health information using search engines like Google, Medline and PubMed. 3 (5%) respondents of the same age range said they searched for health through video services such as YouTube whiles 23 (38%) respondents of the same age range said they search for health information using more than one of the listed items.

It can also be observed from the data that 3(6%) out of 48 nurses said they search for health information with their smartphones through health applications on smartphones when asked how they searched for health information using their smartphones. 35 (73%) of the same group of respondents said they search for health information using search engines like Google, Medline and PubMed. 3 (6%) respondents of the same group said they searched for health through video services such as YouTube. 7 (15%) respondents of the same group said they search for health information using more than one of the listed items. Again, 2 (11%) out of 18 doctors said they searched for health information with their smartphones through health applications on smartphones when asked how they searched for health information using their smartphones. 11 (61%) of the same group of respondents said they searched for health information using search engines like Google, Medline and PubMed. 1 (6%) respondents of the same group said he searched for health through video services such as YouTube whereas 4 (22%) respondents of the same group said they search for health information using more than one of the listed items. Moreso, 3 (27%) out of 11 pharmacist (who answered this question) said they search for health information using search engines like Google, Medline and PubMed. 2 (18%) of the same group said he searched for health through video services such as YouTube, 6 (54%) of them said they use two or more of the listed items whiles none of said they searched through health applications on smartphones. Furthermore, 1 (10%) out of 10 laboratory technician/radiologist) (who answered this question) said he search for health information on his smartphone through health applications. 3 (30%) of the same group search for health information using search engines like Google, Medline and PubMed.6 (60%) of the same group

said they search for health information using more than one of the listed items. whiles none of said they searched through health applications on smartphones.

5.5. Correlation between Age, Profession and the Variables.

Age and profession were matched with other variables to ascertain the correlations they have with each other. Chi-Square was used to ascertain the correlations.

The data revealed a significant difference between the professions of the respondents and the means by which they communicate with patients through their smartphones. (Chi-Square test, p= .026). The data also revealed a statistically significant difference between the ages of health professionals and how often they communicated with patients through their smartphones. (Chi-Square test, p=.007). Also, there was a significant difference between the profession of the health professionals and their smartphones aid in disease diagnosis. (Chi-Square test, p=.012).

Furthermore, the data revealed a correlation between the ages of the respondents and how they search for health information using their smartphones. (Chi-Square test, p= .001). Again the data revealed a correlation between the age of the respondents and the effectiveness of smartphones for health purposes. (Chi-Square test, p=.050). Moreover, the data also showed that there is a correlation between the ages of respondents and the problems they encountered in using smartphones for health purposes. (Chi-Square test, p=.047).

CHAPTER SIX

DISCUSSION

6.0. Introduction

The current chapter aims at discussing the objectives of the study in relation to the findings acquired. This chapter further highlights some probable reasons as to why this study yielded such responses. It finally discusses the theoretical model in relation to my findings and some limitations.

6.1 Smartphone ownership of health professionals at the 37 Military Hospital.

From table 2, the ownership of smartphones among health professionals at the 37 Military Hospital is quite alarming. The data collected, revealed a higher (100%) ownership rate. Which means that all the respondents who took part in the study owns a smartphone and use them for various reason. Table 2 even revealed a 100% response rate. That is, all the 95 health professionals who took part in the study, answered their questionnaires. These findings confirm the assertion of the Pew Research Center (2016) and Oyeyemi et al. (2014), that there has been a conspicuous upsurge over the past two years in the proportion of people in the evolving and developing nations who say that they own a smartphone (Pew Research Center, 2016; Oyeyemi et al., 2014). What makes these findings very fascinating is the point that Ghana is considered as one of the less financially advanced countries in the world and even struggling to provide the basic source of drinking water for some of its citizenry (Lazuta, 2013; Qiang et al., 2011). A survey conducted by Pew Research Center (2016) on smartphone ownership in 40 nations among 45,435 respondents from March 25 to May 27, 2015 showed that the topmost rates of smartphone ownership were among the advanced economies surveyed. The bottommost levels of smartphone ownership were in the developing nations in sub-Saharan Africa (of which Ghana is considered part). The 100% response rate of this study shows contrary results to the survey conducted by Pew Research Center (2016). Another study conducted by Patel et al. (2015) found that a similar results. From their study, a total of 341 participants were surveyed with a complete response rate: 93.5% of which owned a

smartphone. Referring to the UTAUT proposed by Venkatesh et al. (2003), which served as a theoretical framework for my study, the higher percentage rate of smartphone ownership associated with health professionals at the 37 Military Hospital could be ascribed to a list of factors. The UTAUT model presents the elementary theoretical framework that can explain individual acceptance of information technology (Venkatesh et al., 2003). The UTAUT model suggests that users ought to have been influenced by a number of factors including; Performance expectancy (perceived usefulness of the technology), effort expectancy (Perceived ease of use), facilitating conditions and social influence. The factors outlined by UTAUT could be narrowed down to the proliferation and the cheap prices of smartphones in Ghana. A simple smartphone for instance could cost 50 dollars in Ghana.

6.2 Reasons for the use of smartphones by the health professionals.

In relation to the above objective, I wanted to find out the reasons why health professionals at 37 Military Hospital use their smartphones for health purposes. To find the answer to this question, item No. 2ii, 3Ai, 3Aii, 3Aiii, 3Ci, 3Cii, 3D, 3E on the questionnaire proved useful. One of the main reasons for using mobile technology in the health sector is to enhance the quality of and access to care (Qiang et al., 2011). The data showed that 69 (73%) out of the 95 respondents said yes when asked whether they communicate with patients using smartphones. 26 (27%) out of the 95 respondents said no when asked whether they communicate with patients using smartphones. Breaking the results down, 36 (75%) out of the 48 respondents (nurses) said yes when asked whether they communicate with patients. 12 (25%) out of the 48 respondents of the same group said no when asked the same question. Moreover, 13 (72%) out of the 18 respondents (doctors) said yes when asked whether they communicate with their patients using smartphones. 5 (28%) out of 18 of the same respondents said no when asked the same question. Again, 12 (75%) respondents (pharmacist) said yes when asked whether they communicate with patients using smartphones. 4 (25%) out of 18 of the same group of respondents said no when asked the same question. Also, 8 (62%) out of the 13 respondents (radiologist/laboratory technicians) said when asked whether they communicate with patients through their smartphones. 5 (38%) out of 13 of the same group of respondents said no when asked the same question. The data revealed that majority of the health professionals at 37 Military Hospital communicate with patients using their smartphones. Comparing my findings to studies carried out, a study conducted by Tran et al. (2014) on medical students and personal smartphones in the clinical environment affirms the findings of my study. Their study revealed

that majority (86%, 85/99) of respondents used their personal phones for patient-oriented communication in the course clinical rotations. Another study conducted by D4 (2010) on mobile phone usage by health professionals in the UK, also revealed that 18% used their smartphones for communicating with patients. The findings of this study revealed a lower percentage compared to my findings (73%).

The data also revealed that 16 (23%) out of 71 respondents who answered the question as to the means by which they communicate with patients said they did so through SMS. 22 (31%) out of the total 71 said they did so through applications (like WhatsApp, Viber, Imo etc). 14 (20%) did so through phone calls, 5 (7%) through emails, 3(4%) did so through Facebook whiles 11(15%) did so through two or more of the options listed. Breaking the results down to the study group, applications like WhatsApp, Imo, Viber is the most used medium of communication by the nurses (38%, 18/48) and it is followed by phone calls (25%, 9/48). The results of the other mediums (emails, SMS and Facebook) are less significant implying that the nurses do not use them frequently to communicate with patients. This finding may be as a result of the constant interactions between patients and the nurses in the healthcare system of Ghana. Some nurses develop good rapport with patients and may want to know the progress of their health after receiving treatments from them. They want to do this at lesser cost and hence the use of smartphone applications (like WhatsApp, Imo, Viber) of which most Ghanaians have installed on their phones.

The most used medium the doctors use to communicate with patients according to the result is SMS (38%, 5/13). The insignificant figures of the other mediums shows clearly that the doctors do no use them to often communicate with patients. The reason for this finding may be linked to the workload of the doctors. The doctor to patient ratio in Ghana was 1:10,034, in 2011 (Ghana Health Service, 2011). This makes it difficult for doctors to have constant communication with patients. The doctors therefore have to find a medium of communication that will prevent constant communication with patients because of their busy schedule. SMS is hence the preferred medium to deliver a message to patients to save time. Also, the data revealed that SMS (42%, 5/12) is the most frequent medium pharmacist use to communicate with patients. The pharmacists also used two or more of the options listed to communicate with patients (33%, 4/12). The results of the other mediums (emails, SMS and Facebook) are less significant implying that the pharmacists do not use them frequently to communicate with

patients. The data also revealed that the radiologist/laboratory technicians preferred communicating with patients through two or more of the listed options (33%, 3/9) the most.

Making reference to my literature review, several studies confirm the usage of smartphones for communications purposes as revealed by my findings. A study conducted by Moon & Chang (2014) showed that phone calls consisted of 51.4% of work-related purposes, while other functions, such as text message, web browser, and scheduling, were mostly used for personal purposes. It is also evident from the study of Koehler et al. (2013) that smartphones have improved contacts between health care professionals. They found that 22 (51%) of the participants said they accessed emails through their smartphones, 27 (63%) of the respondents said they made and/ or received phone calls with their smartphones from healthcare colleagues. Also 16 (37%) of the respondents said they made and/ or received phone calls from patients using their smartphones. 6(14%) also said that they sent and/ or received text messages from patients. A study conducted by D4 (2010) on mobile phone usage by health professionals in the UK, revealed that 82% used a mobile phone for communicating with colleagues while 18% did so for communicating with patients.

The data also revealed that 28 (40%) out of 70 respondents who answered the question as to how often they communicate with patients said they did so daily whereas 42 (60%) said they did so weekly-yearly. Breaking the results down to the study group, the nurses, doctors, pharmacists, laboratory technician/radiologist tend to communicate with patients more on a weekly-yearly basis (58%, 21/36), (54%, 7/13), (67%,8/12), (67%, 6/9) respectively, as compared to daily basis (42%, 15/36), (46%, 6/13), (33%, 4/12), (33%, 3/9). This revelation could be attributed to the heavy workload on the health professionals. In other words, the huge workload on the health professionals will not permit daily communications with patients. The doctors especially give a prolong time to patients for review so as to avoid constant contact with patients.

Again, from the data gathered, 35 (37%) out of the 95 respondents said their smartphones helped them in diagnosing diseases whereas 60 (63%) said their smartphones does not help them in disease diagnosis. Breaking this results further to the study group, majority of the nurses, pharmacists, laboratory technicians/radiologists said their smartphones does not help them in the diagnosis of diseases (63%, 30/48), (94%, 15/16), (62%, 8/13). A slim majority of doctors (39%, 7/18) said their smartphones does not help them in disease diagnosis. Interestingly, whiles majority (61%, 11/18) of the doctors admitted that their smartphones help

them in the diagnosis of diseases, a handful of the nurses (37%, 18/48), pharmacists (6%, 1/16), and laboratory technicians/radiologists (38%, 5/13) also admitted that their smartphones helped them in the diagnosis of diseases. The results have therefore revealed that it is the doctors who said their smartphones aided them in diagnosing diseases. The results also show that nurses use their smartphones in one way or the other in diseases diagnosis. One of the reasons for such results is that in the health care setting majority of diagnosis and patient care is performed by mostly doctors and in some instances nurses. Also it is the doctors who make decisions regarding patient care and then consult with nurses and other medical professionals to make sure the care instructions are carried out. Health care professionals augmented dependence on electronic resources for this purpose was acknowledged in the Manhattan Research/Physician Channel Adoption Study, which revealed that physicians use the majority (64%) of their online time looking for information to make or support clinical decisions (Chase, 2013).

Making reference to the TTF model proposed by Goodhue and Thompson (1995), which served as one of the theoretical framework for my study, the higher percentage rate of smartphones usage by the health professionals could be attributed to various reasons. As the TFF model puts it, when the users of technology think that the technology is capable of supporting the job at hand, they are likely to perform well. In other words, TTF models suggest that IT will be used only if the functions available to the user fit the activities of the user. The ability of the technology to support the task means that the functionalities of the technology enable a smooth performance of the task, decrease the cost of performing the task, and simplify its performance. It can be said that the reason for the higher percentage of health professionals communicating with patients through their smartphones and the higher percentage rate of the means of communication suggest that the health professionals of 37 Military hospital think that the technology and its communication functionalities are capable of supporting their job. Also, the higher percentage rate at which the health professionals think their smartphones does not help them in diagnosing diseases imply that the diagnosing functions that may be available to them does not fit the activities of their jobs.

6.3 Research Question Two:

How effective is the use of smartphones to clinical practice by the health professionals?

In relation to the above objective, I wanted to unearth how effective the use of smartphones to clinical practice by the health professionals. From the data gathered, 89 (96%) out of the 92 respondents said their smartphones were very effective when asked whether their smartphones are effective for health purposes 3 (4%) out of 95 said their smartphones are ineffective when asked whether their smartphones are effective for health purposes. Breaking this results further to the study group, all the doctors and pharmacists (who answered this question), said their smartphones are highly effective when asked whether their smartphones are effective for health purposes (100%, 15/15), (100%, 16/16) respectively. 47 (98%) out of 48 nurses, 12 (92%) out of 13 laboratory technicians/radiologists said their smartphones are highly effective when asked whether their smartphones are effective for health purposes. On the other hand 2 (4%) nurses, 1 (7%) out of 13 laboratory technicians/radiologists said their smartphones are highly ineffective when asked whether their smartphones are effective for health purposes. One study of physicians found that most doctors believed that significant adoption of health information technology (EHRs, e-prescribing, health information exchange, analytics/decision support, patient support tools [websites, mobile apps, tools to track and manage health and wellness], and mobile health technologies [tablets, smartphones]) could increase the effectiveness of clinical practice (Deloitte Center for Health Solutions, 2013). Also, a study conducted by Tran et al. (2014) on the use of smartphones on general internal medicine wards also showed that participants understood the risks associated with communicating confidential health information via their personal smartphones, but appear to favor efficiency over privacy issues. Again, a study conducted by Tran et al. (2014) on medical students and personal smartphones in the clinical environment revealed that a total of 26% (26/99) of participants reported not having any type of security feature on their personal phone, 94% (90/96) of participants agreed that using their personal phone for clinical work makes them more efficient, and 86% (82/95) agreed that their personal phone allows them to provide better patient care. The use of mobile tools has been shown to provide health care professionals with numerous enhanced efficiencies, comprising: improved quality of patient documentation through less errors and more comprehensive records, more quick access to new information, and enhanced workflow designs. Health workers working in health care organizations have cited enhanced care harmonization, as well as rapid and more effective access to clinical support resources

(guidelines, lab tests, and reports) as primary importance related with mobile device use (Ventola, 2014).

6.4. Research Question Three:

What problems do health professionals encounter in using smartphones for health purpose?

In order to achieve the above objective, item 6 on the questionnaire was used to generate the needed response. From the data gathered, 35 (37%) out of the 95 respondents said their Internet access problems is their major challenge in using their smartphones for health purposes. 21(22%) respondents said their unstable electricity is their major challenge in using their smartphones for health purposes. 20 (21%) said lack of knowledge on health applications is their major challenge in using their smartphones for health purposes whereas 19(20%) said they are faced with two or more of the problems listed when asked the same question. Breaking the results to the study group, 21 (44%) out of 48 Nurses, 10 (56%) out of 18 doctors, 1 (6%) out of 16 of pharmacist, 3 (23%) out of 13 radiologists/laboratory technicians said Internet access problems is their major challenge in using their smartphones for health purposes. Again, 11 (23%) of the nurses, 2 (11%) of the doctors, 5 (31%) of the pharmacist and 3 (23%) radiologists/laboratory technicians said poor electricity supply is the major challenge in using their smartphones for health purposes when asked the same question. Moreover, 5 (10%) nurses, 2 (13%) pharmacist respondents said the lack of knowledge on the use of health applications was the major challenge they faced in using their smartphones for health purposes. No doctor or radiologist/laboratory technician lacked knowledge on the use of health applications. Furthermore, 11 (23%) of the nurses, 6 (33%) of the doctors, 8 (50%) of the pharmacists attributed their problems to two or more of the items when asked the same question. It is clear from the data that Internet access problem is the leading problem health professionals of the 37 Military Hospital encounter in their use of smartphones for health purposes. Dehzad et al. (2014) in their paper "Adopting Health Apps, What's Hindering Doctors and Patients?" identified several barriers to the use of mobile devices for health purposes. Some barriers were, a difficulty for physician to adopt new technologies in their current work-environment, privacy and security, not enough central control and steering from the government, insufficient evidence of clinical outcomes, effectiveness and efficiency, technological obstacles (connectivity and battery lacks performance), high degree of technological knowledge and cost intensive, as well as too high and unrealistic expectations of

integration and interoperability of all technological devices. Although, they enumerated a number of barriers, only high degree of technological knowledge affirms the findings of my study. Internet problems, which is the leading barrier to smartphone use for health purposes at the 37 Military Hospital was not mentioned. The provision of Internet services is a major issue that affects the operation of ICT and telemedicine projects in Ghana and other evolving countries (Achampong, 2012). A survey by the WHO Global Observatory for eHealth (2011) in member countries showed that Lower-middle income countries have the following needs with respect to mHealth: knowledge needs among other needs. The result of my study also confirms the knowledge needs of mhealth devices by health professionals at the 37 Military Hospital. The study by Koehler et al. (2013) also revealed that mobile phones were perceived negatively in regard to confidentiality. Confidentiality as revealed by Koehler et al. (2013) does not affirm the results of my study since none of the health professionals raised that issue as a barrier.

6.5. Research Question Four:

How does the health professionals search for health information using your smartphones at the 37 Military hospital?

In order to achieve the above objective, item 4 on the questionnaire was used to generate the needed response. The data showed that 52 (60%) out of the 87 respondents of the said they search for health information using search engines like Google, Medline and PubMed. Also 6 (7%) out of the 87 respondents of the said they search for health information using health applications on smartphones. Again, 6 (7%) out of the 87 respondents said they search for health information through video services such as YouTube. Moreso, 23 (26%) out of the 87 respondents said they search for health information through two or more of the options listed. Breaking the results to the study group, 35 (73%) out of 48 Nurses, 11 (61%) out of 18 doctors, 3 (27%) out of 11 of pharmacist, 3 (30%) out of 10 radiologists/laboratory technicians said they search for health information using search engines like Google, Medline and PubMed. Furthermore, 3 (6%) out of 48 nurses, 2 (11%) out of 18 doctors, 1 (10%) out of 10 radiologists/laboratory technicians said they search for health information using health application. Surprisingly none of the pharmacists chose this option when asked the same question. Again, 3 (6%) out of 48 nurses, 1 (6%) out of 18 doctors, 2 (18%) out of 11 of pharmacist said they search for health information using video services such as YouTube. Surprisingly none of the radiologists/laboratory technicians chose this option when asked the

same question. Finally, 7 (15%) out of 48 nurses, 4 (22%) out of 18 doctors, 6 (55%) out of 11 of pharmacist, 6 (60%) out of 10 radiologists/laboratory technicians said they search for health information through two or more of the options listed. It can be established from the findings that search engines like Google, Medline and PubMed are the preferred means searching for health information by majority of the health professionals at the 37 Military Hospital. The findings also reveals that a considerable percentage of the respondents search for health information through two or more of the options. It can be seen from the findings that while the nurses and doctors preferred using search engines like Google, Medline and PubMed, the pharmacists and radiologists/laboratory technicians also prefer using two or more the options listed. The study by D4 (2010) on mobile phone usage by health professionals in the UK affirms my finding. Their study revealed that 46% of the health professionals used smartphones for accessing information on the Intranet/Internet 18% used them for running work related software/applications. A study conducted by Patel et al. (2015) found that a total of 341 participants were surveyed with a complete response rate: 93.5% of which owned a smartphone, with 54.2% of those owning medical apps and 86.2% using their device to access online medical resources. Also, Moon and Chang (2014) conducted a study on technology acceptance and adoption of innovative smartphone uses among hospital employees. They found that the common smartphone usage modes were Internet searching, e-mail, scheduling, and social networking in consecutive order.

6.6. Limitation of the Study

My study had a considerable number of limitations. First of all the study place, which is 37 Military Hospital is the second largest hospital in Ghana with highly qualified and knowledgeable health professionals. It is expected that the group of health professionals (Nurses, Doctors, Pharmacist, Laboratory Technicians/Radiologist) used for the study should earns high income so they should be able to afford a smartphone and hence the 100% ownership rate of smartphones from the findings.

Again, the role of the researcher as a former worker of the hospital might have influenced the respondents in taking part in the study. For this reason I cannot unequivocally say that this study could be replicated by a different researcher who has never worked at the hospital.

Also, the questionnaires were general in nature and the study would have been more deepened if other variables were added. For instance questions on whether health professionals communicated with themselves for clinical practices should have been asked. Again, the variables regarding short battery life and security problems should have been added to the list of problems listed the questionnaire as the problems health professionals encounter in using smartphones for health purposes. The question on the questionnaire which asked for the type of smartphones used by the health professionals was irrelevant since it was in the discussing the data.

Also, the Technology Acceptance Model (TAM), used as one of the theoretical frameworks for this study, is not without its limitations. Some researchers have criticised that TAM may have attracted more easy and quick research so that less reflection has been given to the real problems of technology acceptance (Chuttur, 2009). The criticism of the TAM model led to the Unified Theory of Acceptance and Use of Technology (UTAUT), which many thought would have addressed the issues of TAM. Grønbek (2012) however criticised UTAUT stating that regardless of being an extension of the Technology Acceptance Model, UTAUT does not deepen the understanding of perceived usefulness or perceived ease of use but presents additional predicators of intentions. At present however, study on technology acceptance is still on going, therefore comprehending the assumptions, strengths, and limitations of TAM is crucial for anyone who is interested in studying acceptance of technology (Chuttur, 2009).

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.0 Introduction

This chapter is divided into three sections. The first section covers the evaluation of research questions. The second section covers the recommendations the respondents and implication of the study for policy and practice. The third section concludes the study.

7.1 Evaluation of research questions

To determine the health professionals reasons for using the smartphones at the 37 Military Hospital.

The study made it clear that majority of the health professionals at 37 Military Hospital use their smartphones to communicate with patients. In doing so, applications (like WhatsApp, Imo, Viber) is the most used medium of communication by the nurses, SMS is the most used medium the doctors and pharmacist use to communicate with patients according to the result. The data also revealed that the radiologist/laboratory technicians preferred communicating with patients through two or more of the listed options as provided in the questionnaire. Again, from the data gathered, although majority of the respondents said their smartphones does not help them in disease diagnosis, a breakdown of the findings to the study group revealed that the doctors admitted their smartphones helped them in the diagnosis of diseases.

To assess how effective the use of smartphones is to clinical practice by the health professionals.

The data gathered, made it clear that majority (96%, 89/92 who answered the question) of the health professionals at 37 Military Hospital see their smartphones as very effective when asked whether their smartphones are effective for health purposes.

To determine the problems health professionals encounter in using smartphones for health purposes at the 37 Military Hospital.

From the data gathered, Internet access problems is the major challenge in using their smartphones for health purposes among health professionals at the 37 Military Hospital. Lack of knowledge on health applications and unstable electricity appears to be the other problems the health professionals encounter. A considerable percentage of the respondents (20%) said they are faced with two or more of the problems listed in the questionnaire when asked the same question.

To assess how health professionals search for health information using their smartphones at the 37 Military Hospital.

The study made it clear that majority of the health professionals at 37 Military Hospital search for health information using search engines like Google, Medline and PubMed. It was also found that a significant percentage of the respondents (20%) searched for health information through two or more of the options listed in the questionnaire.

7.2 Recommendations

The study has added literature to the research into smartphones for health purposes in health care organizations. The study will also help management of the 37 Military hospital to take decisions on telemedicine and eHealth issues in the facility. In view of the findings of the study, the following are recommended.

- A stable Internet network should be established in the hospital where health professionals can access it all the time on their mobile devices.
- There must be an intensive education on available health applications on smartphones and how these applications could be used to enhance clinical practice. This will enhance the knowledge of health professionals on the potential of mobile devices on their work.
- Policy makers of the hospital should embark on a mhealth project where health professionals of the hospital are provided with special mobile devices which will be used specifically for clinical practice.
- Management must also put in place measures to ensure a constant supply of electricity. This should be done to ensure that health professionals get enough battery life on their mobile devices especially when they need it for health purposes.

It is recommended that further studies assess the use of smartphones for health purposes from the patients' point of view in Ghana. This will help reveal how the smartphones of patients help them in managing their diseases. It is also imperative that more studies are carried to assess the use of smartphones among health professionals in other hospitals in Ghana. Finally, it is recommended for further studies to adopt both quantitative research approaches to generate diverse responses from participants.

7.3 Conclusion

The use of smartphones by health care professionals is rising in popularity especially less financially advanced countries (Tran et al., 2014). The use of mobile technologies to support the achievement of health objectives (mHealth) has the potential to transform the face of health service delivery across the globe (WHO Global Observatory for eHealth, 2011). The purpose of this study was to analyse the health professional's use of smartphone for health purposes. This study explored and addressed the possible use of smartphones in providing basic health services in Ghana using health professionals at the 37 Military Hospital as a reference group.

Employing the convenient sampling technique, my findings revealed that all the 95 health professionals who took part in the study at the hospital owned smartphones and were using the smartphones for health purposes. Internet access problems was consistently rated as the greatest barrier to the use of smartphones for health purposes in the hospital by respondents.

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APPENDICE I

A SAMPLE OF THE RESEARCH QUESTIONNAIRE

QUESTIONNAIRE

I am Felix Osei-Bonsu, an MSc student at the department of Clinical medicine of the University of Tromso, Norway. As part of the requirements for the award of an MSc degree in Telemedicine and E-health, I am conducting a research on the use of smartphones among health professionals in Ghana using 37 Military Hospital as a case study. This study will give important data about how health care staff in Ghana use smartphones to the best of their patients and about the potential of this technology in healthcare. I will therefore need your help to make this possible. Be assured that your responses will be used exclusively and strictly for academic purposes only. You have the ability to withdraw from the study as and when you consider necessary. You are also assured that partaking in this study will result in no risk or harm, emotional upset, discomfort among others.

Please tick (√) the appropriate answer.

1. **Demographic data**

i. What is your age?

20 and below……..

21-30 ……..

ii. What is your profession? .....

2. **Use of smartphones.**

i. What type of smartphone do you use?

iPhone ……. Samsung…… Sony…… Nokia…….. Huawei……
Alcatel……... Techno …… LG……. HTC…… other……

3. Reasons for using your smartphones.

A. i. Do you communicate with patients through smartphones?

Yes…… No……

ii. If yes, by what means

SMS…… Email…….. Facebook……. Apps (like WhatsApp, Viber, Imo) …… Phone calls…….. Two or more of the options listed……..

iii. How often do you do this?

Daily…… Weekly-Yearly……..

iii. i. Can you access patients' records by means of smartphones?

Yes…….. No…….

ii. If yes, is it used for gathering information only or also for entering information into Electronic patients' records?

- For gathering information only……..
- For entering information into Electronic patients' records…….

iv. Does your smartphone helps you in diagnosing diseases?

Yes……. No……..

4. How do you search for health information using your smartphone?

i. Through Apps for smartphones

ii. Search engines such as Google, Medline, PubMed, Google Scholar, Science Direct.

iii. Social media such as Facebook and Twitter.

iv. Video services such as YouTube.

5. **How effective is the use of mobile phones?**

   i. Highly effective ……

   ii. Highly ineffective …….

6. **What problems do you encounter in using smartphones for health purposes?**

   i. Internet access problem……..

   ii. Poor electricity supply…….

   iii. Lack of knowledge of the use mobile health applications…….

   iv. Two or more of the options listed.

APPENDICE II

A COPY OF THE APPROVAL LETTER FROM THE ETHICAL REVIEW COMMITTEE

Institutional Review Board
37 Military Hospital
Neghelli Barracks
ACCRA

Tel: 0302-775958
Email: irb37milhosp@hotmail.com

11th August 2015

Our Ref: IRB/37MH/093/15

ETHICAL CLEARANCE

37MH-IRB IPN 034/2015

On 5th August 2015 the 37 Military Hospital (37MH) Institutional Review Board (IRB) at a Board meeting reviewed and approved your protocol.

TITLE OF PROTOCOL: ASSESSING THE USE OF SMARTPHONES AMONG HEALTH PROFESSIONALS IN GHANA: A CASE STUDY OF 37 MILITARY HOSPITAL.

PRINCIPAL INVESTIGATOR: FELIX OSEI - BONSU

Please note that a final review report must be submitted to the Board at the completion of the study.

Please report all serious adverse events related to this study to 37MH-IRB within seven (7) days verbally and fourteen (14) days in writing.

This certificate is valid till 5th August 2016

DR EDWARD ASUMANU
(37MH-IRB, Vice Chairperson)

37 MILITARY HOSPITAL
INSTITUTIONAL REVIEW BOARD
DATE 11/08/15

Cc: Brig Gen (Dr) Ralph Ametepi