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Graduate Program in Education

A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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The Role of Mobile Phones in Health Education for Rural Communities in Ghana: An Exploratory Study in Digital Technologies

(Thesis format: Monograph)

by

Kinful Lartebea Aryee

Graduate Program in Education

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

The School of Graduate and Post-Doctoral Studies
The University of Western Ontario
London, Ontario, Canada

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Abstract

The use of wireless, mobile, and handheld digital devices is growing in every sector, including education and health. The increase in mobile (handheld) phone usage has gradually drawn most healthcare practitioners' and patients' attention to its capability as a promoter of health education. It has helped with reduction in social and economic impact of preventive and curative and unexplained non-curable illnesses, especially among rural communities in sub-Saharan African countries such as Ghana.

Activity theory—an object-driven activity— was employed as the conceptual framework to answer the following research questions: What views do people have about information that relates to their health? What are the existing media used for obtaining information related to their health? What are the types of health-related activities that people perform on and with their mobile phones? What are the factors that influence employing a mobile phone in activities related to their health? And, what are some of the impacts of employing the device for activities related to their health in remote and isolated communities in sub-Saharan Africa? To help find responses to these questions, the study utilizes sequential mixed-methods approaches to sample 92 participants' views about the role and potential of mobile phones to promote health literacy and access to information about health in order to improve the healthcare delivery system among people living in rural communities.

Findings from the study show that health-related activities performed on and with mobile phones include: (i) inquiring about health concerns from friends, family, or healthcare personnel; (ii) practising teleconsultation, and telehealth with health helplines that address specific health issues such as pregnancy and cholera outbreak; (iii) clarifying any health symptom before travelling to healthcare centres; and (iv) scrutinizing counterfeit medications entering the country. Implementation of mobile phones in mobile health (mHealth) is revealed to be influenced by demographic and socio-economic status, as well as cultural practices and traditional beliefs in accessing and seeking medical assistance.

Findings from this research add to literature on ways of addressing health inequities in remote communities through conducting capacity-building projects. Also, the findings contribute to educators' understanding in identifying various forms of learning, seeking information, and pedagogies for which activity theory is particularly appropriate. Further, the results assist development agencies and policy-makers' understanding on ways of promoting adult education and means of addressing issues related to patients' privacy and confidentiality.

Keywords: STEM and Health Education, Health Information and Literacy, Mobile Phone, Community Education, Digital Communication Technology, Mixed Methods, Activity Theory, Sub-Saharan Countries, Rural Communities, Adult, Women, Global Health

Acknowledgments

To begin with, thank you, the Lord Almighty, for my life and how far you have brought me, in the midst of all the storms of life. I have fought a good fight and I won the battle.

I would like to express my sincere appreciation and gratitude to my PhD supervisor, Dr. Immaculate Namukasa. You have been a wonderful support throughout this journey. Thank you for your unrelenting encouragement in my studies and completion of this thesis. Your advice on both research, as well as on my career, has been tremendous. To my committee members, Dr. Kathy Hibbert and Dr. Femida Gwadry-Sridhar, thank you for your precious time and constructive insights in helping to shape my entire dissertation. I wish to extend my gratitude to my thesis examination committee for their time and participation.

My sincere appreciation goes to the Faculty of Education for awarding me the Western Graduate Research Scholarship (WGRS) throughout my entire program of study. I also extend my thanks to the staff of UWO Educational library and staff eLearning Technology centre, especially Clint, Chris, Dave, Christina, and Nadija, for their technical support during my dissertation write-up. My deepest appreciation goes to my research participants, Ghana Health Services staff from Awutu Senya, Kassena-Nankana West, and Savelugu, and all of you who have been there to support me when I gathered data for my PhD dissertation, for without you, this research would not have become possible.

A special thanks goes to my family. Words cannot express how grateful I am to my dad, Rev. Stephen Okentey; my aunt and her husband, Joana and Bismark Nerquaye-Tetteh; my siblings, especially Ebenezer, Gladys, and Grace, for your prayers and sacrifices are what have sustained me till now. I also extend my thanks to my cousins, nieces, and nephews for their wonderful daily prayers for my life. I would like to express gratitude to my beloved husband,

Dr. Abednego Aryee, who has always been my strongest supporter, and who made me the person I am today. I am grateful for all his valuable effort in encouraging me to come this far.

I will forever be thankful to my friends, especially CJ, Gyamfuaa, Harriet, and Paulina who encouraged me to strive toward my goal in moments when my journey of life seemed to have come to a dead end. No amount of words could ever express my gratitude for the emotional and psychological support you provided me. I would also like to thank all of my friends, particularly De-Graft, Godfred, Jonathan, and Sam, who supported me during the entire write-up.

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Chapter 1

1 Introduction

There is a proliferation and use of wireless, mobile, and handheld digital devices in every sector, including education and health (Brown, 2004; Greenspun & Coughlin, 2013; Kukulska-Hulme & Traxler, 2005; Mechael, 2010; Ofosu, 2009; Sarasohn-Kahn, 2010; Traxler, 2006). The increase in usage of technological devices such as mobile phones, smart phones, and palmtops has gradually drawn the attention of social services, particularly that of most healthcare practitioners and patients', to the devices' capabilities as promoters of health literacy and access to health information (Mackert, Love, & Whitten, 2009; Mechael, 2009; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005). An individual's access to and use of relevant information, especially in health, is considered to be one of the ways of minimizing the social and economic impact of preventable and non-preventable diseases and illnesses.

In this chapter, I introduce the study by outlining background to the study, stating the problem of the study from which the research questions and the research objectives are formulated, and also the context in which the study takes place. This chapter also highlights the researcher's position and introduces key concepts of the study—health literacy.

According to Clayton (2011) and BBC News (2011), Africa is the fastest-growing mobile phone market in the world, with an increasing growth of 20 percent phone users annually. A BBC interview with Lyons (2011), the Global System for Mobile Communications Association's (GSMA) director of spectrum policy for Africa and Middle East, reveals that mobile phone use in Africa had reached 649 million

subscribers in the fourth quarter of 2011, and is expected to be more than 735 million subscribers by the end of 2012. A new GSMA report released on socio-economic impact on mobile industry in sub-Saharan Africa indicates that sub-Saharan Africa leads the world's mobile growth with 781 million mobile subscriptions (GSMA, 2013; IT News Africa, 2013). There is no doubt that current mobile phone subscription growth rates in developing countries far exceed that of developed countries (Mims, 2012). The people of Ghana, where this study was conducted, are no exception. The increasing rate in subscriptions as well as usage provides an opportunity to harness mobile phones in health literacy of the masses as they employ the device to perform health-related activities. Ghana is also one of many African countries with healthcare literacy needs that continue to challenge public policy leaders.

UNESCO (2009) takes literacy broadly speaking, as one of the ways of promoting sustainability in most developing countries. In the same way, Kickbusch and Buse (2001) define the term *literacy* as involving "a complex set of abilities to understand and use the dominant symbol system of a culture for personal and community development" (p. 4). A broad definition of literacy, however, is important for this study in the global south, since it acknowledges that literacy is more than reading and writing. The advances in technology have widened literacy beyond the usual functional skills of reading, writing, speaking, and listening to include multiple literacies such as visual, media, and information literacy. Literacy is an important foundation for learning through life (The Centre for Literacy, 2013). For literacy learning, the New London Group has pushed for change toward experiential and situational learning (Cope & Kalantzisis, 2000). This is also applicable to health literacy.

With the high usage of technological devices across the globe, and cultural and linguistic diversity of learners as well as individuals, literacy goes beyond basic literacy—reading and writing (Hibbert, 2013; Kress, 2003; Radha, 2007). Again, obtaining and receiving health-related information, especially for individuals living in remote communities with limited healthcare resources, are made possible through practices of multi-literacies (Cope & Kalantzis 2009; Hibbert, 2013), including digital literacy (Gee, 2009), and other media such as posters, healthcare personnel, and the Internet for obtaining health-related information media for communication. Thus, individuals with no formal education could understand and apply obtained health information to their health needs when the information is in various forms. The term multiliteracies which was created by the New London Group (1996) defined as a multiple-form of knowledge, including print, images, video, and combinations of forms in digital contexts needed to represent in an equally complex way. In line with the concept of multi-literacy, Gee noted that the practice of employing technologies goes beyond the mere use of a digital tool. Digital literacy involves ways of acting and interacting with a device—images, sounds, and multimodal texts—(Gee, 2009).

Education in general, and health literacy specifically, are noted to be key determinants of good health, as well as of employment and social well-being (DeWalt, Berkman, Sheridan, Lohr, & Pignone, 2004; Friedman & Hoffman-Goetz, 2008). Health and education tend to go hand in hand. Education, particularly health education and mass education, is one of the most effective means of combatting the spread of certain illnesses and diseases such as HIV/AIDS and Tuberculosis (Coombe & Kelly, 2001).

Considering the low level of literacy rates among individuals in most developing countries, Education For All (EFA), a goal for UNESCO by 2030, aims at achieving 50 percent improvement in literacy and distance education for both youth and adults. The Organization for Economic Co-operation and Development (2003) indicates that health is a major determinant of educational attainment, since it has a direct impact on cognitive abilities. Masizana-Katongo and Morakanyane (2009) define low-literate adults as people who have never been to school to have any form of formal education, or those who have been to school at some stage in their lives, but have lost touch with reading and writing.

Further, many governmental agencies and non-governmental organizations (NGOs) in developing countries emphasize the urgency to promote literacy, especially health literacy, among individuals (Grosse & Auffrey; Kickbusch, 2001). Elder and Clarke (2007) contend that despite the above efforts to promote literacy, health literacy remains a critical challenge in developing countries. The current rate of health challenges calls for more than general literacy (Kickbusch, 2001). Meanwhile, individuals need to possess literacy that is functional in order to perform health activities (Nutbeam, 2006). Kickbusch and Buse explain that the debate around health literacy emerged from two different areas: (a) the community development around the Freirean model of adult learning, particularly geared toward empowerment of people; and (b) the concern over poor health literacy levels among a great number of patients in most developed countries.

Poor health status, a wide range of controlled and uncontrolled, preventable and non-preventable diseases, and inadequate healthcare services are considered to be a major deterrent of human, social, and economic development in developing countries (Braa, Hanseth, Heywood, Mohammed, & Shaw, 2007). As a result, Millennium Development

Goals (MDGs) include three out of the eight goals directly related to health (Chetley, Davies, Trude, McConnell, Ramirez, Shields, et al., 2006). These goals are to: (i) reduce child mortality; (ii) improve maternal health; and (iii) combat HIV/AIDS, malaria, and other diseases. It is not surprising that the search for, and usage of, health information has become a great concern for both individuals and healthcare providers (Kickbusch & Buse, 2001). This clearly indicates that health is considered central to the global agenda of reducing poverty and improving sustainability.

Contemporary health care calls for multi-literacy that is geared toward assisting individuals to identify their health needs, and gain better understanding about these concerns in order to seek and access appropriate remedies. These literacies that are needed include health literacy. Health literacy could be promoted among individuals, with the help of mobile phones. Given that Ghana is one of the countries that have adopted the universal healthcare system, Andreatta, Debpuur, Danquah, and Perosky (2011) argue that an individual's ability to access, seek, evaluate, and use relevant health information with a mobile phone will serve as an economic relief to the nation, as well as economic and emotional relief to the families. In addition, recent adoption of mobile phones with features such as the use of Short Message Services (SMS), Bluetooth, camera, and voice calls across Africa projects the device as a timely technological tool that allows individuals to be both consumer and producer of information that relates to their health. In other words, individuals are able to employ a mobile phone to inquire about, search for, and evaluate obtained health information, and share information with both families and colleagues. This makes the device a viable tool for healthcare delivery service and information seeking and accessing for both healthcare personnel and

individuals, especially in communities where an individual's access to health information is traditionally limited. In summary, digital technology holds a lot of promise for making the big strides urgently needed for improving the health of communities, particularly in the area of health inequities.

Considering the nature of health challenges facing individuals in rural communities, the best way to address some of these related issues is to solicit individuals' views about possible ways of promoting health literacy in order to improve their health situations. Also, the majority of people living in the rural communities own and use mobile phones. Hence, inquiring about participants' views about the use of the device to promote health literacy seems to be the way forward in addressing some of these health inequities. For instance, the simple definition of literacy as the ability to read and write is too general a concept to differentiate among those whose literacy correlates with safe and sound health practices. As Nutbeam (2006) notes, general literacy is not enough for emancipation and empowerment.[1] There is the need to better understand the ways improved and sustainable health, the use of mobile technology, and adult literacy are, or can be thought of as complementary to one another. Hence, in order to address these research problems, the study adapts activity theory as a theoretical lens. It also utilizes sequential transformative and explanatory mixed-methods approaches as the methodology, which will be explained in detailed in the thesis. A sample of 92 participants' views about the role and potential use of mobile phones to promote health literacy and access to information about their health, taken from people living in rural communities, is explored.

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[1] Empowerment refers to the process by which people gain control over the factors and decisions that shape their lives.

The rationale for adapting the theory is to provide the researcher the lens to: (a) investigate participants' use of mobile phones to perform health-related activities, such as finding information about a person's health status, and making an inquiry about first-aid practices, especially in rural communities; and (b) explore related challenges with the use of mobile phones to perform health-related activities. Mixed-method approaches are employed in this research for the following reasons: (i) to obtain both quantitative and qualitative responses for complementary data; and (ii) to use interview data to obtain detailed responses that are difficult to acquire from survey data for elaboration and clarification of responses. The study examines ways mobile phones may assist in: (a) improving an individual's access to health information, both in formal and informal settings, and (b) healthcare delivery services. The study also examines factors that may influence the use of mobile phone in assisting with promoting access to health information, particularly among individuals living in communities with limited medical health facilities.

Penetration and usage rate of mobile phones in Africa has created potential use of the device in health sectors as an information-searching and receiving tool. Additionally, low level of literacy in general is considered to influence individuals' ability to seek, obtain, and apply relevant health information to promote health status. Current health needs confronting most developing countries include maternal and child mortality and importation of counterfeit medications.

The subsequent sections of this chapter are categorized into four main areas. The first section consists of three subsections that discuss the statement of the problem, study objectives, and the research questions guiding the study. The second section explains the

study context and sectors where mobile phones have been employed in Ghana to perform various activities including health. In the third section of the chapter, the researcher's position is clearly outlined. The fourth section examines various definitions of health literacy, and the concept of health literacy in health promotion. In this same section, I provide the device's potential in the health sector.

1.1 Statement of the problem

Health inequities such as inadequate health services, limited healthcare resources, and importation of counterfeit medications are seriously hampering human, social, and economic developments in developing countries. The alarming prevalence of communicable diseases such as Hepatitis C and tuberculosis remains endemic in the developing world, with chronic carriers numbering in the hundreds of millions (Restum, 2005). According to Millarm (2008), recent observations from individuals in most rural communities and other agencies in Ghana indicate a tremendous decline in the health of individuals.

Estimation given by the World Health Organization (WHO) (2004) indicates that in the African region, there is an average of 1000 deaths per 100 000 live births for maternal mortality, which is a huge concern. According to WHO (2013), despite the effort in improving health and access to information related to health, health literacy continues to be a huge challenge for both individuals and the nation as a whole. Most of these health challenges, Prinsloo, Slade, and Galpin (2011) believe, are partly due to cultural beliefs and practices about traditional herbal treatment in certain communities, and largely due to a low level of health literacy and limited access to healthcare resources. Although access to relevant health information is considered a vital component of human life, this practice

of seeking health information seems to be uncommon when it comes to individuals living in remote areas.

Ghana, like most developing countries, is faced with many social and economic problems. The country is also faced with several health-related challenges ranging from access to health facilities to access to health information. As a result, many people suffer from various health-related conditions, such as malnutrition and poor personal hygiene. Others lose their lives to malaria and diarrhea due to ignorance and lack of health education. In the rural communities, because healthcare facilities are extremely limited, most individuals do not have access to healthcare services and relevant information needed to stay healthy.

Further, when it comes to healthcare resources and service delivery, obtaining emergency service is a problematic because of a poor road network and inadequate ambulance service. Also, healthcare workers' ability to generate effective and updated monthly reports and keep patients' medical records up-to-date for proper diagnoses is a huge challenge in Ghana. For instance, most healthcare centres keep patients' medical records in folders that seem to be hard to keep because of limited storage capacity and poor record-keeping practices. As a result, medical practitioners find it difficult to follow up on patient medical history. Figures 1 and 2 illustrate how patients' medical folders are obtained from the healthcare storage room in order to record their medical information at the hospitals. DeHart and Heckerman (2008) note one of the means of keeping up with updated patients' medical records would be to save them electronically, which could be accomplished by employing computers, tablets, and smartphones to collect and upload patient information onto a server or a computer. This process guarantees reduction in any

previous medical errors and inconsistencies that used to occur as a result of lost paper-based health records, and also keeps updated and reliable medical records of patients. Hence, this is where investigation of the use of mobile phone implementation in healthcare becomes useful.

Figure 1. A picture showing a healthcare worker looking for a patient's folder. Source: Images taken by researcher with permission during field work at the Savelugu Health Centre, Ghana, 2012.

Figure 2. A picture showing healthcare personnel entering patients' medical information. Source: Images taken by researcher with permission during field work at the Savelugu Health Centre, Ghana, 2012.

Family-planning practices, maternal and child mortality, and environmental cleanliness remain a huge challenge in most communities situated in these regions. Thus, pregnant and nursing mothers and their children are losing their lives from lack of antenatal and neonatal care. According to WHO (2013), the proportions of births attended by skilled personnel and antenatal attendance is still under 60 percent in most African regions, of which Ghana is not an exception. These problems pertain to virtually every region in Ghana, but they are more predominant in most rural communities in regions located in the central, northern, and upper east of the country. On these health issues, Glassman and Helgeson (2012) find that the use of mobile phones to deliver healthcare services such as receiving health messages on the phone, and calling to inquire about health information from healthcare personnel has the potential to reduce service and travel costs, and to improve quality of healthcare delivery services in rural and other medically underserved areas.

Although mobile phones can be useful tools for reducing health problems, studies in this area are limited in developing countries (Anta, El-Wahab, & Giuffrida, 2009; Dougherty, 2006; Kaplan, 2006). Additionally, given health-related challenges faced by most individuals in rural Ghana, and the potential that a mobile phone with its features holds, investigating the device's role in promoting health education, especially health literacy and access to health information, is worth researching.

1.2 Research questions

The study poses the following questions: What views do people have about information that relates to their health? What are the existing media used for obtaining information related to their health? What are the types of health-related activities that

people perform on and with their mobile phones? What are the factors that influence employing mobile phones in activities related to their health? And, what are some of the impacts of employing mobile phones for activities related to their health in remote and isolated communities in sub-Saharan Africa?

This research is adding to ways of addressing health inequities such as importation of counterfeit medications, and limited healthcare resources and delivery services faced by most communities in rural Ghana. The research also bridges the healthcare delivery services gap between patients and healthcare personnel by promoting telemedicine. Most studies in investigating ways that mobile phones are employed as a tool to promote health literacy for rural communities are in their pilot stages.

1.3 Study objectives

The overall objective of this study is to examine the potential use of mobile phones to promote health literacy through individuals' ability to access, seek, and apply relevant information about their health in order to improve healthcare delivery systems and healthy living among people living in rural communities. The study aims to achieve the following objectives:

1. Examine participants' views about why their health is important to them
2. Explore existing media used for obtaining information related to their health
3. Explore the use of mobile phones to perform various activities that relate to their health
4. Identify factors that may support or hinder employing mobile phones to obtain information about their health

5. Inquire about the impact of employing mobile phones to perform activities related to their health in remote and isolated communities in sub-Saharan Africa

According to Arievitch (2007) and Harrison and Holley (2001), having a tool, especially a device with multiple functionality, in your hands, and the ability to identify which of your current pressing issues and challenges could be solved by using the device, are two separate matters.

Telemedicine set-up is among the least developed in Ghana, despite the fact that use of mobile phones is increasing and has the potential to support healthcare delivery services in Ghana. The country is struggling with effective healthcare delivery due to limited resources and infrastructure. Hence, this study aims at employing mobile phones as a way to promote healthcare services among residents of Ghana. This process will be done through the use of: (i) mobile telephony for health services (mHealth); (ii) audiovisual support for clinical decision making (telemedicine); and (iii) electronic messages to promote public health. This study is a way of contributing to Ghana's eHealth strategy dreams that aim at promoting healthcare delivery and also at achieving the MDGs by 2015.

1.4 The study context

The Republic of Ghana is a sovereign country located in West Africa, a few degrees north of the Equator. It lies between latitudes 4° and 12° N and longitudes 4° W and 2° E and spans an area of 238 500 km^2 (92 085 sq. mi.) (CIA World Factbook, 2011). The country has three neighbours: Burkina Faso, Côte d'Ivoire, and Togo. According to CIA World Factbook (2012), Ghana borders with Burkina Faso 549 km to the north, with

Côte d'Ivoire (668 km) to the west, with Togo (877 km) to the east, and the Gulf of Guinea (located at the Atlantic Ocean) (539 km) to the south (Fig. 3).

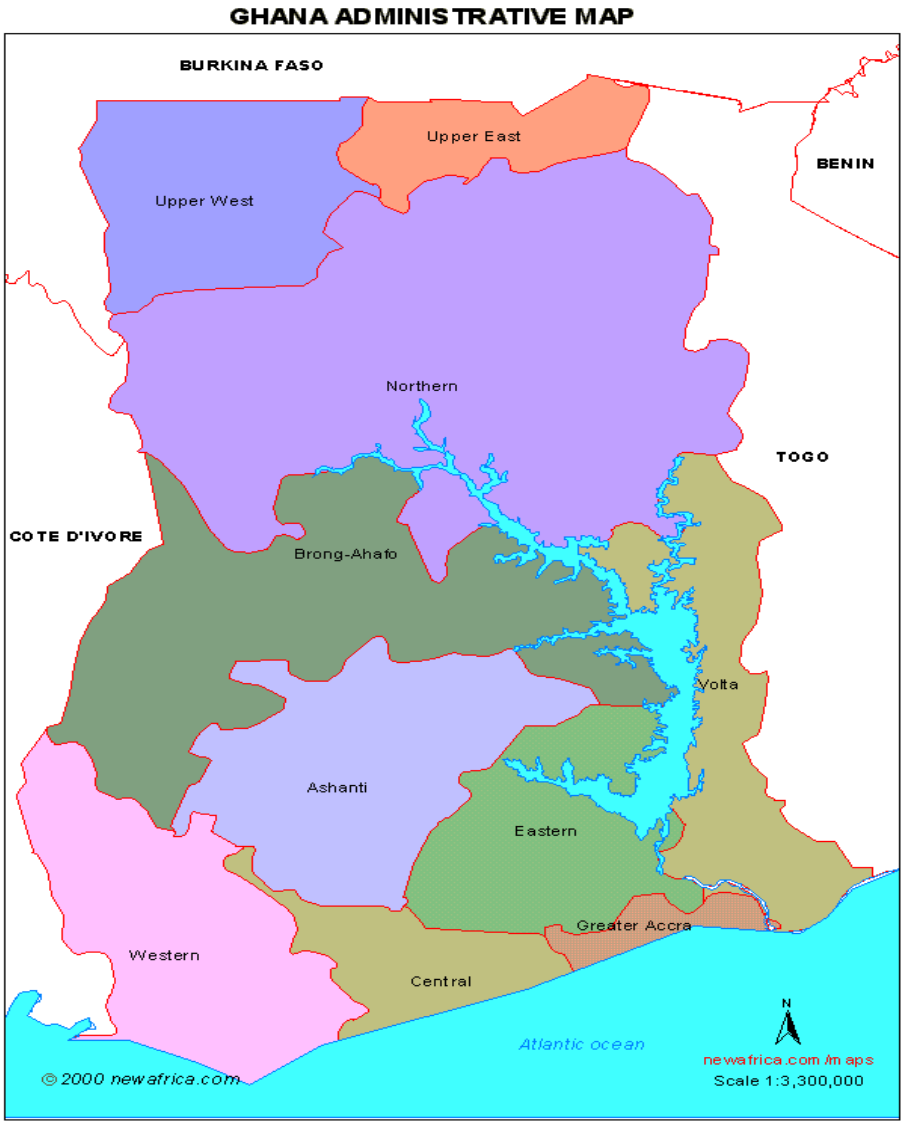

Figure 3. The Map of Ghana.
Source: http://cdn.ghanaweb.com/GHP/img/pics/59387424.gif

As of July 2014, Ghana's population was estimated at 25.7m (*CIA World Factbook*, 2014). The country is divided into 10 administrative regions (Provinces), subdivided into a total of 170 districts (counties), with diverse ethnic cultures.

Economically, Ghana is among the world's top 10 fastest growing economies (The Sun, 2012) and the fastest growing economy in Africa. The country is endowed with a wide range of natural resources—mineral deposits such as gold, industrial diamond, manganese, bauxite silver, salt, limestone, as well as crude oil reserves and natural gas. Other resources include arable land for cocoa, rubber plantations, and other agricultural produce. Ghana has a wide and varied industrial sector that centres on aluminum smelting, sawmills, timber and agricultural processing plants, brewing, cement manufacture, oil refining, textiles, electrical, pharmaceuticals, mining, among others. In terms of demography, from the population of about 25.2 million (m), including children, nearly 10.9 m range from ages 15 to 64 years, representing 43.3 percent of the population who are considered economically active, whereas 13.8m, representing 54.8 percent, are considered to be economically inactive. This group has individuals below 15 years and above 64 years of age. Out of the economically active populace, 10.2m (95.3 percent) are employed, with 4.3m (2.3 percent) unemployed. Of the individuals who are employed, 8.4m (81 percent) are self-employed/private employees, with the remaining percentage (19 percent) being government employees.

As catalogued by World Bank (2008), the general literacy rate in Ghana (Fig. 4), which is a person's ability to read and write basic statements on his or her everyday life, has increased from 58 percent in 2000 to 65.8 percent in 2008. This increment is mainly attributed to developmental agencies' activities, including Literacy Bridge (2009) and UNESCO (2008). When the data are compared with those of other developing countries such as Rwanda, Uganda, South Africa, and Zimbabwe, 65 percent, 67 percent,

82 percent, and 92 percent, respectively, it can be deduced that the literacy level in Ghana is quite low (NationMaster.com, 2005).

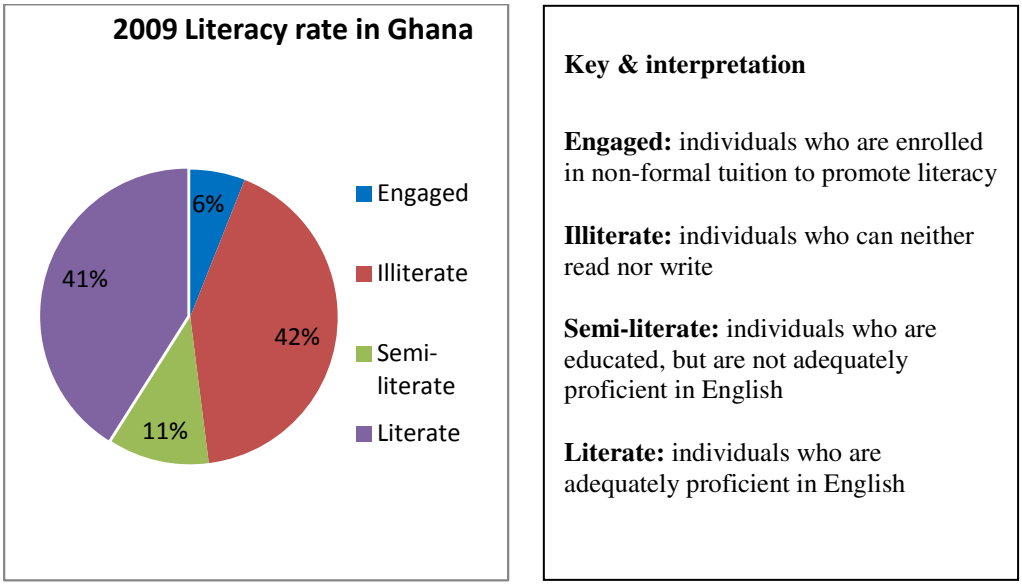

Figure 4. 2009 Adult literacy rates in Ghana.
Source: Afronline.com

As a way of promoting access to relevant information, Literacy Bridge, a public charity in 2009, started a literacy project where information on agricultural techniques, educational stories, and health practices were recorded onto handheld mobile devices known as *Talking Books*. The devices were distributed among members of the Nadowli Kuubataanono community in northern Ghana, where literacy and access to information was considered to be extremely low, in order to listen to information related to their health and farming, among other things (Fig. 5). This audio device, which utilizes dry batteries, was specifically designed for people who cannot read, and who live in communities where there is no source of electrical power.

According to Literacy Bridge (2010), results from the project indicate a dramatic increase in participants' knowledge of agricultural practices and healthy lifestyle.

Figure 5. People's interaction with the device.
Source: Literacy Bridge, 2010.

To consider how mobile phones may impact the health literacy and access to information about the health of the residents of Ghana, it is useful to review the impact that access to information plays in the area of agriculture. Agriculture is Ghana's main occupation, and cocoa and timber are exported to generate revenue for the country. Most farmers, however, do not have access to agricultural information that could improve their farming practices. In that regard, World Education, in collaboration with Ghana Cocoa Board, is currently using mobile phones to educate and provide information regarding fertilizers, application of pesticides, and other farming practices. Masuki et al. (2010) indicate that agricultural extension officers [2] are now employing mobile phones to deliver agricultural information, such as types of insecticides, pesticides, fertilizers, and nature of market access to their clients. This is done by providing farmers with a phone number link, where they can access the information on their phones or call the agricultural extension officers for inquiries. Farmers also send SMS to the link to receive help with their cocoa products (Personal conversation with Agyarko-Kwarteng, project coordinator

[2] Agricultural extension officers are individuals with degree or diploma certificates in agriculture, who offer education and services to rural farmers on best farming practices and methods, and needed agricultural knowledge and skills for obtaining best yields.

August 14, 2011). Agyarko-Kwarteng further states that preliminary results reveal a tremendous yield in the quality of the farmers' cocoa, with an increase in family income.

This research was conducted in three different districts—Awutu Senya, Kassena-Nankana West, and Savelugu-Nanton—located in the central, upper east, and northern regions of Ghana, respectively. Awutu Senya district is situated between latitudes 5, 20 degrees N and latitudes 5, 42 degrees N and longitudes 0, 25 degrees W and 0, 37 degrees W at the eastern part of the central region of Ghana, with a population of 274 584 (anticipated from the 2000 Population and Housing Census). The main economic activities in Awutu Senya are farming and fishing. Most communities located in this district are currently enrolled in the MoTeCH program, where pregnant women and nursing mothers are receiving health-related information on their mobile phones. Kassena-Nankana West is one of the nine (9) districts in the upper east region of Ghana. This district shares boundaries to the north with Burkina Faso, south by the West Mamprusi district in the northern region, to the east with Bolgatanga, and to the west with the Builsa District. The district has an estimated population of 92 188, with a population density of 92 persons per square kilometer (N-lanjerborr Jalulah, Ghanaian Chronicle news, 19 March, 2009). The main occupation in this district is farming. Most communities located in the district are enrolled in the MoTeCH program as well. The district that is not enrolled in MoTeCH is Savelugu-Nanton. Savelugu-Nanton district is in the central part of northern Ghana. It is situated 673 km north of Accra on the Gulf of Guinea, with estimated population of 139 283 based on the 2010 census. Savelugu is one of the tourism sites with a major slave trade route, as well as the historical Saakpuli Slave Market in Ghana. Savelugu has both crop and livestock farming as the major occupation.

1.5 Researcher's position

This study was inspired by my background as a science teacher and my experience of poor healthcare delivery services in rural Ghana when I was teaching in one of the remote communities with limited access to health information and healthcare services.

Global health challenges and health inequities facing many individuals have augmented the need to search for and use health information. Notwithstanding incredible advances in health since 1950, there are still a number of health challenges that could easily be addressed. Global health problems, according to Shah (2011) and WHO (2012), include, but are not limited to, cardiovascular diseases, maternal and child health, infectious and non-infectious diseases, sanitation and hygiene, and the new threats to health. Most global *health inequities* are usually a combination of overlapping social and economic systems. These health inequities are particularly prominent in poor, remote, and isolated communities and settings that have increased frequency of diseases and illnesses (Andreatta, Debpuur, Danquah, & Perosky, 2011; Nutbeam, 2006). For instance, many people in rural communities in Africa may not be in a position to visit the healthcare centres or inquire about their health conditions due to limited knowledge about health literacy. These problems are no different from the situation that exists in Ghana. Although literacy is fundamental in promoting global health, it is important to focus on health literacy as a specific form of literacy because being literate does not guarantee that an individual is health literate when it comes to learning much about health status.

Researchers have noted that most of the problems faced by many individuals in rural Ghana are exacerbated by lack of adequate medical care, poor roads to travel to

healthcare centres, and low level of health literacy (Pearce, 2009). In Ghana, currently, an individual's ability to acquire health literacy has become important for making healthcare decisions, especially where there are limited travel times and few healthcare facilities. Several authors (see, for example, Lukenbill & Immroth, 2010; Mackert, Love, & Whitten, 2009; Nutbeam, 2006; Pakenham-Walsh Priestley & Smith, 1997) have also noted that in health practices, obtaining reliable health information is considered basic for reducing health challenges.

According to Johnson (2005), HIV/AIDS is wiping out young adults, and leaving frail, malnourished children in the care of their siblings and grandparents in Africa. Clifford, Blaya, Hall-Clifford, and Fraser (2008) indicate that many times, certain situations make it difficult for many individuals to seek medical assistance at the right time. According to Clifford et al., these situations include: (a) limited access to healthcare centres and medical personnel; and (b) poor road conditions and distance that patients may need to travel for medical care and consultation. Other major health challenges currently facing individuals in both the developed and developing world, according to Bezold, Murata, Rosenkrans, and Kiefhabe (2006), comprise chronic diseases such as heart disease, cancer, diabetes, and asthma.

Ghana was selected for the study because I have a personal interest in the country. I wanted to conduct this project as a way of obtaining more insight into some of the health- related challenges faced by most rural communities, and to share the results with agencies willing to assist such communities. Importantly, as in most of sub-Saharan Africa, there are seasonal outbreaks of diseases and illnesses such as cerebrospinal meningitis (CSM), yellow fever, and cholera, which continue to pose a threat to residents,

especially in the northern and upper east regions of Ghana (Mensah, 2011), not to mention the development and spread of diseases including hepatitis B, buruli ulcer, and HIV/AIDS, which is killing many individuals in Ghana. These health issues clearly indicate that the country is struggling with effective healthcare delivery services. Ghana aims to promote healthcare delivery in order to meet the global challenge targets for 2015, but current healthcare delivery systems do not seem to be effective enough to ensure these targets are achieved.

Rural communities in Ghana face several health-related challenges including limited healthcare facilities and poor road conditions that make access to health facilities difficult. The study sets out to explore potential ways in which the affordances of a digital technology—the mobile phone—could be harnessed to address these health inequalities.

The health statuses of individuals living in Canada and in Ghana are compared (Table 1). This is followed with comparing the health statistics between Ghana and Zinbabwe (Table 2).

Table 1
Comparing Health Statistics of Canada and Ghana

	Ghana	Canada
Life expectancy	65.2 years	81.6 years
Infant mortality rates	40.9 deaths/1000 live births	4.9 deaths/1000 live births
Total population estimated to be living with HIV/AIDS	1.8%	0.3%
Total fertility birth rate per woman	4.1	1.6
Healthcare personnel	15 physicians and 93 nurses per 100 000 persons, 11	2.1 physicians and 10 nurses per 1000

	midwives per 10 000 persons	persons
Access to essential medication	0%	95%
Access to sanitation	64%	100%

Source: Central Intelligence Agency (CIA) World Fact Book, 2014; 2013; WorldStat.info 2011; World Health Statistics, 2005; 2011.

Table 2
Comparing Health Statistics of Two African Countries

	Ghana	**Zimbabwe**
Life expectancy	65.2 years	51.9 years
Infant mortality rates	40.9 deaths/1000 live births	28.23 deaths/1000 live
Total population estimated to be living with HIV/AIDS	1.8%	14.3%
Total fertility birth rate per woman	4.1	3.6

Source: Central Intelligence Agency (CIA) World Fact Book, 2012.

1.6 Various definitions for health literacy

Health literacy is very complex and it plays a significant role when it comes to a person's ability to fully understand health information in order to take good care of his or her life. As a result, health literacy has become one of the top health priorities across the globe (Mackert, Love, & Whitten, 2009). Also, due to its *complex* nature, and the fact that health literacy appears to be a new concept in health education, the term has been narrowly defined by various researchers (Nutbeam, 2006). This section of the thesis

examines various definitions of health literacy. It also outlines how the term has been adapted in this study.

Health literacy is not merely the ability to read. Hence, as a way of deconstructing the complexity of the term, in Canada, health literacy has been correlated with literacy practices, such as an individual's ability to read medical brochures, and applying relevant health information to their health needs. According to DEMarco and Nystrom (2010) health literacy involves an individual's ability to access, understand, evaluate, and use complex health information, be it on labels, brochures, or elsewhere. This appears to be a major component of health literacy.

As part of the concept of health literacy, Nelson and Parvanta (2011) also define the term as an "individual's ability *to understand and use complex health information*, so it is multifaceted skill with many domains [including, communication skills, beliefs about health issues, cultural and linguistic factors, and public health] feeding into it" (p. 120). Examples of this complex health information include an individual's ability to *understand instructions* on prescription drug bottles, appointment slips, medical education brochures, and the ability to negotiate complex healthcare systems (Health Literacy, 2010; Hughes, Bellis, & Tocque, 2002).

Consistent with Nutbeam, in most developed countries, health literacy is used to describe and explain the relationship between patient literacy levels and their ability to comply with prescribed therapeutic regimens such as breast cancer and drug addiction. Hence, the Public Health Agency in Canada (2011) defines health literacy as an individual's ability to access, seek, comprehend, evaluate, and communicate information as a way to *promote*, *maintain,* and *improve* health in a variety of settings across the life

course. The Center for Health Care Strategies Inc. (2000) adds to the definition by viewing health literacy simply as the ability to read, understand, and act on healthcare information.

The Center for Literacy (2013) sums up the definition of health literacy as the use of a wide range of skills that improve the ability of people to act on information in order to live healthier lives. These skills, according to The Center for Literacy, include reading, writing, listening, speaking, numeracy, and critical analysis, as well as other communication and interaction skills. Since many people have the capability of possessing such skills, the term implies that both patients and healthcare personnel may seek access, comprehend, evaluate, communicate, and use health information.

The level of literacy in health, in my view, appears not to be improving as it should in most developing countries because a majority of individuals tend to rely and entrust nearly their entire lives to healthcare providers, without much inquiry. This is evidence that many people cannot manage their own health because they lack decision-making skills and understanding of medical information and high healthcare costs. According to Garner (2005), the reason most patients rely on medical practitioners is that they lack what [he] refers to as *information literacy.* Garner explains that information literacy assists people from all walks of life to seek, understand and evaluate, and utilize information effectively to achieve their personal, occupational, and social goals. These practices, however, seem not to be functioning in the lives of most individuals due to low level of health literacy. As a result, various health related challenges persist across the globe.

Low health literacy is considered to be a public-health issue for many developing countries, including Ghana. As explained by Ishikawa and Yano (2008), health literacy has recently become one of the healthcare priorities due to its association with health information literacy. Challenges in poor health information literacy according to Institute of Medicine (2004) include inadequate preventive behaviours, unsafe self-care and chronic-disease management, and increased medical costs. Low health literacy—a person's inability to obtain, process, and understand basic health information needed to make suitable health decisions—and lack of access to health information, are mostly visible and prominent in rural communities in both the global north and south (Fong, 2009; Sandhu, Hey, Newman, & Agogino, 2005). According to the National Network of Libraries of Medicine (Nd), the low health literacy level is due to lack of educational opportunity, learning disabilities, and cognitive declines in older adults. Lack of educational opportunities is a huge problem in rural areas in the global south. Worst still, rural communities are faced with uneven distribution of, and inadequate, medical services and facilities (Deogaonkar, 2004).

In this study, I adapt the definition of health literacy from an Institute of Medicine report (2013) to include the degree to which individuals have the ability to seek, access, understand, evaluate, and apply basic health information and services needed to make appropriate health decisions related to their health in order to promote, improve, and maintain healthy living. Unfortunately, most individuals may not have, or be able to attain, the ability to make such decisions due to socio-economic and demographic factors such as level of education, employment, and marital status.

1.7 Health literacy: A journey to health promotion

The term *health promotion* has been defined in various ways by several researchers. Health Promotion, according to O'Donnell (2009), is the art and science of helping people discover the interactions between their core passions and optimal health, enhancing their motivation to strive for an ideal health, and supporting them in changing their lifestyle to move toward a state of optimal health. To Nutbeam (1998), health promotion is the process of enabling people to increase control over the determinants of health in order to improve their health. WHO (as cited in Nutbeam, 2006) states that health promotion includes the process of enabling individuals to improve their health status to become self-managers of their lives through activities that include, but are not limited to, the preventive, curative, and relaxing health services provided by healthcare systems. Consistent with what has been said by other researchers, Kickbusch (1986) considers health promotion to: (a) involve the population as a whole in the context of everyday lives; (b) be directed toward action on the determinants of health; (c) combine diverse, but complementary, methods or approaches; (d) aim for effective and concrete public participation; and (e) involve health professionals. According to the Department of Health and Human Services (2010) in the United States, health promotion is usually directed toward action on the determinants or causes of health. Hence, the aim of health promotion is to keep individuals well and prevent diseases from occurring and recurring. In other words, the rationale for health promotion comes from the scope to prevent ill health through healthy living (Hubley & Copeman, 2008). Living a healthy life takes an individual's ability to become health literate by seeking, accessing, and applying relevant health information to health problems.

A report from Eastern Health (2012) in Canada reflects that "health is determined to a large extent by the conditions of everyday life where people live, learn, work, and play" (p. 16). The report further states that the extent to which people experience good health is influenced by a variety of factors, of which most of them may not be evenly distributed within the population due to differences in individuals in terms of life circumstances. Nutbeam (2006) provides examples of health promotional activities to include searching online for health tips, reading medical brochures, visiting healthcare centres to inquire about medications, and applying this information to daily life. Adding to health promotional activities, Green and Potvin (2002) consider lifestyle which is usually viewed as a combination of specific practices and a personal beliefs system. To Gerber, Stolley, Thompson, Sharp, and Fitzgibbon (2009), lifestyles involve an individual's ability to obtain and apply relevant information to make good choices in, for instance, eating habits, taking the right medications, regular check-ups, and asking doctors more questions about their health conditions. Nutbeam (2000), however, states that less attention has been given to these practices, including the influence of culture on access to health information (Erumban & de Jong, 2006).

Chetley (2006), on the other hand, observes that most individuals appear not to perform these activities due to low level of health literacy in terms of applying the needed skills to make appropriate health decisions. In relation to this, Kinnon (2002) lists five strategies that would help achieve the aim of health promotion: (a) building healthy public policy such as environmental protection legislation and occupational health; (b) creating supportive environments through community development and family support; (c) strengthening community action so that communities can identify needs and

address them; (d) developing personal skills that enable individuals and groups to address health issues; and (e) reorienting health services to be more client focused and integrated.

Health literacy is considered as one of the means to promote individuals' health status. Promoting health literacy helps individuals to be self-managers of their lives through various activities that involve the prevention and curing of illness and diseases. However, most of these activities are not being performed because of challenges such as low level of literacy, lack of interest in seeking health-related information, and lack of working policies that support health-promotion activities.

1.8 Potential use of mobile phones in health

Current technological devices such as mobile phones, tablets, televisions, and radios have facilitated communication and access to information among individuals. According to Leo (2006), most of these devices are being used by a majority of adults in most developed and developing countries on a daily basis to perform various activities that range from calling to accessing information. Leo states that researchers conducted studies worldwide and found out that 75 percent of mobile phone users carry them at all times and had them turned on all the time, except when sleeping.

Ghana is one of the African countries with extensive access to mobile phones (Ofosu, 2009). The country has six mobile phone-subscribing companies: MTN, Vodafone Ghana, TiGo, Airtel, Glo, and Expresso. Dowuona (2013) provides the number of subscribers for each company, including their percentages based on an estimated total population, as follows: MTN 11.5 million, representing 45 percent; Vodafone Ghana 5 million subscribers, representing 20 percent; TiGo 3.6 million, which represents 14 percent; Airtel 3 million representing 12 percent; Glo 1.5 million signifies 6 percent;

and, Expresso 0.2 million, representing 0.7 percent of the total market share. These figures indicate promising evidence of the shrinking digital divide in ICT between the global south and global north, particularly with the use of mobile phones (Lustria, Smith, & Hinnant, 2011; Rouvinen, 2006). Dogbevi (2011) reports the total number of mobile phone users in 2011 as 17.4 million of the country's estimated population of 23 million, including children. Kunateh (2012) notes current mobile phone subscribers in the country, using information from Ghana National Communications Authority (NCA) as of August, 2012, to be 24.4 million out of a population of 25 million, as indicated by the World Bank. Though this penetration and usage rate is nearly 100 percent, Dowuona clearly states that the increase may not necessarily mean everyone possesses the device because most individuals may have more than one mobile phone line.

Despite the increase in mobile penetration and usage, government, NGOs, business co-operations, and individuals have not adequately explored the role digital technologies might play in health service delivery, especially in the health and education sector. The role of the device may also be beneficial to explore in rural communities where there is little or no access to clinics/hospitals.

As indicated by Tamocha (2007), the high use of mobile phones has increased most researchers' interest in the concept of mobile learning, specifically for literacy development and access to educational information. Mobile phones are viewed as one of the new artifacts with the ability to perform various kinds of activities, particularly in Africa, where infrastructure is not highly developed (Traxler, 2009). In Ghana,

individuals' usage of mobile phones [3] for communication and other activities is on the increase. The high usage of the device serves as potential tool for accessing health information, either through healthcare personnel or family and friends by voice call or by short message service (SMS). Before exploring health-related activities that individuals use their phones to perform, I highlight other related activities that are performed with and on the device.

According to NGO News Africa [4] (2010), many Ghanaian residents, especially individuals with a high level of education, have shifted from reading newspapers and listening to radio news to accessing information on electronic devices such as computers, tablets, and mobile phones. Perhaps this is due to the fact that the devices have the capability of offering additional features such as audio and video animations, which may enhance understanding and be more engaging. Others use the devices to learn how to write and read basic sentences, browse websites, take and share camera and video pictures, and for recording audio voices (Kratzke & Cox, 2012). To increase productivity, effective learning, and access to relevant information, private companies, information technology (IT) analysts, non-governmental organizations (NGOs), as well as

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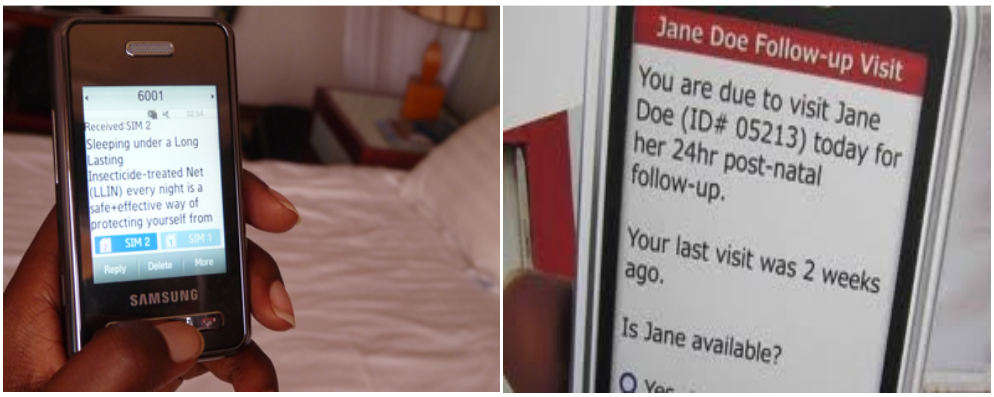
[3] Current use of the mobile phone in Africa is not without repercussions: In my view there are health-related issues to its usage as well as socio and economic issues. For instance, legend has it that people could suffer from brain tumours due to over usage of the device. In terms of economic and social issues, people spend a lot of money to purchase the devices, and to purchase plans and air time, using up funds that could otherwise be used to take care of their own and their family's basic needs. Other people are so addicted to the device that they are constantly engaged with it at the expense of interacting with their family and friends. The various features and promotional packages, increasingly innovated by mobile phone designers and companies appear to be motivated by the agenda to reap money from the users rather than to solve substantial users' problems. Despite the challenges with the use of the mobile phone, the device's advantage far outweighs its disadvantages when it comes to employing the device in the healthcare sector. For instance, patients who have the opportunity to teleconference with their medical practitioners do benefit from this opportunity. Also, pharmacists and medicine stores who employ mHealth to bring health information to consumers and also offer to them other therapeutic solutions that balance traditional treatments, do save consumers time and money.

[4] NGO News Africa is an independent non-profit news organization with Head Office in Accra, Ghana.

government organizations, are all involved in rolling out various mobile phone-based products, services, and applications. In banking, customers perform transactions on mobile phones, called *mBanking*; in health, individuals perform activities such as verification of drug authenticity; health organizations perform activities such as dissemination of information on malaria prevention to individuals with no literacy or low literacy rate (Fig. 6a); and healthcare personnel communicate among themselves concerning a patient's postnatal visitation (Fig. 6b) (Ramey, 2007; Smith, 2011). Multifaceted features that include voice and data transfer tools, GPS navigation, alarm clock, and the amazing healthcare apps that can be downloaded on the device (Greenspun & Coughlin, 2013) connect people to inquire about information, *wherever*, for *whatever,* and *whenever*, regardless of their level of literacy.



Figures 6a & b. A patient and a healthcare worker receiving health-related information on their mobile phones.
Source: theguardian.com

Some organizations have found innovative ways to integrate health education into economic activities to ensure that it is accessed. One such non-governmental organization is World Education (WE), with branches in most developing countries, such as Benin, Ghana, India, and Uganda. In 2008, the dire situation of illiteracy and poor health status

moved the WE to design a disease awareness and prevention program that suited boys and girls, and combined HIV prevention with agriculturally based, income-generating activities in some rural communities in the central part of Ghana. The program included supporting peer education for HIV/AIDS prevention; helping youth develop skills in agribusiness; and empowering youth to offer meaningful leadership opportunities in their communities. In addition, this organization has employed mobile phones in one of its health projects as an expansion to disseminate health information, with the aim to deliver easy and effective HIV/AIDS and reproductive health (RH) information, advice, and services to youths who lack access to such information in urban centres. Noteworthy is that the organization sent SMS and Internet messages through a created web link called *My M-info* to deliver information, advice, and referrals to 1000 students in Accra, the capital city of Ghana. The link promotes active discussion among youth on sensitive issues and other health information. According to Agyarko-Kwarteng (2011), there has been a huge increase in students' knowledge and literacy in health information. She states that most of the students now receive RH information and other health-related information on a weekly basis.

Organizations such as World Education have found innovative ways to utilize the mobile phone's multiple features, such as voice and data transfer tools, for obtaining health information in order to promote health education, especially among youth. Many other organizations have developed various activities to be carried out on mobile phones including access to health information. The ability of individuals and communities to access health information on their mobile phones can serve to improve their health. This

is fundamental, especially among individuals living in remote rural communities that have limited access to health facilities.

Chapter 2

2 Literature review

Literature relevant to this study is diverse. It includes literature related to perspectives about health and healthcare challenges, such as the importation of counterfeit medication, and limited healthcare facilities facing developing countries; literature on the importance of accessing and obtaining timely health care; and literature on various media for seeking and obtaining information about health. There is also literature on mobile phone usability in mHealth activities; literature on various health-related activities performed on and with mobile phones; literature on challenges to adopting the device for the promotion of health information; and how mobile phones have impacted mHealth and individuals' lives.

2.1 Health perspectives and healthcare challenges in developing countries

Numerous global health-related issues and illnesses such as non-communicable diseases (e.g., cardiovascular disease) (Shah, 2011), obesity (Caballero, 2007; Shah, 2010), tuberculosis (Corbett, Watt, Walker, Maher, Williams, Raviglione, & Dye, 2003), and HIV/AIDS (Igoumenidis & Zyga, 2011) confront many individuals across the globe, as well as in Africa. According to Lima, Granich, Phillips, Williams, and Montaner (2013), three major global public health threats are HIV/AIDS, tuberculosis, and malaria. In Africa, HIV/AIDS, malaria, and tuberculosis are considered to have the greatest impact on both human lives and resources. For instance, the Centre for Diseases and Control (2012) discerns that malaria is one of the most severe public health problems worldwide and leading cause of death in developing countries, specifically of young children and pregnant women. Additionally, maternal, adolescent, and child/infant

mortality, which are highly preventable situations, have baffled many individuals in Africa, along with several pandemic diseases that most individuals are facing, some of which are infectious and others chronic. In particular, the majority of people in Africa find it extremely difficult to access and evaluate health information regarding safe contraception, prescribed medication, and dieting practices (DeWalt et al., 2004; Lukenbill & Immroth, 2007).

2.1.1 **Counterfeit medications in developing countries**

According to Bryan (2006) and Igoumenidis and Zyga (2011), one of the major challenges facing healthcare service delivery in most developing countries is the importation of unauthentic medications into the country. Baratta, Germano, and Brusa (2012) put it more explicitly when they state that the problem of counterfeits has a greater impact in developing countries. Bryan (2006) indicates that the counterfeit market has proliferated and developed so much in its usage from so-called *lifestyle* medications to *lifesaving* medications. WHO (2006) lists some of these counterfeit medications to include over-the-counter pain medications, anti-malaria drugs, antibiotics, hormone replacement therapy, cancer medications, and anti-arthritis medications. Burns (2006) noted the recent figures estimate that a worldwide sale of counterfeit medications has reached at least US $3.5 billion in a year. Shakoor, Taylor, and Behrens (1997) comment that although counterfeit medications appear to be harmful to human lives, reports on their existence, and effects of poor-quality medications, are often subjective and lack scientific detail to allow objective evaluation of the problem.

With regards to issues of counterfeit medications, Ramey (2007) also adds that a lot of medications, specifically anti-malaria that are exported to Africa, may be

compromised. This is posing huge health problems that may result in loss of precious lives. In response, a system called *mPedigree* has been developed by a health agent in Ghana to send a code of the medication through an SMS, right from the pharmacy, to verify the drug's authenticity (see Fig.7a). This process is believed to close the health-information gap that exists among most Ghanaian consumers and consequently to reduce the mortality rate.

Figure 7. A patient sending a code to verify a drug's authenticity.
Source: Afronline.com

Swaminath (2008), WHO (2010), and Cockburn, Newton, Agyarko, Akunyili and White (2005) indicate that counterfeit medications are prevalent in all countries around the globe, and represent a major public health concern, often resulting in treatment failure, serious deterioration of health, or even death. Reggi (2007) states that in Africa, most individuals may realize the risk that they take in buying the medications, but they may not have any other place or option to purchase them, just as the hospitals that could not buy directly from the pharmaceutical companies. The issue of counterfeit medications is a concern, but it appears that most studies are only reporting about the challenge, instead of inquiring how to resolve this daunting situation faced by individuals in

developing countries. This is where conducting a study of such nature becomes crucial and timely. Patients are able to check the drug's authenticity when they buy them by sending the medication's code to the code-verification system at the pharmacy (Ramey, 2007). Sending the code assists pharmaceutical companies in analyzing components of the medications in order to obtain scientific details for proper diagnosis. Hay, Guerra, Tatem, Noor, and Snow (2004) estimate that one million people, usually children less than 5 years old, die every year from the reappearance of malaria due to counterfeit anti-malaria medications. Studies in regards to ways of checking counterfeit medication seem to be in order, but so far are limited.

Although, the use of mobile phones to check for counterfeits and verification of medication appears to be closing the health information gap between consumers and healthcare personnel, not much is happening in communities with limited access to healthcare facilities. In addition, despite the fact that most individuals are able to read and write, these skills alone may not suffice to address issues faced by most developing countries on importation of counterfeit medications and other health-related concerns (Ramey, 2007). Hence, there is the need to develop literacy that would help individuals to be aware of their health status and to be able to access relevant information.

This study is also relevant in the prevention of diseases and illnesses such as malaria and outbreaks of cholera. The issue, however, is that most African countries have weak systems of governance (Kaseje, 2006), as well as limited health resources. Consequently, these countries are hesitant to publicize problems with the quality of the medications supply or issue warnings relative to the scale of the problem in their

countries (Cockburn, et al., 2005). This makes the claim on counterfeit medications difficult to verify. Cockburn et al. have perhaps captured this worrying development well:

> Agyarko [CEO of the Food and Drugs Board, Ghana] found counterfeits of the GSK [GlaxoSmithKline] paediatric anti-malarial syrup halofantrine (Halfan) in August 2002 in Ghana. They added that that month Agyarko prepared a public health warning. Chryss (2004) added that Agyarko and his deputy informed the BBC that in addition to the public health warning Agyarko also alerted GSK's Ghana agent, who visited him with staff from GSK's London headquarters and took away samples of the fake Halfan. [According to Chryss], Agyarko publicly stated (on 23 September 2002, at the First Global Forum on Pharmaceutical Anti-counterfeiting in Geneva, Switzerland) that he was asked by GSK to withhold his public warning because it would 'damage' their product. After his meeting with GSK, no warning was issued. In a written statement (Email letter, 24 October 2003), GSK denied receiving Agyarko's fake Halfan alert and said the company was "not provided with any samples of fakes by the authorities in Ghana. [According to Chryss], after a year of enquiries, resulting in a BBC Radio programme (BBC Radio 4, 'File on 4, 5 October 2004), GSK reversed its position and said that its local agent had 'bumped into Agyarko and had received his alert and samples of fake Halfan syrup. In a new statement (Email letter, 5 October 2004) GSK said: 'At no point was any pressure put on the Ghanaian authorities not to issue a public warning on fake Halfan.' (pp. 0304–0305)

Given the challenges identified with respect to counterfeit medication, people would benefit from tools that would not only assist them to verify the authenticity of medications they purchase, but also allow them to make further inquiries in terms of the medication's dosage and related side effects before using the medications. Health challenges, such as counterfeit medications, confronting most individuals are being

addressed by sending codes on medications to pharmacists via SMS verification of their authenticity prior to administration.

Mobile phones, therefore, have great potential to bridge the health information gap between patients and healthcare personnel. The device has the capability of being employed by healthcare personnel to upload and store patients' health records, thereby improving effective healthcare delivery services.

2.1.2 **Promoting access to timely healthcare services**

According to Kaseje (2006), healthcare delivery services to patients are becoming very problematic, as current and re-emerging diseases seem to have resisted orthodox medical technology. Additionally, with the increasing development of drug resistance and counterfeit medicines, and above all, the fact that many patients wait at home until their situation becomes critical, before showing up for medical attention, is another health concern. Preventable and treatable diseases are taking a massive toll on the world's poorest people, and causing millions of people to die prematurely. WHO (2002) lists preventable and curable illnesses to include insect and waterborne diseases such as bilharzia; childhood diseases such as measles, tetanus, diphtheria, and acute respiratory infection; malnutrition; and tobacco-related diseases.

Shah (2011) observes that most people across the globe lose their lives from non-communicable diseases, such as cardiovascular disease and chronic lung diseases. WHO indicates that in Africa, infectious and parasitic diseases such as bilharzia and hookworm accounted for more than half of all deaths in 2001, compared with 2 percent of deaths in Europe. This is attributed to the fact that most developing countries are affected by the global poor–rich "health gap" (WHO, 2003), a factor that may hinder an individual's

access to relevant health information, such as nutrition and personal hygiene. Although the health gap is considered to be one of the factors attributed to obtaining relevant health-related information, studies I have reviewed so far seem to be limited in terms of addressing some of these gaps.

Igoumenidis and Zyga (2011) indicate that the lack of resources, such as pharmacovigilance system and weak infrastructures in developing countries, limit many researchers' capability of conducting their own clinical research into some of these challenges. Baratta et al. (2012) state that even though these medications appear to be one of the most challenging health issues in developing countries where there is absence of control and sufficient pharmacovigilance[5] (drug safety) systems, enlightening and monitoring the phenomenon and its effects among the population becomes difficult. Ghana News Agency (GNA) (2012) adds that, especially in northern Ghana, where there are rampant outbreaks of cerebrospinal meningitis (CSM), a pharmacovigilance system would be a useful tool to monitor adverse events after individuals have taken the CSM immunization.

2.2 Media/systems for seeking and accessing health information

Currently, health literacy is considered to be a promoting factor in seeking and utilizing information (Shieh, Mays, McDaniel & Yu, 2009). According to Levetown (2008), the need for patients and their families to search and receive detailed information beyond what is usually provided in the outpatient setting has become very pressing in today's society. Health information seeking behaviours (HISB) among patients and non-patients in health care have increased exponentially in the last decade, partly due to

[5] Pharmacovigilance (PV) is defined as the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other drug-related problem.

current increases in diseases and health-related issues (Lustria, Smith, & Hinnant, 2011). Besides, the HIV/AIDS pandemic, together with the human resource crisis, brings a desperate need for evolution in healthcare systems, both by healthcare personnel and patients (Braa, Hanseth, Heywood, Mohammed, & Shaw, 2007). Additionally, more individuals are seeking information as a key coping strategy in health and psychosocial adjustment to illness (Lambert & Loiselle, 2007; Sanders Thompson, Talley, Caito, & Kreuter, 2009).

This section discusses health information-seeking behaviours among individuals, followed by ways or systems for obtaining and receiving information related to health. It also examines how information that individuals provide about their health contributes data for both research and healthcare delivery. The section also reviews literature on factors that may influence health information-seeking behaviours.

Consistent with Anderson-Lewis, Kohler, and Green (2003), HISB involves the act of gathering information to shed light on or confirm knowledge about a particular topic. To Griffin, Dunwoody, and Neuwirth (1999), HISB represent an individual's premeditated active efforts to search and obtain specific information above and beyond the regular outlines of media coverage and use of interpersonal sources. Interpersonal sources, as stated by Dutta-Bergman (2005) and Niederdeppe, Hornik, Kelly, Frosch, Romantan, Stevens et al. (2007) include any interpersonal conversation or non-formal information inquiry about a specific health topic and behaviours. These health topics and behaviours may involve observing special programs about health-related treatment; using a search engine such as the Internet, mobile phones, family, and friends to find information about a particular health issue; and asking questions about specific health-

related issues. In this study, HISB is defined as an individual's conscious effort and attempt to access, seek, and obtain information from various sources in response to personal or family health needs, or simply to broaden one's knowledge.

According to Anker, Reinhart, and Feeley (2011), HISB is more than simply a commitment to search for information. It involves several attributes and factors such as: a medium that, drawing from Activity Theory, I call in this thesis *system*, through which the information is being searched (for example, consulting physicians; searching the Internet; inquiring from families, friends, and colleagues); (b) the trustworthiness of the information; (c) the kind of environment in which to search for the information; (d) the context in which the information is being searched; (e) characteristics of the person looking for the information; and, (f) the duration needed to obtain information. Gray, Kleinb, Noyce, Sesselberg, and Cantrill (2005) add that a person may seek, or passively immerse himself or herself in health information, depending on an individual's situation and demography. In the same way, the information may be obtained from several means or sources, and under various circumstances. Gray et al. broadly categorize these sources under two main headings: (a) health information from professionals or from lay sources (Gore & Madhavan, 1993); and (b) from personal or impersonal sources (Elliott-Binns, 1986). Personal information sources, which may be termed as a *two-way communication*, include obtaining health information from family, friends, and colleagues from work, community organizations, and health professionals (Cutilli, 2010; Ford & Kaphingst, 2009; Redmond, Baer, Clark, Lipsitz, and Hicks, 2010), whereas lay or professional sources, which are termed a *one-way communication*, include print media (books, health brochures, magazines, pamphlets), television, and the Internet (Benigeri, 2003; Sanders

Thompson et al., 2009). Print media such as posters, textbooks, and magazines can also be termed as non-technological/non-electronic media (Cutilli, 2010). Given numerous information sources about health, low health literacy still remains high, and that has retarded healthy health status.

As noted by Kroeger (1983), information-seeking behaviour (ISB) may be determined by several factors such as gender, physical, socio-economic, cultural and political. To Lorence, Park, and Fox (2006), these determinants of ISB may be associated with a broad variety of factors such as: (i) socio-demographic factors and poor socio-economic status; (ii) lack of physical accessibility; (iii) level of education; (iv) cultural beliefs and practices; (v) gender discrimination; and (vi) the healthcare system itself. Young (2001) states that when it comes to health ISB in a specific individual, education, level of income, and other socio-economic factors play a significant role. In line with these factors, Young, Deering, and Harris (1996) observed that individuals with lower socio-economic status are three times more unlikely to seek information relating to their health when they have any health concern, and at the same time, have the highest barriers in accessing health information.

Generally, as Shieh et al. (2009) have observed that findings from previous studies imply that the influence of low health literacy on health outcomes may begin with individual not seeking further information on his or her health status. Ishikawa and Yano's (2008) finding is not different from that of Shieh et al. when it comes to personal information sources. According to Ishikawa and Yano, a majority of individuals who employ personal information sources, such as health professionals, seem not to comprehend the information adequately. This could be due to lack of or limited health

education in the context of terms used in the medical settings (Shieh, Belcher, & Habemann, 2013). Further, certain information may be in the medical language, and that makes it difficult to understand from a layperson's perspective, both with or without basic literacy and that has become a significant concern.

A systematic review conducted by Ishikawa and Yano reveals that most individuals only use their physicians as a medium for information, without consulting other media as information supplements. Similarly, Koo, Krass, and Aslani (2006) add that adult patients with low health literacy, who are suffering from rheumatic pain or other health-related illnesses, show no interest in seeking written information on medicine. When it comes to seeking information about health from either professional or personal sources, Kutner, Greenberg, and Paulsen (2006) and Dutta-Bergman (2004b) note that individuals who tend to employ television, radio, healthcare professionals, and family as sources are those with a basic or low health literacy level, whereas individuals with a higher level of health literacy seek health information from print sources (e.g., books, magazines, newspapers, and health brochures).

Non-print sources here involve information technologies such as mobile phones, tablets, computers, and Internet, according to Prensky (2004), features such as audio/video calling, taking pictures, and streaming television have made communication and accessing information much easier and more affordable. Similarly, Benigeri and Pluye (2003) express that in health, Internet and mobile phones are considered major changes in the dissemination of healthcare services and medical information, with a promise of transferring knowledge and information from health professionals to the general public and vice versa. Cline and Haynes (2001) mention three main ways that

individuals may employ the Internet to access online health information to: (i) searching for health information; (ii) participating in health support groups; and (iii) interacting with health professionals. Adding to Internet usage, Dutta-Bergman (2004) discloses that usually, individuals who employ this medium are more likely to be health conscious and engage in many health related-activities and practices. These practices may involve, consuming a balanced diet, engaging in regular exercise, and going for regular check-ups, compared with individuals who do not search the Internet.

Sanders Thompson et al. (2012), however, argue that looking for health information sometimes becomes a challenge and is unattractive when access to the information does not directly address one's health issues.

With reference to technological usage, Cutilli (2010) states that employing the Internet and other non-electronic written material may be influenced by several factors, such as an individual's age, level of education, health literacy, and health status. Anker et al. (2011) add that individuals who are more likely to employ the Internet to search for health information include females (Drentea, Goldner, & Cotton, 2008; Underhill & McKeown, 2008), individuals with higher levels of education (Flynn, Smith, & Freese, 2006; Cotten & Gupta, 2004), and individuals with higher income. Other differences in the Internet usage for seeking health information may include age and level of health literacy (Bright, Fleisher, Thomsen, Morra, Marcus, & Gehring, 2005).

In terms of gender and preference to information source, Health Information National Trends Survey (HINTS) Briefs (2005) note that when the Internet is considered as an information source, women are less likely than men to use it in seeking information about health. For instance, seeking information about illness such as diabetes and family

planning, women prefer to use healthcare providers, health brochures, and books, whereas men appear to use the Internet. Cohen and Adams (2011) and Fox (2011), on the other hand, argue that women are more likely to seek health information on the Internet compared to men. Denner (2000) adds that when men decide to seek information, they do so indirectly from either their friends or partners/spouses, and sometimes from healthcare providers.

Besides usage of the Internet as a source of health information to be based on gender, HINTS (2005) also note Internet usage to be influenced by age. According to HINTS, young adults tend to use the Internet for most of their health information needs, whereas older adults prefer using healthcare providers or books as their sources of health information. Pakenham-Walsh and Bukachi (2009) on the other hand, state that though there has been an increasing percentage of individuals who employ the Internet to search for health information, the majority still preferred to use medical personnel such as doctors, pharmacists, and nurses as their main sources of information. Others prefer to seek information from members of their social network (Gollop, 1997). According to Matthews, Sellergren, Manfredi, and Williams (2002), most individuals do not seek health information or medical help because they have the belief that discussing serious issues related to health and disease would be troublesome to their family members and friends.

According to Tudiver and Talbot (1999), when it comes to seeking health information in general, most men would not like to seek the information on their own. Tudiver and Talbot explain men's reluctant behaviour in seeking health information to include lack of time, poor access opportunities, and the lack of a male care provider. In

2009, Thompson conducted a study on African-American men's perceptions of factors influencing health information seeking and found that although Black men find healthcare providers to be a valuable source of health-related information, they are less likely than Black women to seek health information from either family members or medical personnel. Courtenay (2003) states that men who do not seek medical help limit chances for health promotion interaction, which could result in poor health care. Thompson et al. (2009) observe that with the practice of not seeking health-related information, Black men tend to have a shorter life expectancy than women. Regarding short life expectancy, Norcross, Ramirez, and Palinkas (1996) affirm that women, especially married women, need to *push* their men to seek medical assistance, since they cannot afford to lose their husbands.

There are several means and systems for accessing health information. Systems such as hospitals, the Internet, and television may be employed to obtain health information, depending on the information needed, and the accessibility. Some individuals may prefer obtaining information from a particular channel or system based on, say, their level of education, interest, and health needs. Also, most educated individuals may opt for hospitals and the Internet as their source of health information, whereas most individuals with a low level of education may rely on family members and native doctors for such information (Matthews et al., 2002). Written information is more popular among the educated. Further, ISB, irrespective of the tool being used, varies with several factors, including education and gender. Evidently, several media and systems for seeking and accessing health exist. When it comes to gender and HISB by employing mobile phone, men and women may access it by either personal or impersonal ways,

depending on the source. The information might also be one-way or two-way communication. Further, features of mobile phones facilitate communication of and access to health information.

2.3 Health-related activities on mobile phones

Digital technological devices, particularly mobile phones, have become a huge ICT success for human–human communication, through voice call, text messages, and visual images, across developing countries (Greenspun and Coughlin, 2013; Sherwani, Tongia, Rosenfeld, & Ali, 2006). Sherwani et al. observe that not only are the devices increasing in usage, but they are also relatively affordable, and suitable for non-literate populations. The device has created entirely new sets of spatial, cultural, and social relations in many sectors (Dyson, 2009). In health, *mobile health* (mHealth) ingenuities reveal the potential of employing a mobile phone and its features to perform a series of activities in health. For instance, health information in the form of text messaging, and a pre-recorded voice messaging, aid the rapid conveying of information such as reminders to take medication, next maternal and antenatal appointments, and first-aid information (Mechael, 2009; Ofosu, 2010).

Mechael (2009) defines mHealth as the use of mobile technologies to improve the way health professionals deliver health-connected services to the general public and enhance an individual's access to healthcare services. According to WHO (2011), the term mHealth is defined by the Global Observatory for eHealth (GOe) as "medical and public health practices supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices" (p. 6).

This section discusses various means of employing mobile phones to perform health-associated activities.

Mechael, Batavia, Kaonga, Searle, Kwan, et al. (2010) admit that the use of mobile phones to perform activities related to health is transforming many lives across the world in general and, specifically, many low-income communities. Mechael (2009) and Greenspun and Coughlin (2013) express that the ubiquity of mobile phones and allied technologies, as well as their related features, harness the ability to communicate and transfer information, specifically health information, within both "literate" and "illiterate" populations. These communication activities range from organizing emergency support to scheduling a doctor's appointment, to remotely monitoring diabetes and other chronic conditions that may not need intense care from physicians, especially in developing countries. mHealth Ethiopia Report (2011) adds that medical and health practices also perform activities ranging from the use of simple mobile phone-based applications to transfer of health information on mobile phone via SMS, to highly sophisticated diagnostic applications that rely on advanced equipment and robust back-end data systems. This process tends to reduce health challenges confronting many individuals, such as cost of transportation to obtain health information and shortages in medications (WHO, 2011). mHealth Ethiopia (2011) adds, for example, that the service of using mobile phones to communicate with healthcare personnel and other healthcare delivery agencies has the potential to greatly address health and other associated issues faced by most individuals, and improve the efficiency of communication between patient and healthcare workers, thereby reducing life-threatening delays in the delivery of care and extending the reach of the health system to underserved communities.

According to WHO (2011), use of Mobile Doctors Network (MDNet), where medical personnel are able to communicate with each other in relation to managing a patient's health, has improved healthcare services, thereby reducing the number of patient deaths. WHO adds that implementation of MDNet facilitates the referral of patients to higher levels of care, especially in the rural communities. In addition, healthcare workers record information or convey bio-monitoring data from an individual to data storehouses or to their healthcare provider (Bezold et al., 2006). Chetley (2006) and Moore and Bloch (2009) explained that with health activities such as remote diagnosis and treatment, telemedicine could involve patients and health personnel, especially in hard-to-reach locations. mHealth Ethiopia (2011) and Bezold et al. add that, while mobile phones by themselves may not reduce health disparities and related illnesses, the devices and mHealth services offer better management of disease by patients and their doctors.

As said by Gerber, Stolley, Thompson, Sharp, and Fitzgibbon (2009), currently, mHealth applications and related activities being performed at both individual and healthcare levels serve as a way of improving health service delivery and access to health information in most communities. These applications, according to Vital Wave Consulting (2009), could be either curative or preventive measures of health and diseases. When needed, medical health practitioners are able to access patient records, laboratory results, and provide remote diagnosis and referral, without being physically present with patients. In the same way, most parents would call the hospital to find out whether a doctor is available to treat their children before commuting for several kilometers (Kalil, 2010). Other health activities in Africa include obtaining up-to-date lists of drugs, and information on a disease, with the help of Java-enabled mobile phones (Ofosu, 2009). In

addition, Vodafone's (a mobile phone service provider) (2006) research study on mobile phone usage ascertained that features on the devices can be employed by young people to access confidential health-related information.

Selanikio (2002) notes that in medicine, medical professionals have installed software called *EpiSurveyor* on mobile phones to gather information about individuals and disease outbreaks in a community-based clinic. Anta, El-Wahab, and Giuffrida (2009) add that the device may also be employed to: (i) collect field data; (ii) alert doctors about any health emergencies; (iii) serve as a public health information gateway from patients to doctors and vice versa; (iv) send email reminders for checking blood pressure at home to patients with diabetes (Masucci, 2006); (v) access patient records and raising health awareness through dissemination of health tips by SMS: (vi) provide health information on patients; and (vii) generally, facilitate public discourse. Lu, Xiao, Sears, and Jacko (2005) observe that these activities are mainly performed by medical personnel.

In connection with mHealth, WHO (2011) reveals that a global eHealth survey conducted in 112 member states, including Africa, aimed to explore: (a) the existence and maturity of mHealth activities within member states; (b) types of mHealth initiatives being conducted; (c) status of monitoring and evaluation of mHealth initiatives; and (d) barriers to its implementation. The survey indicated that most mHealth initiatives performed by individuals include calling health centres, calling emergency toll-free telephone services, and calling for help during emergencies. However, there were fewer initiatives/activities on awareness raising, downloading health information onto the mobile device, and decision support systems.

WHO noted that although such activities tend to improve healthcare service delivery, the results differ from the reports in the literature that support the use of mobile devices for data collection and disease surveillance. Further, results from the survey, according to WHO, indicate that mHealth activities such as emergency toll-free telephone services and creating health awareness are performed less in Africa. The low practice may be due to insufficient infrastructure to respond efficiently and promptly to emergency health calls. In addition, Cotten and Gupta (2004), Kreps (2005), and Kukafka et al. (2003) supplement that despite the increase in the device's adoption, with its fanciful features and applications across the globe, in health, such patronage seems slow in Africa, particularly in those most vulnerable and geographically hard-to-reach locations.

Mechael (2009) notes that with the demand on medical practitioners in developing communities, mHealth is considered to be a gateway to balance doctors and healthcare workers' responsibilities through *telemedicine* and *teleconsultation*. In congruence, Chetley (2006), Moore and Bloch (2009) express that for health activities such as remote diagnosis and treatment, telemedicine could involve patients and health personnel, especially in hard-to-reach locations. This form of health service is a way of building equivalence between health services delivered using in-person methods and health services delivered using *telehealth* methods (Glassman & Helgeson, 2012). In addition, *telemedicine* and *teleconsultation* allow patients to change the time, location, mode of receiving health care, and above all, communication gaps between clients and healthcare workers may be bridged. Delivery of health care, using these digital communication technologies, according to Centers for Medicare and Medicaid Services

(2012), is perceived by both individuals and by government as a cost-effective alternative to the more traditional face-to-face way of providing medical care. Thus, the service has the ability to provide earlier diagnostic and preventive services. It also saves transportation and other associated costs. As a result, most countries have created health call centres, known as *health hotline,* to respond to patients' inquiries, providing medical advice and information over the telephone to individuals, in the form of voice calls (West, 2012). To make the process and service more effective and reliable to patients, according to Moore and Bloch (2009), software with built-in protocols are built to guide call agents through a series of questions to respond to clients' common illnesses and diseases.

Moreover, primary healthcare workers utilize mobile phones to seek advice from healthcare experts in order to refer patients to the appropriate specialists when needed. According to Moore and Bloch (2006), when healthcare personnel at the triage are provided with the right information, they are able to make informed decisions and diagnoses about patients' and provide patients with a better understanding of their conditions. In addition to audio and verbal communications between patients and healthcare workers, other applications of telehealth, according to Centers for Medicare and Medicaid Services, include videoconferencing between a patient and healthcare provider for consultation. Other activities comprise transmission of data, such as X-rays, photographs, remote monitoring of vital signs, video captions of patients and other health indicators to health practitioners for disease management. A study conducted by Lazev, Vidrine, Arduino, and Gritz (2004) to explore the possibility of using cellular telephones to improve access to smoking cessation counselling in a low-income and HIV-positive

population revealed positive results. Thus, the use of the device in these locations provided for prompt treatment of illness, flexibility and convenience, confidentiality, and the ability to provide counselling in real-time situations.

In addition to impact and benefits of using mobile phones, the device has recently become a web-accessing tool, and is used for other educational and business activities such as literacy (Attewell, 2005) and banking (Herzberg, 2003). Presnky (2004), an expert in digital technology, notes that features such as text messaging on mobile phones can be used in education to facilitate the learning process. Ofosu (2010) adds that the mobile phone is not only benefitting education, but also health, especially mHealth (Awoonor-Williams et al., 2013; WHO, 2006). For instance, Ogilvie (2010) notes that in the Toronto public health sector mobile phones are used to create awareness among youth about sexually transmitted diseases. Andreatta, Debpuur, Danquah, and Perosky (2011) nonetheless state that in health, studies on the device's usage mostly focus on medical practitioners employing the device to collect data from patients, with less emphasis on how individuals themselves may use the device to promote their health by seeking, evaluating, and utilizing health information.

Although there is no doubt that there is a significant growth in technological devices in healthcare delivery, Glassman and Helgeson (2012) argue that in general, spreading of mHealth as a mode of healthcare delivery appears to be slower than expected, given the high spread of mobile phones. The slowness is a result of multiple barriers discovered by telehealth report to its wider exploitation. This involves confusing definitions of telehealth, uncertainty of payment for services, challenge of integrating technology among providers, lack of training resources, and privacy and protection of

patient information (Burke & Weill, 2013). Similarly, the United Nations (2008) states that, the challenge with slow spread of the service lies with the tools' availability in most developing countries. In that sense, tools to gather reliable data in order to make a diagnostic decision on a patient's health are either too expensive to purchase, unsupportable, or inaccessible to train healthcare workers to provide the necessary care to patients (Pakenham-Walsh & Bukachi, 2009).

Further, mHealth services and mobile phones are not utilized by the majority of patients and other individuals due to limited education on how the service operates (Masucci, 2006). The low patronage may also be attributed to the fact that less attention has been paid to how the devices may be employed by individuals to obtain independent health information. Hence, to realize the device's potentials, and maximize its opportunities to promote equitable access to health information and other health-related activities, it is imperative for individuals to be educated on the device's usage, as well as potential outcomes of the services.

With all these controversies with regard to low patronage of the device for health-related activities, Mechael (2009) argues that people use the device for health-related activities casually, and that makes it hard to recognize and determine its benefits. Stilwell (2001) notes low adoption of health-information technology in the health sector as another issue confronting effective healthcare delivery, especially in rural areas. A report from Daar, Thorsteinsdóttir, Martin, Smith, Nast, and Singer (2002) indicates that many diagnostic techniques, such as laboratory tests for infectious agents, and imaging techniques—radiology and ultrasound examination—currently in use in developing countries, are burdensome and unsuitable for use in low-resource settings. This is due to

low financial margins to support diagnostic techniques or lack of funds to purchase, maintain, and upgrade the diagnostic equipment (Sheps, 2006). The Institute for Alternative Futures (as cited in NORC at the University of Chicago, 2010) summarizes that:

> The use of mobile/smart phone applications to transmit health-related information, monitor disease, and directly communicate with providers is viewed as a potentially beneficial mechanism for improving the quality of health and management of chronic disease. Similar to health kiosks, mobile phone health applications are viewed as potentially effective for reaching low-income minority populations who are more likely to have access to mobile phones than to the Internet (p. 36).

Diseases and illnesses such as diabetes may be monitored remotely by the use of mobile phone to communicate between patients and healthcare personnel (see Fig. 7b).

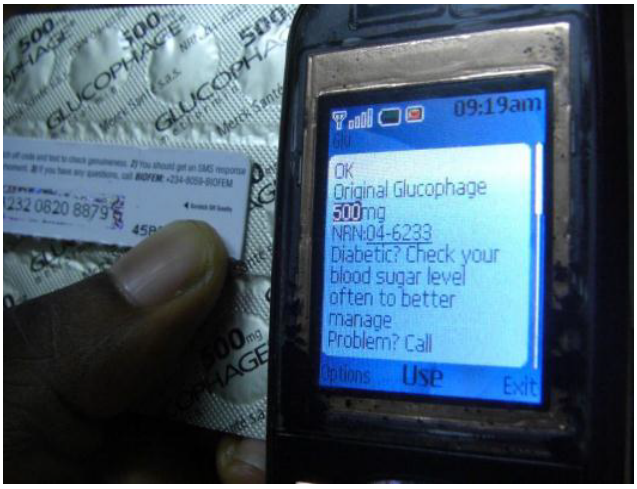


Figure 8. A patient performing health-related activities on a mobile phone. Source: Afronline.com

Greenspun and Coughlin (2013) conclude that extensive use of technological devices has made access to health care and information more personalized for individuals, and service has created prospects to transform the industry of healthcare delivery and individuals' personal care.

This section of the chapter reviewed literature of various mHealth activities performed with the mobile phone. Although this literature is informative and timely, not much focus was placed on how the device could assist in promoting health literacy in general and also allow individuals living in remote and cultural domineering environment to obtain access to health information. Most individuals in such communities have limited access to relevant health information and lack the ability to promote their health status due to low level of health literacy. Studies reveal that individuals can become health literate by reading, listening, analyzing the information, and being able to apply the obtained information in a skillful manner. This is where I find this study of mobile phones very timely and beneficial in communities where healthcare delivery and services are limited, and obtaining health information is mainly influenced by demography.

2.4 Barriers to the use of mobile phones in mHealth implementation

According to NORC at the University of Chicago (2010), there has been a substantial amount of documentation regarding general barriers to adoption and implementation of health information technology. Additionally, access to modern communication technologies and medical assistance is a challenge for the majority of people living in developing countries, especially in rural communities (Clifford et al., 2008).

In this section, I review literature on challenges for individuals in adopting a mobile phone device to perform health-related activities.

Prior to examining these factors in their respective categories, I highlight some of the general challenges to mobile phone implementations in mHealth.

Haddon and Vincent (2007) note the cost of phone service as the biggest challenge for individuals, especially among youth, to employ the device for any form of activities. There are several daunting challenges with regard to the use of mobile phones in health-related activities. According to Mechael (2006), in Egypt, these factors include: (a) cost; (b) perceptions of risk; (c) reliability of telephone systems in health facilities; (d) safety, liability, and cost recovery for unknown contacts as well as information and services provided at a distance; (e) lack of understanding and use of a range of functions available through mobile phones; and (f) poor quality of health services. A systematic literature review conducted by Déglise, Suggs, and Odermatt (2012) on the use of the SMS feature for disease prevention in developing countries such as India, Kenya, and South Africa, identified primary barriers to include language, timing of messages, mobile network fluctuations, lack of financial incentives, and data privacy. These deep-rooted factors and the daunting challenges involved in employing the device to perform health-related activities are frequently noted by individuals living in the rural areas (Odutola, 2003).

In addition to the above challenges, other controlling factors include a person's age, gender, level of education, individual innovativeness (National Research Council, 2011), the community's cultural practices (van Biljon & Kotzé, 2008), and the nature of information content sought (Chetley, Davies, Trude, McConnell, Ramirez, Shields, et al.,

2006). These factors, according to van Biljon and Kotzé, are termed as *social constructs*. Rashotte (2006) defines a social construct as a "change in an individual's thoughts, feelings, attitudes, or behaviours that results from interaction with another individual or a group" (p. 1). On the other hand, the influence includes: (i) an individual's cultural practices and interests, such as beliefs about using mobile phones to obtain relevant information about health as a way of promoting a healthy lifestyle (Gerber et al., 2009; Green & Potvin, 2002; Nutbeam, 2000); (ii) an individual's demographic information and the type of health information to access on the mobile phone; (iii) an individual's security and privacy of information.

In general, mobile phone usage, according to van Biljon and Kotzé (2008), involves "the mobile phone, the telecommunications system, the mobile phone users, the adoption, and the use of the system" (p. 1). Kalil (2010) observes that the mobile phone, akin to any new technology, has costs and risks as well as benefits, yet many of these benefits would certainly fail to happen due to several factors. This notion of underlying challenges with the device's usage in mHealth is an aspect of this inquiry in this study. According to the National Research Council (2011) and to Ouma, Herselman, and VanGrauen (2011), several factors combine to influence the delivery of m-Health services within communities in particular. In most cases, these elements do not operate in isolation; rather, a combination of two or more, many of which are uncontrolled elements such as demographic, environmental, and socio-economic status. The challenges/factors are categorized under three main clusters:

(1) Socio-economic and demographic factors including: (a) age; (b) level of education; and (c) income

(2) Technological features and service impacts including: (a) affordability of mobile devices and service; (b) mobile network systems; (c) the device's screen size; and (d) availability of information

(3) Cultural beliefs and practices about health including: (a) individuals' beliefs about health care in general; and (b) beliefs about access to health information

2.4.1 **Socio-economic impacts on mHealth activities**

Socioeconomic factors, according to Kwon and Chidambaram (2000), are a major mediating factor that may have influence on the mobile phone's adoption for various activities including health. Cline and Haynes (2001) sum these variations of access to health information on the basis of socio-economic factors and name this factor the *digital divide.* Socio-economic status affecting device usage includes variables akin to an individual's job status, level of education, and income of most people in the rural communities. In addition, Ojo (2006) states that a high level of illiteracy, poverty, and absence of basic infrastructure prevents most people from adopting the device.

2.4.2 **Technological features and services on mHealth activities**

It is believed that for individuals to feel comfortable in using mobile phones to perform any form of activity, certain factors such as affordability, suitability, and dependability of the device should be in place (Gerber et al., 2009; Rashid & Elder, 2009; van Biljon & Kotzé, 2008). Satellife (2005) identifies connectivity, content, and capacity as major factors to the adoption of mobile devices. This subsection examines some technological factors that limit the usage of mobile phones for seeking and receiving health information.

According to Ghyasi and Kushchu (2004), some of the reasons for low use of mobile devices, especially in Ghana, to access health information include poor technology infrastructure and low level of income of most people in the rural communities. Frempong, Essegbey, and Tetteh (2007) add that the initial costs for obtaining the device as well as ongoing service costs in terms of purchasing mobile phone credits influence an individual's usage. Mechael (2006) agrees that the initial start-up cost situates the device into the hands of a large number of individuals. When it comes to employing the device for health information and emergency-related benefits, however, household individuals could share their mobile phones with others.

One major barrier to the device's implementation is a reliable network system to access health information and transmit data from health personnel to patients and vice versa (Biljon & Kotzé, 2008; Jeng, Chen, Yin, Yang, Tsai, & Yeh, 2004). The network is perceived to be about how useful and easy the device is to an individual in terms of its features and reliability (Biljon & Kotzé, 2008). For Chetley et al. (2006), the problem with connectivity involves access to electricity, solar power options, and network connectivity. Similarly, Ashraf, Gine, and Karlan (2005) observe that sometimes, an unreliable phone network makes it difficult to maintain or use the device, especially in rural and other medically underserved communities. Idowu, Cornford, and Bastin (2008) assert that most traditionally hard-to-reach individuals are without an electrical power supply. Hence, it becomes hard to maintain the device.

Another technological barrier to the employment of mobile phones in mHealth is the screen size (DeHart & Heckerman, 2008; Jeng et al., 2004). The small screen and keypad pose challenges to most users, especially when medical personnel are entering

voluminous data, such as a daily summary of patients who may need medical care, or a patient's diagnosis, onto the phone (DeHart & Heckerman, 2008). Above all, Sarasohn-Kahn (2010) expresses that most mobile health applications on the device are mostly designed for use by hospitals and physicians.

Besides technological barriers, the availability of the information itself and set-up of the information to be accessed pose another major challenge. Thus, an individual's tendency to discover knowledge and information, and adopt the information based on needs and interests may largely depend on availability and accessibility of the information. For example, an individual's ability to appreciate the usefulness of a mobile phone as a tool for disseminating and accessing information will be based on how reliable and easy he or she may locate and apply the information to his or her needs. Gyasi and Kushchu (2004) decry the fact that despite the high coverage of mobile phones, many are not adopting the device much for developmental purposes, especially in rural communities. This low interest is as a result of the lack of unreliable databases or centres where such health information may be accessed.

Moreover, when the contents of the information seem not to gear toward an individual's/community's needs, introduction and successful application of ICTs including mobile phones in the health sector, may be impeded (Chetley et al., 2006). They further add that appropriate language is frequently neglected in ICT programs and little or no content is available in local languages. This makes it difficult for people to get involved in such programs, especially in areas where low level of literacy seems to be high.

Meanwhile, the enactment of technological devices in healthcare delivery in developing countries, specifically rural communities in sub-Saharan Africa, of Ghana, are no exception, has been hampered by several factors. Bukachi and Pakenham-Walsh (2007) describe these factors as traditional obstacles. These include lack of resources, such as poor infrastructure and road network, and insufficient political commitment to and support for information accessed on the Web for health purposes. Malhotra and Galletta (1999) add another influencing factor known as individuals' *attitudes* toward technological usage. In other words, employing a mobile phone to execute an activity may largely depend on personal preference and the importance of that activity to an individual. Parveen and Sulaiman (2008) note that adopting mobile phones to perform any form of activity, be it in a health or non-health capacity, may depend on the individual's acceptance of the devices as explorative and learning tools.

Chetley (2006) and Satellife (2005) explain acceptance to involve the type of activity or information that the device is capable of performing or accessing. For example, it is perceived that individuals stand a chance of using mobile phones to inquire about information pertaining to their health and other related information from healthcare centres, without necessarily travelling to the centre (Smith, 2011). Cockcroft, Sandhu, and Norris (2009) and Ojo (2006) observe that, in addition to an individual's beliefs and interests, mobile phone adoption to access health information or perform any health-related activity becomes more beneficial when an individual's cultural values and aspirations are considered.

Sometimes, an individual's preferences and beliefs about the benefit of the device, including relative advantage, needs, image, and trust, may allow him or her to

employ the device to improve health literacy (Friction & Davies, 2008; van Biljon & Kotzé, 2008). This is clearly experienced in communities where cultural beliefs influence access to health care and health information, especially among women living in the rural communities (Kyomuhendo, 2003).

The use of a mobile phone for health-related activities is influenced by several factors. Certain factors, including technological features, socio-economic and cultural practices may hinder use of the device to perform health activities. Technological factors which hinder these activities include poor technology infrastructure, small screen size of the device, unreliable networks by service providers, and the limited availability of a power supply to regularly charge the device. mHealth application designed for use by the public and that takes into consideration potential barriers would facilitate use for health activities.

2.4.3 **Cultural practices, beliefs, and mHealth**

As observed by Satcher (2010), most times, circumstances in which people are born, grow up, and live, as well as the kind of healthcare service delivery available to them, influence their readiness to employ a device such as a mobile phone for attending to health-related activities. Silverstone and Haddon (1996) indicate that such settings are typically influenced by factors such as cultural beliefs, social policies, and insufficient political commitment to and support of healthcare systems, especially in societies where nearly everything is controlled by political and traditional practices. According to Vaughn, Jacquez, and Baker (2009), “cultural issues have increasingly become incorporated into medical care as there has been greater recognition of the intimate tie between cultural beliefs and health beliefs” (p. 69). Vaughn et al. add that these related

issues from culture have influenced most individuals' perceptions of good and bad health and the causes of illness.

The impact of cultural beliefs and probably lack of medical personnel has caused most individuals to rely heavily on self-treatment or medication, on consulting traditional healers, or both (Young, 2001). According to Young, not only are traditional healers and lay practitioners accessible and affordable, they are trusted members of the community who possess the ability to provide an explanation to illness and prescribe treatment in a cultural context. Helman (2007) indicates that culture and traditional beliefs play a very significant role when it comes to health and health information-seeking behaviours. He further states that the practice may be greatly observed among individuals living in a non-Western world. Thus, in populations where different cultural groups have diverse belief systems with regard to health in general, healing and access to health-related information may be achieved through the use of traditional and indigenous healthcare practices and approaches. DiMatteo, Haskard, and Williams (2007) suggest that making health care and treatment of illness effective may involve approaches that would allow medical personnel to effectively understand, assess, and manage a patient's health by embracing the individual's language, culture, ethnicity, and social class into the treatment.

Moreover, Vaughn, Farrah, and Baker (2009) contend that people of diverse cultural backgrounds often make different attributions of illness, health, disease, symptoms, and treatment. Similarly, Ghana, just like many Africa countries, is culturally diverse, and for that matter, the perceived attributions may only be said to be widespread. Also, Helman (2007) notes that most individuals attribute causes of illness to several factors. These factors, according to Helman, include: (a) factors within individuals

themselves (e.g., bad habits or negative emotional states); (b) factors within the natural environment (e.g., pollution and germs); (c) factors associated with others or the social world (e.g., interpersonal stress, medical facilities, and actions of others); and (d) supernatural factors including God, destiny, and indigenous beliefs such as witchcraft, sorcery, or voodoo. Global north residents tend to attribute the cause of illness to the individual or the natural world, whereas individuals from non-industrialized nations are more likely to explain illness as a result of social and supernatural causes. In congruence to Helman's, Chipfakacha (1994) adds that most Africans attribute illness to superstitious causes and therefore believe that disease is due to: (i) magic and evil spirits; and (ii) psychological phenomena.

A study conducted by Landrine and Klonoff in 1993 to compare causal attributions of illness found that supernatural beliefs are more important to African Americans, Latinos, and Pacific Islanders than White Americans. According to Landrine and Klonoff (1994), the study also reveals that African participants are more likely to attribute illness to "evil others," but all of the groups rated interpersonal stress as a potential source of illness. This is reflective of the reason most individuals do not seek medical help when they are sick. Landrine and Klonoff note that although there are several methodologies and approaches to change an individual's perceptions about causal attribution to illness, these ethnic minority groups still hold onto their cultural and supernatural beliefs. Madge (1998) compares Western populations with non-Western populations like Africa and found that patients in most African countries may be more likely to attribute illness to a spiritual or social cause, rather than a physiological or scientific cause. Thus, African patients are more likely to expect health practitioners to

provide an experiential and a spiritual reason why they have been afflicted with illness. A study conducted by Mulatu in 1999 to examine lay Ethiopians in Africa for their causal beliefs about the perceived importance of various treatments for, and attitudes toward, mental and physical illnesses reveals that most Ethiopians largely attributed mental illness to cosmic or supernatural causes, including curses or spirit possession.

Consistent with the Public Health Agency of Canada (2011), an individual's health is determined by complex interactions between social and economic factors, the physical environment, and individual behaviour. Connecting all these challenges with an individual's use of mobile phones, Ouma (2011) states that there is a great deal of ongoing research on the device to perform health-related activities; few of these studies, however, focus on challenges that involve the adoption of the mobile phone in health sectors.

Cultural practice is believed to influence an individual's attitude toward seeking for health information in general. Most illnesses and diseases are attributed to various sources, depending on individual's location and beliefs.

2.5 Impact on mobile phone usage in mHealth

As part of a literature review that explores the use of mobile phones to promote health literacy, I examined some of the benefits of employing mobile phones to promote health literacy, and I also reviewed reports relating to my study to find out how the use of mobile phones in the health sector impacted the lives of individuals, as well as the impact on healthcare delivery. These reports include reports on Mobile Technology for Community Health (MoTeCH) (2012), which is geared to bridging the gap between community health workers and patients. The Novartis Foundation and Millennium

Villages Project, also known as *Ghana telemedicine project* (2013), focuses on employing mobile phones to improve the quality of primary health services, particularly in rural areas. The project is in collaboration with the Ministry of Health (MOH) and the Ministry of Communications in Ghana. Other projects included: (a) the AAD Telemedicine Project, which employs mobile phones to electronically connect primary care physicians with dermatologists to assist with diagnoses; (b) Global Authentication Network (GAN) system for tracking counterfeit drugs; (c) Texting4Health, which involves the use of mobile phones to send health messages about health promotion and disease prevention as a way of creating the awareness of the ability to employ mobile phones in healthcare delivery services.

MoTeCH (2012) is an open-source software project operated by the Grameen Foundation through funding from the Bill & Melinda Gates Foundation for mHealth applications. The program has interconnected mobile health services: Mobile Midwife and Nurses' Application. Mobile Midwife service is a program provided by MoTeCH Ghana, whereby mobile technology is employed to deliver automated voice or SMS health information messages containing time-specific information to pregnant women and nursing mothers. MoTeCH project was first piloted in Kassena-Nankana West district, located in the upper east region of Ghana. The project, according to Awoonor-Williams et al. (2012), involved: "(a) the development and deployment of a Simplified Register, which centralizes the recording of health data in a significantly reduced number of books; (b) the development of a *mobile phone-based health information system for health workers*, which automates the production of monthly activity reports and provides alerts and reminders about possible defaulters; and (c) the implementation of a *mobile*

phone-based health promotion module, which provides pregnant women and mothers of newborns with key information required to enhance the quality and frequency of patient-provider interaction, as well as alerts and reminders of upcoming or missed care events" (p. 4). Awoonor-Williams et al. stated that the aim of the project was to: (i) improve the quality of antenatal and neonatal care in districts, thereby reducing the rate of childhood and maternal mortality in general in Ghana, and (ii) reduce the number of paper registers used, for a more efficient and faster reporting process at Community Health Compounds (CHCs). The program also aimed to improve health outcomes through recording and tracking of care delivered to women and newborns in their areas, using mobile phones with installed MoTeCH Java application.

My research includes a review of relevant reports and documents on the mHealth project from the office of Policy, Planning, Monitoring, and Evaluation Division (PPME), Ghana Health Service (GHS) in Accra, and Ghana Health Service regional office at Upper East region, where the MoTeCH pilot project was conducted. This project involved the use of mobile phones by most healthcare centres to generate weekly and monthly reports on medications. This process was carried out using SMS and mobile phones to take stock levels and track anti-malarial medicines, Rapid Diagnostic Tests (RDTs) and Amoxicillin, an anti-bacterial medicine in health centres. By so doing, health centres that may have extra medications in stock may share with other centres during emergencies. The documentations and reports included how to maintain adequate supplies of anti-malarial medicine, and other medications at the health facility level in rural areas, for effective management of diseases and illness. The reports are used by the Community Health Officers (CHOs) and the District Health Managers to make accurate

and informed decisions on the kind of medications and healthcare facilities to import for a specific healthcare centre.

To conclude, mobile phones are relatively affordable technologies with several useful capabilities. There is no doubt that the mobile phone holds the potential to minimize digital and health information gaps between the developed and developing world, the rich and the poor, and the literate and non-literate individuals. With such increase in their affordances, use of the device as an information-exchange tool and consultation tool in healthcare systems seems very promising (Greenspun & Coughlin, 2013; Wade, 2004), not to mention the fact that users are also able to provide information that allows for better care and also serves as data for future research (for example, diabetics can upload their daily blood readings, HIV/AIDS patients can also upload information about their medication dosages as well as side effects of the medications to the healthcare information database). In line with this thought, various organizations such as MoTeCH, SMS For Life, and Mobile Health are tapping into the proliferation of the device's usage to promote not only health literacy, but also a means of exchanging data between patients and healthcare personnel on health-related issues confronting patients. By so doing, the healthcare industry obtains required data to supply necessary resources to healthcare professionals for effective diagnosis and treatment of diseases and illnesses.

This chapter reviewed related literature on how low level of literacy, limited access to health information, and other socio-economic status confronting individuals has resulted in compromising the health status of most individuals living in the developing world. Many are losing their lives as a result of the importation and administration of counterfeit medications, cultural beliefs and practices that prevent them from seeking

medical attention when needed, and limited healthcare personnel, among others. As a result of some of the issues confronting individuals' health, emerging and existing technologies such as mobile phones, tablets, Internet, radio, and televisions have been considered as various means of searching and obtaining health information. Other means that may not be based technologically include traditional healers, community durbars, family, friends, and colleagues depending on the information needed, and the accessibility.

Access to and seeking information about health with the use of mobile phones is the main focus of this study. The literature reviewed revealed that various mHealth activities are not performed by most people in rural communities, especially among the culturally responsive groups. Other challenges with the use of the device to perform mHealth activities are due to poor technological features and socio-economic status. Mobile phones are employed in various development fields such as agriculture, banking, business, education, and health. The device also serves as a potential tool to promote health literacy and provide access to information related to health among individuals living in Ghanaian rural communities.

Chapter 3

3 Conceptual framework

This chapter introduces Activity Theory (AT) and the suitability of the theory to the study. This theory is employed as a lens to inquire into individuals' use of mobile phones to promote health literacy. First, I provide a brief overview on how other theoretical frameworks have been employed in technology education and in development in general. Second, I outline AT, its origin, tenets, generations, and principles. Third, I highlight the usefulness of AT. Lastly, I discuss how AT informs this study.

Several theoretical frameworks such as Self-Directed, Socio-Cultural theories of Learning, and Technology-Mediated Learning (TML) have been used to guide investigation in technology education and development. For example, Chinnery (2006) used the concept of TML to examine how technological devices are employed to assist learning. Whereas these frameworks are useful for understanding the connection between technology and literacy, most of them are employed as methodologies, rather than theoretical frameworks. Emergent tools that afford literacies in science education involve work with theories that adequately and critically combine elements such as tools with objects, subjects, and communities to promote literacy. Activity theory is among these theories.

According to Sam (2012), the distinction between AT and other theories is its unit of analysis as an *activity*. I selected AT over other theories because this study is not solely to empower individuals as depicted in Critical Theory (CT). Rather, the study aims to investigate how best individuals and healthcare personnel can employ mobile phones to access useful health information and also perform health-related activities to promote,

maintain, and improve healthy living. Hence, adapting a framework that allows individuals to discover for themselves what their health issues are, and various ways of dealing with the health issues, AT was the appropriate choice.

From an Experiential Learning Theory (ELT), Miller and Boud (1996) define experience as the totality of ways in which humans sense the world and make sense of what they perceive. The value of experience as a tool in the creation of knowledge and the promotion of human development, according to Aristotle (n.d.), is a theory that is not understood as possessed knowledge until learners prove that they are able to apply that knowledge in their lives. Hutton (1989) adds that once learners identify the kind of knowledge they need, the next level to look out for is how such learning can be achieved. However, this study is not generally about adult learning. It is about using tools (mobile phones) to perform health-related activities.

Boud (1991) begins to introduce Self-Directed Theory (SDL) with the assumption that "the ultimate purpose of education is the betterment of society" (p. 13). In this theory, individuals are considered to be responsible owners and managers of their own learning content and process. According to Gibbons (2002), SDL is any increase in knowledge, skill, accomplishment, or personal development that individuals may select to bring about their own efforts, using any method in any circumstance at any time. The theory involves the learner initiating learning, making the decisions about it to reinforce the learning. As a result, SDL has been identified by researchers as an approach to learning, where learners are responsible for what they learn and the decision to be self-directed and selective in their own learning (Smedley, 2007). Thus, SDL is somehow helpful at studying informal learning activities with mobile phones. My study is not

centrally about learning with phones. It is about using a digital device in information-seeking behaviours among adults. Hence, I found SDL to be limited in theoretical tools it could offer.

Critical theory (CT) is "a reflective theory which gives agents a kind of knowledge inherently productive of enlightenment and emancipation" (Geuss, 1981, p. 2). The theory focuses on political, cultural, economic, and social relationships within a culture, particularly as they are related to what groups of individuals have power and which groups do not have power? The theory is more on interpretation and explanation, rather than social transformation (Perry, 2002) in terms of how individuals may have access to information in order to address their needs. Although CT helps to empower the powerless and transform social inequities and injustice by applying brakes on moves made by the powerful and inhumane to distort human life (McLean, 2008), it views information technology (IT) as another means of production. Mobile phones can either be employed as emancipatory tools or as tools of destruction, depending on the individual's motives and on prevailing environmental conditions.

Socio-cultural theory is one of the theories that emerged from Vygotsky's work. The theory has three central conceptual aspects that have contributed to the understanding of human interactions as social phenomena. These conceptual aspects are: (a) genetic analysis; (b) social learning; and (c) mediation (Wertsch 1991). Socio-cultural theory is at its heart an interpretation that higher-order human functions, such as learning and, obtaining and seeking information, grow out of social interaction (Rogers, 2002). The theory has been employed in several educational research in literacy such as educational research in digital literacy (Gee, 2009) and educational research in technology (Kirkup,

Gill, Kirkwood & Adrian, 2005; Peer & McClendont, 2002). Socio-cultural approaches and activity have in common the concept of mediation. Whereas socio-cultural theory focuses on how social interactions and cultural factors influence and are influenced by—mediate—human action, activity theory focuses on how physical tools mediate human activity. In terms of differences, for instance, Wertsch (1991) observes that sociocultural theories focus on action rather than activity. Sannino, Daniels, and Gutiérrez (2009) further explain the difference between sociocultural theory and activity theory "as a unit of analysis, the focus on action [by socio theorist] does not account for the historical continuity and longevity of human life" (p.3).

Theories examined so far in this chapter inform my study in one way or another; however, literature I reviewed tends to suggest AT (Engeström, 2008) as a more appropriate framework. Hence, this study considers AT to adequately explore the use of mobile phones to promote health literacy in rural communities. Moreover, AT is more descriptive than predictive. It also focuses on the activity afforded by a technological tool.

There are many strands of AT. This study draws from Engeström's (2008) concepts of AT and the concept of *runaway objects*. Engeström's concept of runaway objects refers to issues of concern that can only be identified or addressed by performing a set of activities. Consistent with Ligorio (2010), the key point of the AT is the concept of *mediation*. Thus, human activity is mediated by an *artifact* or a *tool*. In other words, the concept advocates that tools may *mediate* between *objects of concern* and the *subject* (human). According to Impedovo (2011), in AT, the human agency is linked to the relationship between the subject and the tools it uses to achieve the agency's objectives.

3.1 Activity theory

Activity theory, according to Engeström (2009), is "a theory of object-driven activity" (p. 304). According to Nardi (2002), AT is a powerful and descriptive tool that aims at interacting with an object in the world. AT originated from Vygotsky (1978) in the 1920s and early 1930s psychological research, "School of Russian Cultural History," and developed in Russia with Leont'ev (1981), and others in the early twentieth century. In addition to Vygotsky's work on the socio-cultural aspect of learning, his work also focuses on how an individual's actions are usually mediated by one or more instruments or tools (Bannon & Bodker, 1991). In accordance with Kaptelinin, Kuutti, and Bannon (1995), there is a rising interest in the AT tradition in Human computer-interaction (HCI) studies being done in Scandinavian countries, Europe, the United States, Canada, Australia, and Russia. Hayes, Pathak, Joyce, and Hall (2005) state that all aspects of activity are shaped over time by individuals' social interactions with each other and with the tools they use.

According to Sannino, Daniels, and Gutierrez (2009), from an AT perspective, "human life is fundamentally rooted in participation in human activities that are oriented towards objects" (p. 2). According to Engeström (2009), the development of AT may be viewed from three generations based on the types of activities specified by knowledge, tools, and number of tasks people use to achieve particular outcomes (Engeström, 2001; Uden, 2008). The first-generation approach to AT is based on Vygostky's concept of mediation, which focuses on Vygostky's triangular model, whereby an individual's actions are mediated by tools/artifacts. The limitation of the first generation, to Engeström (2009), is that the unit of analysis remains individually focused, and the process is linear. This limitation was overcome by the second generation, which was

"built on Leont'ev's notion of activity system" (p. 307). Based on Leont'ev's (1978) work, the study of artifacts is integral and inseparable from components of human functioning.

Engeström argues that the focus of the study of mediation should be on its relationship with the other components of an activity system. Engeström further combines the first and second generations to form the third generation. The third generation then becomes the unit of analysis for "reflective appropriation of advanced models and tools" that results in new activity systems (Cole & Engeström, 1993, p. 40). Hence, the third-generation approach centres on the development of conceptual tools to understand multiple perspectives and networks of interacting systems (Engeström, 1999). Engeström is a member of the third-generation activity theorists, and one of the outstanding representatives of the *multivoicedness* approach among activity theorists.

AT embraces the concept of *mediation*. Thus, human activity is mediated by artifact (Bannon & Bødker, 1991). Artifacts, according to Nardi (1991), are mediators of human thought and behaviour, instruments, signs, language, and machines. Artifacts, which include mobile phones and laptops, may provide individuals and healthcare personnel the possibility of using voice calls and textual and multimedia content to access and deliver information, since they are directly used in production in line with the *tripartite division* proposed by Wartofsky (1979). Nardi (1991) adds that these artifacts do not occupy the same ontological space, as they are created by humans to control their own behaviour. Rather, artifacts serve as channels and forms from which individuals could obtain needed information and ideas to solve their problems. The theory casts the relationship between people and the tools as one of the mediations. This makes the

activity system fully integrated to become a whole when using it to analyze and solve an individual's problems (Engeström, Miettinen, & Punamaki, 1999).

AT has tenets and principles. The tenets of AT are human intentionality, intermediates between humans and things, the idea of culture and society, and the interaction between agents and their environments (Bannon, 1986). These tenets explain why tools shape the way human beings interact. According to Engeström (1987), the theory is not simply concerned with doing activities for the sake of it. It is concerned with doing the activities in order to transform something, with the focus on the contextualized activity of the system. Technologies are both designed and used in the context of people with intentions and desires. From this theory, contexts in this study are neither containers nor situationally created experiential spaces. Rather, they are *systems* that integrate the *subject*, *object,* and *instruments/tools* to form a unified whole (Engeström, 1996; Engeström, 1987; Kuutti, 1996).

According to Engeström (2009), objects do not emerge nor exist without human activities. Hence, human beings need to identify and name them appropriately. As a result, the effects of *runaway objects* can remain dormant, invisible, or unseen for long periods of time until they come out into the open in the form of acute crisis or breakthroughs. Human activities are driven and instigated by certain objects or problems individuals may face in life or at workplaces. As a result, Murphy and Rodriguez-Manzanares (2008) state that the lens of AT can provide insights into change in individuals' practices and motives into how their access to information and knowledge may be reformed when a new technological tool becomes part of the activities that they perform. The theory, therefore, allows exploring the kind of health activities that

individuals perform on their mobile devices, and challenges they encounter during this process. Figure 8 shows Engeström's (1987) components of the activity system mode.

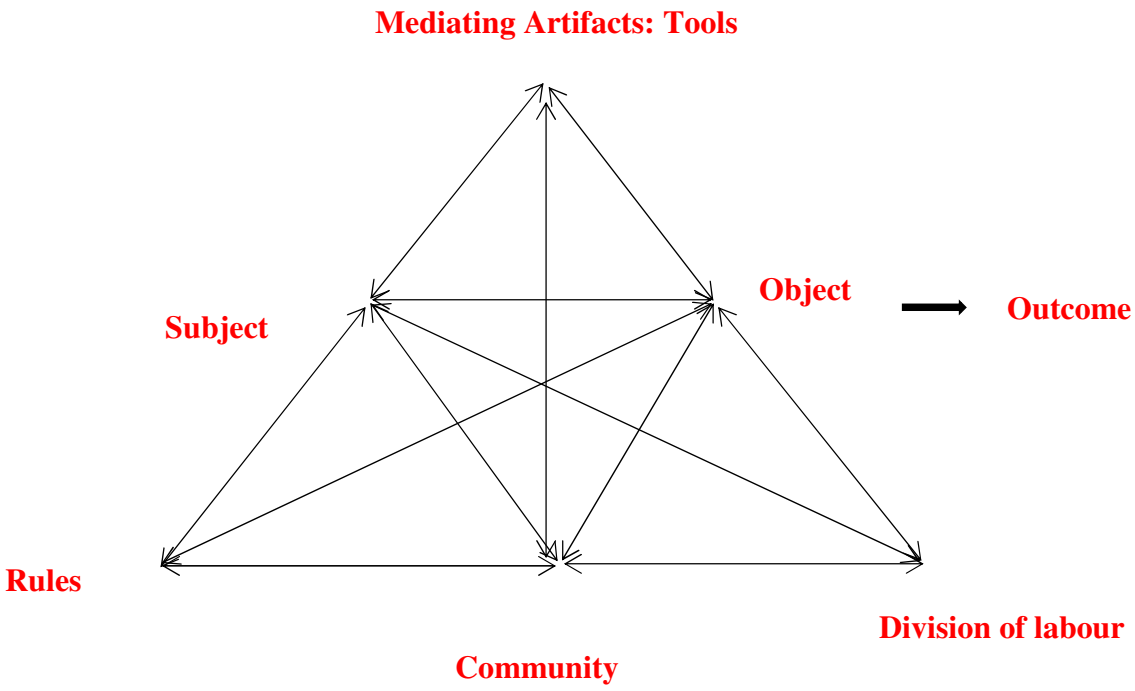


Figure 8. A model showing components of an activity system, adapted from Engeström (1987) human activity system.

The key components of AT are subject, object, and mediating tool, together with the unique feature of the object that motivates activity toward certain needs that people wish to achieve (Bannon & Bodker, 1991; Engeström, 2009; Kuutti, 1991; Leont'ev, 1978). Nardi (1991) explains that the subject represents individuals engaging in the activity, and the object symbolizes an issue or an idea that needs to be addressed by employing the tool (mobile phone in the case of this study) to perform a particular activity (calling, sending SMS, browsing the Internet) in a specific direction. de Feijter, de Grave, Dornan, Koopmans, and Scherpbier (2011) add that *rules* dictate how the tool should be employed, *community* comprises various agencies and locations where the

needed information may come from to solve the problem, and finally, *division of labour* describes the roles of the members of the community involved in the activity system. Nardi notes that usually, in the constituent/component of an activity system, the subject remains fixed, whereas object, tool, and activity change dynamically, depending on individuals' conditions and needs. The mobile phone is a good example of a tool whose activities have changed dramatically since its inclusion in health, and continues to change, depending on conditions and needs. Figure 9 illustrates how I adapt Engeström's (1987) model for the study on mobile phones for accessing health information.

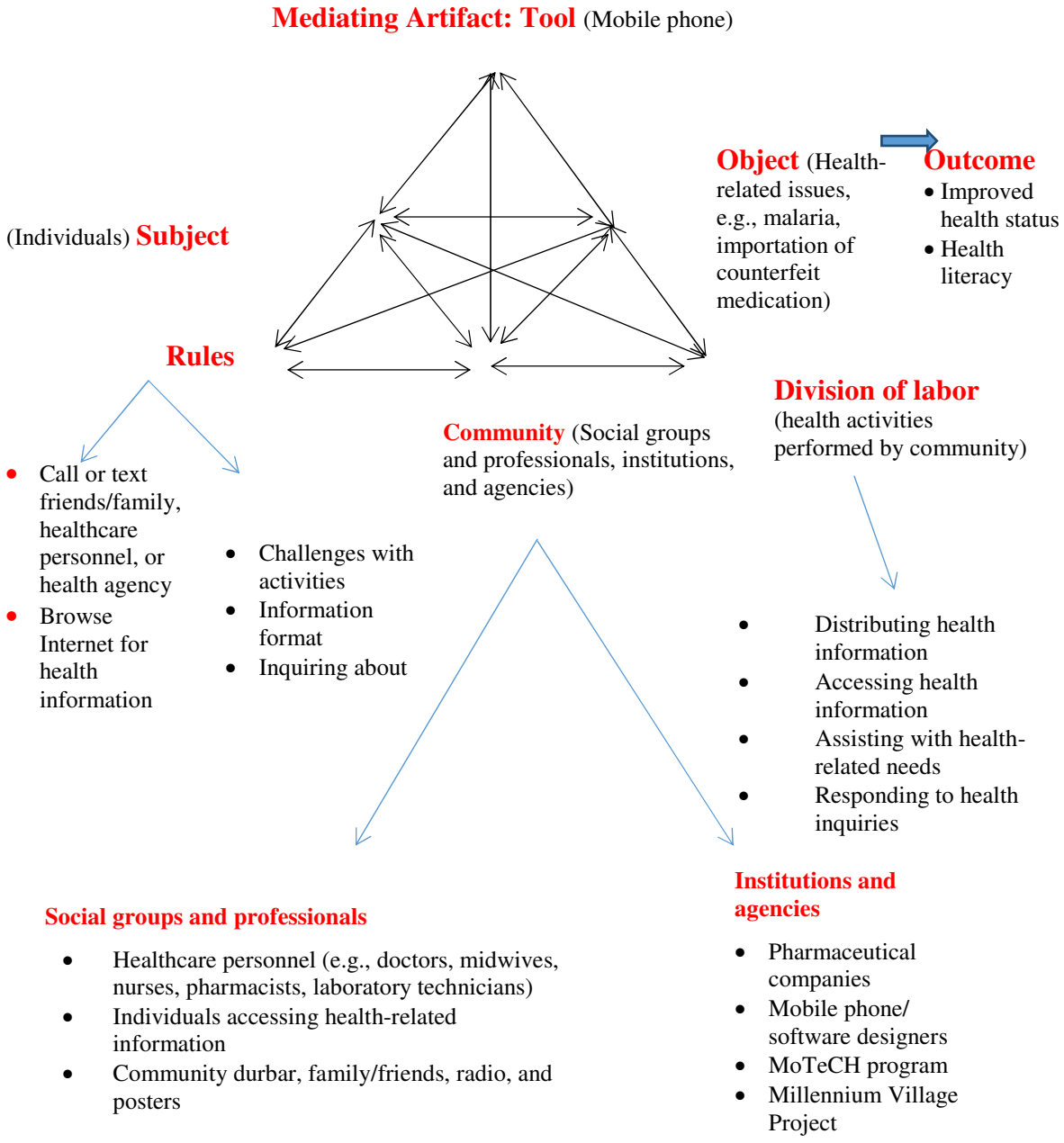


Figure 9. A model of the mobile phone for health information for activity system

The model in Figure 9 represents how individuals (the subjects) employ the tool (the mobile phone) to access health-related information from various sources (community) such as websites, family members, and healthcare agencies that provide the information in order to improve healthy lifestyles (outcome). This triangular activity

system represents the interaction of complex elements that constitutes the activity system whereby individuals and communities employ mobile phones in promoting their health literacies. Activity theory, adapted for this study, provides a framework for conceptualizing how health-related issues can be addressed by the possibilities of employing mobile phones. A significant concept adapted in this theory is the manner in which mobile phones (tools/artifacts) can be mobilized to mediate the issue of low health literacy and limited access to healthcare service in order to deliver positive health outcomes.

Kaptelinin and Nardi (2006) note the usefulness of AT in the following ways: (a) the theory has the potential to discuss the depth of *users and their needs*, *technologies and their possibilitie*s; (b) the theory opens up avenues for discussion and properly understands both *subject and object* in terms of learning and developmental opportunities; (c) the theory focuses on the analysis of the particular, rather than formation of generalized claims and hypothesis—concentrates mainly on the practicality of *everyday activities and life's situations*. To add to Kaptelinin and Nardi, AT supports the concept that a subject's relationship with the objective world is mediated by tools that can be used to accomplish activities in various ways. Engeström (1999), for example, states that activities that are implemented with the tools are *open systems* that adopt new elements and ideas from the outside of expansive transformations in activity systems. Thus, engaging the mind and body through activity, reflection, and application increases the possibility of educating and addressing the needs of individuals. With the diverse features and applications on mobile phones, several activities may be easily performed.

This theory provides an opportunity to focus on the potential and possibility of employing the device, for instance, to promote access to health information.

Linking the concept of mediation to this study, there is a high incidence of low health literacy and low access to information related to individuals' health due to lack of or limited health facilities, and a poor healthcare delivery system. Bearing in mind these challenges and the fact that mobile phones serve as great communication tools as audio, text, and visual, the device has the promise to mediate the problem coupled with low health literacy and limited health facilities among individuals living in rural communities in Ghana.

There are five basic principles of AT (Kaptelinin, 1995). These basic principles, according to Kaptelinin, constitute a general conceptual system, rather than a highly predictive theory. These basic principles include the hierarchical structure of activity, object-orientedness, internalization/externalization, tool mediation, hierarchical structure of activity, and development. Engeström (2001, p. 136) also outlines these basic principles as follows: first, activity system comprising of tools (mobile phone), subjects (humans), and objects (health-related problems), which is the main unit of analysis; second, individuals' multiple perspectives, interests, and traditions, as members of an activity system, "carry their own diverse histories," and the system itself "carries multiple layers and strands of history engraved in its artifacts, rules, and conventions; third, the principle of historicity argues that the history of activity systems helps individuals to comprehend their problems as well as their potentials to solve the dilemmas at hand; and, fourth, though contradictions can result in tensions, transformation in activity systems in

terms of expansive learning that reconceptualizes the object and the motive of activity will help reduce the tension.

Engeström (2009) stated that "the societal relevance and impact of activity theory depend on our ability to grasp the changing characters of objects" (p. 304). According to Engeström and Escalante (1996), when addressing individuals' health issues, the object can manifest itself in various forms, and that may involve employing different activities with the tools to reach the objectives. In situations like this, a single activity may not be suitable in dealing with such problems. Engeström (2008) broadly defines these objects or needs as generators of foci of attention, effort, motivation, and meaning. He calls them *runaway objects*.

Runaway objects, according to Engeström (2009), refer to *issues of concern* that can only be identified by performing a set of activities. Runway objects have the potential to escalate and expand to a global scale of influence. They are objects that are rarely under anybody's control and have far-reaching, unexpected effects. Most objects do not start out big and risky. The objects "begin as small problems, which makes their *runaway* potential difficult to predict and address" (p. 304). Engeström (2009) outlines some *fundamentals* for runaway objects. These include: (i) the object should have the potential to "transcend the limits of the original *utilitarian profit motive*" (Engeström, 2009, p. 305); (ii) the objects or problems stand at the "juncture of legitimate and illegitimate, sensible and crazy, work and leisure, technology and art" (p. 305); and, (iii) the objects should be visible, accessible, and easy to be returned to by humans in the near future.

Runaway objects can be placed into two perspectives; one, the objects are concerns that generate attention, effort, and meaning; and two, the objects are powerful

technological innovations, emancipatory objects that open up radically new possibilities for *development and well-being* (Engeström, 2009). The objects can be small or large. Small runaway objects tend to have one activity system, whereas large runaway objects have numerous activity systems working on the object. Again, with small runaway objects, the boundaries of the object are hard to draw. As well, "the positions of the activity systems are big and ambiguous, which sometimes seem to be subsumed by the object rather than in control of it" (p. 305). On the other hand, big runaway objects, according to Engeström, tend to be either what used to be viewed as *natural forces* or *technological innovations*. These objects, according to him, are usually seen as objects for comparatively exclusive professional expert activities. As a result, patients and users of the activity system become marginal or "rubbish" (Engeström & Blackler, 2005) when big runaway objects become exclusive professional expert activities. Therefore, the task of AT is to "recycle the rubbish and turn it into diamonds" (Engeström, 2009, p. 305). Connecting the concept of runaway objects with the study, AT as a theoretical tool illustrates how to recycle or turn mobile phones from just chatting with friends and family into a useful health information-seeking tool.

We see the components of AT in the activity system, as tools in the system represent mobile phones, subjects become individuals/participants, and objects represent health-related issues that need inquiry. Linking the tenets of AT, the theory seeks ways individuals use mobile phones as tools to obtain health assistance (e.g., from either community healthcare personnel or family members) in order to improve their health status. To Hashim and Jones (2007), the theory allows the most advantageous design of tools to support technology-mediated activities in various contexts such as health literacy,

and develops methods to put them into practice. Within the activity theory framework, individuals are considered to employ the devices to carry out diverse activities, from voice calling to text reading. AT has not been employed much as a conceptual framework in the study of mobile phones and access to health information. There is a gap in employing AT to study mobile phone activity. Other studies that employ AT and mobile phones focused only on the contribution of the theory as a theoretical framework (Tan & Melles, 2010), without carrying on empirical studies. Sharples, Taylor, and Vavoula (2005) used AT to study how technologies (e.g., mobile phones) can serve as a bridge between formal and experiential leaning, whereas Madsen (2009) employed the theory to conceptualize the processes students undergo when accessing academic resources, such as the use of the school library and its challenges. Keddie (2007) also utilized activity theory in an action research to analyze what goes on in the context of the classroom when a new mathematics software package is introduced as the primary teaching tool. In a more recent research, Timmis (2014) applied the theory to discover various conceptual and methodological challenges in researching sustainable computer-supported collaborative learning (CSCL) within authentic educational settings.

All these studies focus on using mediating tools in learning. There is the need for a study that explores the potential use of mobile phones to promote health literacy and access health information among informal learning and literacy settings such as in rural communities.

In terms of how individuals may view their health experiences, possession of the device and other health information-related challenges are basic to seeking and using relevant health information in a self-directed environment. As such, mobile phones are

regarded by most researchers as tools with the potential to promote an individual's access to health information. Commenting on the high interest of usage of mobile technology devices for learning and health, Wan, Fang, and Neufeld (2009) state that comprehensive theoretical framework on relevant constructs for studying mobile learning and their relationships has yet to emerge.

The core premise of AT is that activities are object oriented, which distinguishes it from other theories such as socio-cultural theory, which focuses on actions and social interaction, rather that activity (Wertsch, 1991). AT focuses on the interconnections of people, organizations, rules and culture, and tools, all directed to the same goal (Bertelsen & Bodker, 2003; Cole & Engeström, 1993). Relating the basic principles of AT, these are some of the questions into which the theory helps to inquire: What happens in the lives of individuals when they obtain needed health information? Is the health information really helpful to address the health problem? Was the device capable of assisting individuals to access the needed information?

Connecting the principles of AT with runaway objects, for instance, individuals may be having problems with diseases and illnesses, such as malaria, cholera, typhoid, or pneumonia, that need attention. Other runaway objects could be health-related issues, such as maternal and antenatal issues, and family planning. With runaway objects, people, however, identify the kind of activities that can be performed on them and, possibly, give names to the activities based on objects and needs. For instance, cholera and typhoid outbreaks may not become a health issue if individuals keep their surroundings and eating areas clean. Hence, individuals identify what the problems are and the best way to control them by practising personal and environmental cleanliness.

Klein (2007) adds that current capitalism, disasters, and unexplained illness are becoming dormant runaway objects of concern. For instance, the effects of low health literacy and limited access to relevant health information may remain hidden for a long period of time, especially in rural communities where there is limited access to medical facilities and healthcare personnel. Individuals' low access to relevant health information may cause outbreaks of illnesses and diseases such as ecoli.

AT considers technological devices as innovative tools that have the potential to "transcend the limits of the original utilitarian profit motive" (Engeström 2009, p. 305) of the designer of and subscriber to the tool. Technological innovation considers mobile phones as one of the powerful tools for supplementing healthcare delivery service, which when used properly, can reveal the objects (health problems) and promote healthy living (Nutbeam, 2006). Diseases and illnesses such as malaria, sexually transmitted diseases (HIV/AIDS, syphilis, and gonorrhea), and cholera (object) are considered to be a result of low health literacy and limited access to health information.

Considering that, by its very nature, access to relevant information has social-constructivist characteristics in terms of individual needs and difference (Hayes et al., 2007), mobile phones enable individuals to take centre stage in seeking, evaluating, and using health information to address several health issues. AT provides a broad theoretical framework for describing the structure, development, and context of human activity, and proper implementation of technological devices in relations to goals, plans, and values of the user or in the context of development (Uden & Willis, 2001). This permits the researcher to comfortably ask descriptive questions, such as: (a) how individuals employ

the device in the health settings; and (b) instances where individuals find it difficult employing the device to perform any form of health activities.

Chapter 4

4 Methodology

This study, focusing on using mobile phones in health literacy, employs sequential explanatory and sequential transformative designs (Andrew & Halcomb, 2009; Creswell & Plano Clark, 2011; Greene, Caracelli, & Graham, 1989) in mixed-method approaches as the research method. Mixed-methods sequential explanatory design, according to Ivankova, Creswell, and Stick (2006), is the collection and analysis of first quantitative data and then qualitative data in two successive phases within one study. Sequential transformative design is the organization of "the concurrent or sequential collection and analysis of quantitative and qualitative data sets within a transformative, theoretical framework that guides the methods" (Creswell & Plano Clark, 2011, p. 73). In this chapter, I describe the methodology and methods employed, and the particular ways they were used. I also explained how participants in the study were selected and how data were collected for the study.

The study seeks to find answers to the following questons: (a) What views do people have about information that relates to their health?; (b) What are the existing media used for obtaining information related to their health?; (c) What are the types of health-related activities that people perform on and with their mobile phones?; (d) What are the factors that influence employing mobile phones in activities related to their health?; and (e) What are some of the impacts of employing mobile phones for activities related to their health in remote and isolated communities in sub-Saharan Africa? These questions are best answered by collecting both quantitative and qualitative data.

In this section, I describe how the study is designed and the approaches for data analysis. First, an overview of the methodology employed in the study is provided. Second, geographic areas of the study, including sampling method and sample size, how participants are recruited, and the procedure for collecting the research data, are discussed. Third, an outline of techniques for collecting the research data, how the study was piloted, and validity and reliability of the study is narrated. Fourth, a summary of data-analysis approaches and how data collected for this study is analyzed. And fifth, I discuss ethical considerations of the study. To begin, the section is a description of the study methodology and the reason for selecting the methodology.

4.1 Research methodology

Cresswell (2005) and Tashakkori and Teddlie (2003) define mixed-methods research as the practice of collecting, analyzing, and combining both qualitative and quantitative data at a certain stage of the research process within a single organized study, for the purpose of obtaining a more holistic understanding of a specific research problem. Also, Tashakkori and Creswell (2007) define mixed methods as a "research in which the investigator collects and analyzes data, integrates the findings and draws inferences using both qualitative and quantitative approaches in a single study" (p. 4). Creswell (2003) adds that mixed methods can consider a variety of techniques including closed and open-ended questions and various forms of gathering data.

According to Lazar, Feng, and Hochheiser (2010), using the mixed-methods approach allows data to be collected from different sources to promote triangulation and the subsequent quality of the data analysis. Greene, Caracelli, and Graham (1989) add that for triangulation purposes, mixed-methods research seeks corroboration between

qualitative and quantitative in terms of similarities and differences in the data. Vassilakaki, Hartley, Johnson, and Randall (2009) define triangulation as a way in which qualitative and quantitative methods are combined to split up findings in order to be mutually corroborated. Moreover, a mixed-methods approach offers a great opportunity to combine methods from both qualitative and quantitative designs to show different aspects of an overall research question.

The rationale for combining both quantitative and qualitative data in a mixed-methods study is mainly twofold: (a) complementarity—ability to seek elaboration and clarification of responses from participants (Greene, Caracelli, & Graham, 1989); and (b) expansion—to find out the range to which a particular response can be probed. Specifically, I employed sequential mixed-methods design to: (i) select which survey (quantitative) results to follow up for further information, based on the research questions; (ii) apply findings from the survey as basis for selecting participants for the semi-structured interviews in the qualitative data phase; and (iii) use interview data to elaborate, explain, and confirm some of the responses from the survey data.

The theoretical assumptions and principles that underpin the study are mixed-methods approaches involving two complementary methods of data collection from both quantitative and qualitative data in a dominant-less dominant (Creswell & Plano Clark, 2011; Padgett, 2012) status. Dominant-less dominant status is when a researcher decides to give priority to either quantitative or qualitative design during data collection and employ data collected from the less priority design to expand on the main dominant data. Hence, in this study, quantitative data becomes the dominant, with qualitative being the less dominant. The notion of dominant-less dominant status may be expressed as

sequential explanatory design. In the sequential explanatory design, one kind of data, say quantitative data, is given priority, whereas the other kind of data, say qualitative data, is employed to provide further explanation to the quantitative variables.

Sequential transformative design involves selecting the appropriate technique for collecting data, whereas sequential explanatory design involves applying the techniques in such a way that data collected will help answer your research questions. Sequential transformative design, which is usually guided by the theoretical lens of the study (Hanson, Creswell, Plano Clark, Petska, & Creswell, 2005), assisted in designing both the survey and interview questions within the context of an AT framework. The design is also employed to select appropriate methods for collecting data within the study's framework. This procedure allows the researcher to identify participants whose survey responses need further inquiry.

4.2 Research methods

4.2.1 Sampling and sample size

In the proposal, I planned to conduct the study in nine communities located in Savelugu-Nanton district. This is one of the districts with a high prevalence of diseases and other health-related needs in Ghana in general, and the northern region in particular. Upon my arrival and preliminary interactions with key informants in Ghana, including the Policy, Planning, Monitoring, and Evaluation Division (PPME) and Ghana Health Service (GHS), an unexpected setback occurred. To my surprise, very few of the nine communities in rural areas of the Savelugu-Nanton district use mobile phones for activities related to health. At the time of proposing the study, I purposively selected this region and district, using the criteria of poor health among community members, but did

not use the criteria of use of mobile phones for health-related activities. When in the field, I saw it necessary to modify my sampling approach to include a combination of random and non-random (Kroll & Neri, 2009) strategies for both regions and districts. With first-hand information about the potential sites of data collection, I proposed adding two districts where mobile phone devices were being employed to perform health-related activities. Studying communities using mobile phone for health activities was the main objective of the study. I also modified the questionnaires with the revision and sought to amend the UWO ethics application.

The research, therefore, was conducted in three different districts: Savelugu-Nanton, Kassena-Nankana West, and Awutu Senya, located in the northern, upper east, and central regions of Ghana, respectively. Most communities located in Kassena-Nankana West and Awutu Senya districts were employing mobile phones to perform activities related to health, especially for pregnant and nursing mothers. Three communities were selected from each of the districts: Savelugu-Nanton, Kassena-Nankana West, and Awutu Senya. Nine communities in total were included. These communities were Savelugu, Pong-Tamale, and Kanshegu, Paga, Kajelo, and Kandiga, Senya, Okwampa, and Akrabong correspondingly. The participants were selected from these nine communities located in three different districts and regions of Ghana.

To identify participants, the communities were purposively selected using non-probability sampling. Random and purposive sampling were utilized for survey data, whereas purposive and snowball sampling was employed for the interviews data. In the purposive sampling, I intentionally selected participants who employed mobile phones to perform activities related to health, including patients and healthcare providers. A

snowball sampling method, that is to say from one mother to another, was employed to obtain individuals who were enrolled in the MoTeCH program. I identified the people using mobile phones with the help of healthcare personnel involved in the MoTeCH program, as well as the research team who assisted with data collection.

The sample comprised ninety-two (92) for survey data and nineteen (19) for the individual face-to-face interviews. My rationale for using the sample close to 100 includes: (a) obtaining adequate responses that can be representative for generalizability when possible, and (b) statistical significance, such as reducing sample error and confidence interval for survey data.

4.2.2 **Participants**

Before selecting research participants, I visited the study sites to familiarize myself with the communities and also to get to know some of the community members and medical personnel. Plowright (2011) states that being an "outsider" and unfamiliar with the research setting results in more time to develop an understating of the research setting. When a researcher is able to interact with participants prior to the study, it creates a better willingness for participants engaging with the researcher in a more genuine way. Visiting the communities prior to the study offered the opportunity to engage with some of the participants on a personal level, which facilitated recruitment into the study. This engagement with, for instance, nurses and midwives was to allow me to identify people who are enrolled in the MoTeCH program, which I was aware, at some point would create bias prior to selecting participants for the study.

Although I interacted with most of the participants prior to the study, I employed criteria for recruiting participants based on: (a) individuals who own and use cellphones;

(b) willingness to share views on use of mobile phones to access health information; and (c) young and older adults (age 18 and above) criteria. All participants for this study were individuals aged 18 years and above, including pregnant and non-pregnant mothers, nursing mothers, healthcare workers, and males and females. Some of the participants had not completed primary education and therefore would be considered non-literate, whereas others who had completed primary level of education would be considered literate. In total, forty-four males (44) and forty-eight (48) females participated in the study.

The categories of participants are indicated in Table 3 below. The first group comprises pregnant women, nursing mothers, and community health workers[6] who have completed the MoTeCH pilot program. The second group involves pregnant women, nursing mothers currently participating in the MoTeCH program, and community health workers. The third group involves individuals who were either employing or not employing the mobile device to perform health-related activities. Participants in this group include both health and non-health personnel, and males and females.

[6] Community healthcare workers were nurses/midwives who have been relocated from clinics into the communities by the Community-based Health Planning and Services Initiative (CHPS) to perform Mobile Nurse Application service.

Table 3

Categories of the Participants Interviewed

Group 1	**Group 2**	**Group 3**
Completed MoTeCH Program: ▪ Pregnant women ▪ Nursing mothers ▪ Community health workers	Currently enrolled in MoTeCH Program: ▪ Pregnant women ▪ Nursing mothers ▪ Community health workers	Individuals (including pharmacist, general practitioners, and laboratory technicians) employing/not employing cellphones to perform health-related activities

Since the study includes both literate and non-literate individuals—basic literacy in terms of ability to read and write— I had anticipated language to be a barrier, especially in areas where illiteracy is high and most individuals speak only the local dialect. In Ghana, English is the official language academically and "Akan," which is one of the main local dialects, is considered to be spoken by almost every tribe in Ghana. In certain communities, nonetheless, especially northern and upper part of Ghana, where the majority of the study was conducted, that was not the case for most participants. Most participants spoke local languages. Spoken in Kassena-Nankana West were Kasem and Nankan, whereas Dagbani and Senya were spoken in Savelugu-Nanton and Awutu-Senya districts, respectively. In those areas, I employed translators to assist me with the interviews. Other participants spoke Akan, English, and their local languages. In those cases, interview and survey data were collected in either Akan or English.

In the subsequent sections, various methods and sources of obtaining study data are discussed. The study collected both quantitative and qualitative data so as to provide better understanding of the study, as well as respondents' views. The next section discusses how data from both quantitative and qualitative components were gathered.

4.3 Data collection and organization

The study utilized two techniques—(a) survey and, (b) semi-structured interviews—within both quantitative and qualitative approaches for collecting data. According to O'Bryan and Hegelheimer (2009), in these approaches, interpretation of quantitative (survey data) can be supported by qualitative data (interview) to explore and clarify participants' views. The research data involved survey and semi-structured interview techniques to ascertain participants' views on the use of mobile phones to obtain health information. The data-collection period lasted three months (March 2012 – May 2012). Data were collected sequentially—survey data first followed by interview data. This strategy for collecting data involves a process whereby data collected in one phase contributes to data collected in the next phase.

4.3.1 Quantitative data management and analysis

I used the Statistical Package for the Social Sciences (SPSS) software (Jones, 2007) for quantitative data management and analysis. SPSS according to Bryman and Cramer (2001) "enables you to score and analyze quantitative data very quickly and in many different ways" (p. 15). I this study, two features of SPPS were also very useful This software for analysis was employed for various reasons: useful (a) graphical representation of the raw data for easy viewing and analysis; and (b) the manipulations of statistical test such as chi square test to investigate relationship between given variables.

The study collected quantitative data for several purposes that include: (i) to select inconsistent or interesting findings that may be examined in greater depth with a follow-up interview from the qualitative component, and (ii) to purposefully select respondents for the qualitative component of the study. This approach allowed the researcher to obtain a general understanding of the data for the study. Quantitative data was collected by distributing a survey questionnaire to each participant. This process will be discussed in detail in subsection 4.4.

4.3.2 **Qualitative data collection**

As part of data collection, participants' views about how mobile phones can be and are being employed to promote health literacy and access information about health are collected through semi-structured interviews. Transcripts of audio-recorded interviews data are qualitatively organized for analysis, using Weft Qualitative Data Analysis (Weft QDA) software (Fenton, 2006). I selected this package for two reasons. First, the software is open access. Second, since the interview data for the study are mainly textual, the features, including import documents from plain text or PDF, retrieval of coded text and "coding-on," and fast free-text search of words and phrases of the package, work for the analysis.

4.4 Survey questionnaire

To expand on information gathered through quantitative means, participants were invited to complete a survey questionnaire. Data-collection procedures began with the distribution of 100 paper questionnaires, each with 37 items, to participants, with the help of the research team. The research team involved two local language translators. The questionnaires were handed out directly to the participants at their homes or workplaces.

Questionnaires provide a way of gathering data from respondents in a standardized way, either as part of a structured interview or through self-completion (Lewin, 2005). There are various approaches for collecting survey data, including face-to-face interviews, telephone surveys, mail surveys, web-based surveys, and household drop-off surveys. In this study, research teams helped hand out most of the questionnaires to participants in their homes, with a few at the workplaces, and picked up the responded questionnaires later. These teams were volunteers who have completed high school and are living in some of the communities I visited prior to data collection. The team members understood the culture of the project areas, spoke the local language, and also had some appreciable degree of facilitating skills. I found these volunteers with assistance from elders and health personnel from the communities.

We administered the survey questionnaire for two main reasons: first, to collect demographic details including the participant's age, gender, background, and level of education; second, to obtain general perspectives that health professionals and other people have about health literacy and information about their health, in order to select key informants for in-depth interviews. The questionnaire was also used to find the perspectives that health professionals and the general public have about health literacy.

Questionnaires usually have a combination of question types. They collect facts, attitudes, and perceptions. Lewin (2005) recommends that survey questions be as precise as possible, especially when the researcher may not be present when participants respond to the questions. In this study, items on the questionnaire were a combination of closed-ended, multiple-choice questions, scale items, and open-ended questions. In closed questions, items are a mixture of dichotomous questions requiring yes or no responses.

Multiple-choice questions had predefined responses for the respondents. Rating scales involving attitudes and perspectives on mobile phone usage were provided. These are scored ranging from “strongly agree” to “strongly disagree” on a Likert scale (see Appendix 3 for survey questions). These forms of questions provide very clear and precise responses that were quantifiable. Box 1 is samples of the survey questions. The survey questions were validated through a pilot testing in 2012 with similar characteristics of participants and communities prior to data collection.

Box 1: Samples of the survey questions

1. Have you ever sent or received health information via your cellphone?

- ☐ Yes
- ☐ No

If no, why not? _____

2. On a scale of 1 to 5, where would you place a mobile phone as a tool for searching and accessing health information? **(Please circle one)**

Excellent	Very Good	Good	Fair	Poor
5	4	3	2	1

3. Have you used any of the following to obtain health information?

	Yes	No	Don't know
Hospital/physician/nurses			
Internet (e.g., Google, YouTube)			
Friends and families			
Radio/television			
Posters			

4. Which of the following sources are you most likely to contact *first* when you have any question about your health?

- ☐ Health brochure
- ☐ A healthcare provider
- ☐ A family member
- ☐ A friend
- ☐ Internet
- ☐ An herbal doctor
- ☐ Other (*please specify)*

In this study, for example, data are collected on the following topics: demographic information; phone possession and phone usage in general; views about phone usage; views about health and health literacy; usage of phone for health activities; views about employing phone to access health information; challenges involving employing phone to perform health activities; and beliefs about access to health information.

With the research question on what constitutes activities related to health on mobile phones, and where individuals usually access health information, the questionnaire involves items such as sources of information about health, and number of times they use the device to seek information. To gather data on factors may pose challenges to the use of mobile phones, specifically to access and seek health information. Questions include the participant's age, gender, and socio-economic status (level of education, type of occupation). The survey also asks whether mobile phones are used by groups of people within a certain age range, and occupation.

Finally, to find out whether use of mobile phones to perform any health-related activities has really influenced their access to information about health in any positive way, I asked participants why and when they employ the device to perform health activities. Table 4 provides a summary of respondents surveyed in the nine communities. A summary of participants' demographic information is provided in Table 5 (see Appendix 4 for demographic information for each respondent).

Table 4
Summary of Survey Respondents

District	**Communities/number of respondents**		
Awutu Senya	Senya	Okwampa	Akrabong
	13	8	11
Kassena Nankana West	Paga	Kandiga	Kajelo
	10	9	8
Savelugu-Nanton	Savelugu	Pong-Tamale	Kanshegu,
	13	10	10
Total respondents		**92**	

Table 5
Participants' Demographic Information

Gender	Male	Female		
%	47.83	52.17		
Age group	18–30	31–40	Over 40	
%	59.8	19.6	20.6	
Current employment status	Self-employed	Civil servant	Unemployed	Student
%	14.1	31.5	31.5	21.7
Marital status	Never married	Married	Other	
%	41.3	53.3	3.4	
Highest level of education	Graduate	Secondary	Primary	No formal schooling
%	31.5	35.9	8.7	22.9

4.4.1 **Interviews**

Interview data were collected using the revised criteria of descriptive qualitative data, specifically a semi-structured interview technique. This technique was employed to gather in-depth responses from selected interviewees (see Appendix 5 for interview questions).

During the interview session, I interviewed 6 healthcare workers (nurses and midwives), 8 pregnant/nursing mothers, and 5 other individuals (including a medical practitioner, a pharmacist, and a laboratory technician), bringing the total interviewees to 19 (see Appendix 6 for detailed demographic information for interview participants). These participants were identified by their survey responses and purposefully selected from three different groups of respondents for follow up information on their survey data.

Since the study aims at inquiring about an individual's views about the use of mobile phones to promote health literacy and access health-related information, a semi-structured interview as a follow-up technique offers the ability to find out more in-depth responses (Lazar, Feng, & Hochheiser, 2010), to get the story behind a participant's experiences and views (McNamara, 1999) beyond survey data collection. Barriball and While (1994) explain that, a semi-structured technique is suitable for an exploration of the perceptions and opinions of respondents regarding complex and sometimes sensitive issues. Lazar et al. (2010) refer to this approach as opportunistic interviewing, as it offers participants the freedom to provide detailed responses to an extent that researchers are able to obtain other information that would otherwise be difficult to capture using the survey method. In addition, a researcher is able to follow up with another question after respondents have clarified their points, to obtain the needed information. Follow-up questions of this nature help the researcher to dig into the respondent's comments to gain insights and understandings. Follow-up questions open the door for in-depth and broad information on topics that may not be achieved through the survey method.

Interviewees responded to the following topics: views about health literacy; how the MoTeCH program operates; challenges with using cellphones to perform MoTeCH

activities; how cultural beliefs and practices may influence an individual's ability to access any form of health information; when and how individuals search for, and receive, health-related information; the top three health concerns for them and their family; what kind of health information individuals wish they had and would like to have; and the format in which individuals would prefer to receive health-related information. An informal conversational interview (Cohen, Manion, & Morrison, 2011) was employed as a follow-up on the survey to understand health-related information, including barriers to implementing mobile phones in health literacy.

The open nature of interviews allowed conversational focus and two-way communication between the participants and the researcher, thereby giving a researcher the flexibility to delve deeply to determine the intensity of the participant's opinions and attitudes on certain issues. In this study in particular, interviews allowed delving into: (i) the degree of awareness of mobile phone use to access health information; (ii) specifics of health-related activities that can be performed on mobile phones; (iii) particular challenges that influence attitudes to perform such tasks on mobile phones; and (iv) the reason why mobile phone devices seemed to be an emergent tool to promote health literacy in the rural areas.

All the interviews were audio-recorded to ensure that I have obtained a precise and detailed record of each participant. Interviews were conducted individually at a location such as at a home or workplace, at a time convenient to both interviewees and the researcher. I also interviewed participants who were not employing mobile devices to perform health-related activities to obtain their views about the device's future potential in mHealth.

Interview sessions lasted between 30 to 50 minutes. This duration allowed me to probe further on questions that needed elucidations.

Below are samples of the interview questions.

1. What are your views about using the cellphone to perform health activities?

   Prompt questions:

   - Have you ever used your mobile phone for any form of health-related activities? If no, why? If yes, how many times?
   - Can you share with me some of these activities?

     What are some of the ways in which mobile phones can be used to promote health literacy?

2. What are some of the factors that may influence an individual's use of a mobile phone to search for health-related information?

With the interview questions, I provide follow-up questions to probe questions that needed detailed information (see Appendix 5 for follow-up interview questions). Probing is a highly effective way to stimulate informants or respondents to provide more information. This technique encourages interviewees to say more, without the interviewer interrupting them in their narrative. According to Patton (2002), if probing is done skillfully, it may provide a lavishness of rich information that otherwise might have been missed from survey or regular straight interviews. In some circumstances, probing may disclose particularly fascinating information that leads to a new line of questioning. There are several probing techniques such as The "Tell-Me-More", The Echo, and The Silent probes (Patton, 2002). This study basically utilized all three probing techniques, where respondents were asked to elaborate on their statements. To break the monotonous

conversation to allow respondents to pause a little and think about their next statement, the researcher/interviewer asked another question. This process results in a flow of rich and insightful information that otherwise would not have been shared. I exploited the echo probe whenever I felt much interest in the story respondents were telling by repeating the last phrase a respondent makes. The echo probe, according to Patton (2001), asked questions such as, "How does this process occur? Then what next?," for instance, when respondents are sharing how they obtain health information in their communities. So I asked them how they obtained health information, and what they do with the information they receive, using face-to-face interviews questions.

Here is a summary of data sources:

Surveys	➢ Healthcare workers (21) ➢ Pregnant and nursing mothers (30) ➢ General public (Individuals who are either employing or not employing cellphones to perform health-related activities in the community) (44) Total – 92
Interviews	➢ Healthcare workers (6) ➢ Pregnant and nursing mothers (8) ➢ Others (5) Total – 19

4.4.2 **Pilot study**

Before the survey began, a pilot study was conducted in Ghana in 2012 to test the questions. I selected ten participants with similar characteristics in terms of level of education and health needs from two communities in the Central and Greater Accra regions of Ghana. I informed respondents about my study and the reason for piloting the

questions before carrying out the main study. Piloting the questionnaire provide the opportunity to revise questions that were misleading or difficult to understand, especially for individuals with a limited level of education. In addition to that, piloting it improved the clarity of the survey questions and the design and style of presenting the questions. The pilot study allowed me to include other information that was useful for clearer and detailed findings. After responding to the questionnaire, I analyzed the data in line with my research questions.

Plowright (2011) suggests that if participants for the pilot study are different from that of the main study, then it would be advisable to treat it as a separate study. Although selected participants for the pilot study had similar characteristics to the main population, I did not include findings from the pilot study in the main research study. Rather, the process made data collection and analysis of the main study more accurate and efficient by revealing needed alterations to the survey questions through: (a) clarifying terms in the questions; (b) adding questions; (c) modifying data-collection methods; and (d) finding out whether the questions were understandable and simple to follow.

4.5 Validity, reliability, and study triangulation

This study aims at exploring the existing potential use of mobile phones to promote health literacy and access to information about the health of individuals in order to improve healthcare delivery systems among people living in rural communities.

Golafshani (2003) states that to ensure reliability in qualitative research, checking trustworthiness is crucial. Trustworthiness in a research study, according to Seale (1999), “lies at the heart of issues conventionally discussed as validity and reliability” (p. 266). Giddings and Grant (2009) add that data and research validation may be influenced by

the selected methodology and methods. In this study, multiple triangulation approaches are employed—methodological, environmental/geographical, and data-collection triangulation—to attain comprehensive views and perspectives on the use of mobile phones to access health information, using a mixed-method approach. Creswell and Miller (2000) define triangulation as a validity procedure, where researchers look for convergence among multiple data and among different dimensions of information to form themes or categories in a study. Olsen (2004) adds that employing triangulation in a research study increases the wider and deep understanding of the study.

Mitchell (1986) defines methodological triangulation as the use of more than two methods in studying the same phenomenon under investigation. In this approach, triangulation is done "across or between methods," whereby data from the survey method was triangulated with interview data. For instance, survey results on sources of health information are compared with those of interview data to see if similar results are found.

The study is conducted in three different locations/regions with three different groups of individuals. The next triangulation approach is environmental triangulation. In this approach, findings from each location are triangulated with each other to find out whether location, cultural difference, and different groups of people in terms of geographical location and type of employment influence an individual's access to health information.

4.6 Data analysis

In this study, quantitative and qualitative data are analyzed using the *QUAN\qual* sequential mixed-methods typology (Plano Clark, 2005). Onwuegbuzie and Teddlie (2003) term this form of analysis as an embedded design where qualitative data are

employed to explain quantitative data. They added that this analysis provides *data representation* and *legitimation*. In other words, sequential quantitative–qualitative mixed method helps a researcher to extract adequate information from the data in order to increase the trustworthiness of the data.

Integration of both quantitative and qualitative data into a coherent whole is one of the pivotal points of mixed-methods research. Creswell and Plano Clark (2011) state that the key data-analysis decision in mixed-methods design involves how to use and when to incorporate the *secondary* (qualitative) data into the *primary* (quantitative) data. Data integration was done at the discussion stage, where both quantitative and qualitative data were *aggregated* and *synthesized* to explain the findings. In this study, quantitative data were chosen as the primary dominant data, whereas qualitative data (semi-structured interviews) were used to illustrate the findings from the quantitative data, and to compare and contrast results. The rationale for employing this approach is to complement and develop data results (Greene, Caracelli, & Graham, 1989) to clarify or expand on quantitative findings. Soy (1997) views this approach as useful for verifying and supporting claims by triangulating information from data sources.

4.6.1 **Quantitative data analysis**

Several general procedures and approaches for analyzing mixed-methods data have been proposed by various researchers (see, for example, Caracelli & Greene, 1993; Creswell & Plano Clark, 2011; Onwuegbuzie & Teddlie, 2003; Plowright, 2011). In this study, I adapted the stages of analysis from Creswell and Plano Clark for the quantitative data analysis. This analysis involves five stages.

The first stage encompasses the process of preparing data for analysis and testing the integrity of the data by performing validity checks. These include: (a) coding/ converting raw data into scoring by assigning numeric values to each response; (b) preparing data for the computer program (SPSS software) analysis by making sure each numerical value corresponds to a given response; (c) entering all the data with their corresponding numeric values into the SPSS database; and (d) cleaning data entry errors from the database by checking for double/wrong coding and recoding new variables when necessary.

The second stage involves conducting descriptive analyses for each question. This is the stage where the researcher develops a preliminary understanding of the data by running series of descriptive statistics, such as mean and median, to conceptualize and visualize general trends in data distribution (Creswell & Plano Clark, 2011). Through the preliminary examination of the data, I was informed of: (i) the type of descriptive analysis to employ; and (ii) the appropriate statistical tests to use in addressing the research question. For instance, examining the association between education, age, and marital status with an individual's likelihood of employing a mobile phone to perform activities related to health appear appropriate for my study. As part of the research questions, the study aimed at exploring systems or sources of obtaining health information, as well as factors that may influence an individual's ability to obtain information from such sources. To answer the questions, descriptive and bivariate analyses are employed to examine respondents' sources of health information and the predicting factors for employing the device in performing health-related activities.

The third stage comprises representing the data. Data representation in this study involves denoting results of the analysis in summary tables or figures through the exploration of various categories and the relationship between these categories. To do that, *a cross-tabulation* approach is provided to produce contingency tables—in visual form for categories such as individual demographic information, level of education, and health activities performed using mobile phones. Barnes and Lewin (2005) caution that if a study explores any differences or relationships between variables, it is imperative to know the kind of differences or relationships the study aims to explore. In this study, the following relationships and differences were of interest: (a) the relationship between: (i) level of education and source of health-related information, and (ii) duration of phone usage, and the potential use of phone to perform health-related information; and (b) the difference between gender and source of health-related information.

In the fourth stage of the analysis, logistic regression is conducted using *complimentary log-log link* function to generate a bivariate and multivariate table in examining the relationships and differences between variables. For instance, multivariate analysis is conducted to ensure that the relationship between the dependent variable and the independent variables is not due to chance; and also to ascertain whether the independent variable really affects the dependent variable in order to estimate the magnitude of its effect, if there was any (Allison, 1999). This form of analysis allows certain variables to be analyzed in detail, for instance, comparing variables such as marital status and the first likely contact for health-related information. Consequently, the researcher is able to tell which variables either decrease or mediate the effect of a particular predictor on the dependent variable. In doing this, the researcher employs both

ordinary least squares (OLS) and logistic regression analyses based on the nature of the dependent variables. In addition to regression analysis, a non-parametric technique employing the *Pearson chi-square* test is employed to examine the relationship and differences in age, gender, and the type of health information they access, the level of education, and the source of health information. The technique is also more robust and less sensitive, which makes it very straightforward to apply. The non-parametric technique typically uses ranking of data to compare groups such as individuals' levels of education and the likelihood of evaluating information accessed.

The fifth stage is the stage for the interpretation of data (Creswell & Plano Clark, 2011). This stage, according to Creswell and Plano Clark, is the crucial moment of the study where a researcher needs to pause and step back from the results to make meaning out of them based on the literature review and the research questions. I compared what was found in the study with related studies as well as personal experience, with mobile phone usage based on level of education, marital status, and age.

In line with sequential explanatory design, specifically the collection of quantitative data first and followed by qualitative data, quantitative data was first analyzed followed by qualitative data. Whereas the sequence of quantitative followed by qualitative data offers a general understanding of the research problem and for data collection, quantitative followed by qualitative enables purposeful sampling for qualitative and analysis of data (Creswell, Plano Clark, Gutmann, & Hanson, 2003). Views gathered from participants offer explanations of quantitative results (Tashakkori & Teddlie, 1998) in the qualitative analysis. Further, since the study addresses questions that are best answered with a mixed-methods approach, I find it more useful interpreting

the results in a more detailed manner by looking through quantitative results and qualitative findings to draw “inferences” and “meta-inferences” (Teddlie & Tashakkori, 2009) from both results.

4.6.2 **Qualitative data analysis**

According to Hendricks (2009), the process of analyzing qualitative data starts with an interview transcription. In this study, I employed two main stages of analysis. The first stage entails preparing data for transcription and analysis. This includes: (a) organizing audio-recorded data for transcription (Fenton, 2006); (b) transcribing audio-recording verbatim into text; and (c) preparing data for analysis with the computer software program (Weft QDA). To begin with, all the audio-recorded interviews with individual participants are transcribed verbatim. Patton (2001) notes that, the challenge with qualitative analysis lies in making sense of the data.

The second stage of analysis involved exploring and analyzing qualitative data. In this process, I read through all the transcribed data from both the interviews to develop a general understanding of the data. As I read through the transcripts, I begin to annotate the transcripts in the margins with my notes. Most of these notes are adapted from phrases and excerpts from participants’ responses, with few newly composed phrases. These notes become the first important step in developing analysis codes, which are the core of qualitative data analysis. Creswell and Plano Clark (2011) define coding to be “the process of grouping evidence and labeling ideas so that they reflect increasingly broader perspectives” (p. 208). Once all the codes are developed, they become statements for the Weft QDA database. These statements allow me to group similar subthemes along with the research questions. Shank (2002) calls this form of analysis *thematic analysis*. I

assign labels to the generated codes and group all similar codes to form themes or categories. Once the emergent themes and categories were established, the software program was employed to relate research questions and findings to current literature. In addition, findings from qualitative data were employed to explain results from quantitative findings.

4.7 Ethical considerations

This study involved both survey instruments and semi-structured interviews. After obtaining ethical approval from Western University, a copy of the form was sent to the participating communities and relevant government agencies. I began the process of interacting with individuals to select my participants. All research participants were fully informed of the research purposes through both verbal and written communications, and informed consent was obtained from selected participants. Participants were made aware that they may withdraw at any time during the research process. Before proceeding with any voice recording for the interview session, participants signed consent forms. Participants were also made aware that they were not obliged to respond to every question, and could leave the study at any time. Each respondent was asked to select pseudonyms to ensure confidentiality during data analysis. Only willing participants were interviewed.

In communities where I noticed speaking in the local dialect was predominant, I went with a translator to assist with the interview session. At the end of every interview session, the research assistant handed me all the recorded audiotapes, which I kept under lock and key in a cabinet in the house where I resided after returning from the field. All information collected for the study is kept confidential. A list was generated with

participants' self-selected pseudonyms during face-to-face interviews. The list that matched pseudonyms and actual names was kept separate from the data in a locked file.

Prior to collecting the research data, I met with directors (mayors) of the three districts, including health directors in each of the three selected districts, to introduce myself, the research study, and ask for an official permission to conduct the study in the respective communities. I also requested for the necessary assistance such as obtaining an interpreter to assist with language translations. The meetings were held within the first week of my arrival. After obtaining permission, I visited the communities to interact with some of the community members, after which all potential participants were informed about the research purposes by being handed copies of the letter of information and consent forms (Appendices 1 and 2) for both survey and interview participants. After explaining participants' rights and roles in the study and that their participation was voluntary, those who were interested in participating were asked to sign consent forms. Before beginning with both the survey and interview data collection, I reiterated the purpose for the study to each participant. Interview procedures were explained, and each participant was assured that everything would be confidential, as outlined in the letter of information. To ensure confidentiality, all respondents were advised to select pseudonyms, which were used during data analysis. In addition, interview participants were informed that they were not obliged to respond to every question, and could drop from the interview at any time that they wished. Only willing participants were interviewed.

Chapter 5

5 Presentation of findings and data analysis

This chapter presents the research data and analyzes both the survey and transcribed interview data using SPSS software for survey and Weft QDA software respectively. The study examines the potential use of a mediating tool—mobile phones—to achieve an outcome, specifically to promote health literacy and access to information about individuals' health in order to improve health care among people living in rural communities. The study aims to achieve the following objectives: (i) examine participants' views about health in general; (ii) explore how participants employ mobile phones to obtain, evaluate, and use information about their health; (iii) identify factors that may support or hinder employing mobile phones to obtain information about their health; and (iv) inquire about the impact of employing mobile phones to perform activities related to their health in remote and isolated communities in sub-Saharan Africa. The study, to use the language of activity theory framework, respectively focuses on: (a) individual users' views about health in general; (b) the division of labour around use of mobile phones to access health information; (c) the rules and systems for accessing health information; (d) various activities they perform on their mobile phones, including health-related activities; and (e) the outcome of the mobile phone as a mediating tool in health literacy.

To achieve the five objectives of the study, I pose research questions about: (a) perspectives that people have about information that relates to their health, the subject's perspectives; (b) existing media used for obtaining information related to their health, mobile phone, and other mediating tools; (c) the types of health-related activities

performed using mobile phones, part of the runaway objects; (d) factors that influence employing mobile phones in activities related to their health; and (e) the impact of employing mobile phones for activities related to their health in remote and isolated communities in sub-Saharan Africa.

This chapter presents research findings from survey and interview data. In this chapter, I organize the research findings by the research questions. For each research question, there were emergent subthemes. Findings from both quantitative and qualitative data are sequentially presented. First, summary findings in the form of statistics of participants' demographic characteristics and phone possession are presented for the quantitative data. The same is done for the qualitative data.

5.1 Quantitative findings and data analysis

In this part of the analysis, quantitative analysis was carried out to provide responses found in the data collected and as the participants responded to the research questions.

Survey questions ask how community members such as healthcare personnel and MoTeCH agencies assist subjects to apply the rules of calling, sending, and receiving SMS to access information about health in order to promote healthy living—the outcome. Other questions involve challenges with employing the device to access and obtain health-related information. Themes established in the interview data were modified to form the theme for the analysis. Generally, descriptive analyses were used to highlight percentages associated with both dependent and independent variables. Where the researcher sought to establish an association between dependent variables and independent variables, first, a bivariate analysis was run on those dependent and

independent variables, using either chi square, ordinal least squares, or logistic regression. This was followed by running multiple regressions to highlight all the predicting variables that had a significant relationship with the dependent variable. This process allowed the researcher to develop a parsimonious model where only a few (significant) variables were selected at the descriptive level in order to analyze high dimensional data.

In this section of the chapter, I highlight how descriptive, bivariate, and multivariate analyses were done to assist in addressing the research questions. I organize it by sections that relate to the research questions. First, I present a summary of participants' responses to two questionnaire items: demographic information and mobile phone possession and usage (Table 6).

Table 6
Descriptive Statistics for Respondents' Demography and Possessing a Mobile Phone, in Both Frequencies and Percentages

Participants' demography and phone possession	**Frequency**	**Percentage**
Sex		
Male	44	47.8
Female	48	52.2
Age group		
18–30	55	59.8
31–40	18	19.6
Over 40	19	20.6
Marital status		
Single	38	41.3
Married	49	53.3
Formerly married	5	5.5
Level of education		
Graduate	29	31.5
Secondary	33	35.9
Primary	8	8.7
No education	22	23.9

Employment status		
Unemployed	11	12.0
Self-employed	30	32.6
Civil Servant	29	31.5
Student	20	21.7
Number of mobile phones owned		
1	71	77.17
2	19	20.65
3	2	2.17
Total number of mobile phones in a household		
1	5	5.4
2	21	22.8
3	13	14.1
More than 3	39	42.4
Duration of mobile phone usage		
Less than a year	19	20.88
2 years	17	18.68
3 years	13	14.29
4 years	6	6.59
More than 4 years	36	39.56
Amount spent per week to purchase phone credit		
GH¢ 5	49	53.85
GH¢ 10	21	23.08
GH¢ 15	6	6.59
More than GH¢15	2	2.20
Other (Less than GH¢ 5)	13	14.29

Note: Data source: Fieldwork 2012.

Among respondents, the proportions of males and female were nearly equivalent (47.8 percent and 52.2 percent, respectively). The percentage distribution on mobile phone possession shows that a slightly greater percentage of the respondents (52 percent), who owned phones, were females, with the rest (48 percent) being males. In terms of the number of phones owned, 77.17 percent owned one mobile phone, 20.65 percent owned two phones, and 2.17 percent owned three mobile phones, each with a different service

provider. Concerning phone duration, 20.88 percent of the respondents have had a mobile phone in their possession for one year, 18.68 percent for two years, 14.29 percent for three years, 6.59 percent for four years, and 39.56 percent for more than four years. With respect to money participants spent to purchase top-up credit for their mobile phones per week, the results show that a greater percentage (53.85 percent) of the respondents spend 5 Ghana cedis (GH¢) on recharging their phones, 23.08 percent spend GH¢ 10, 6.59 percent spend GH¢15, 2.20 percent of the respondents spend much more than GH¢15 per week to purchase top up mobile phone credit, and 14.29 percent spend less than GH¢ 5 per week.

Overall, there is an almost equal distribution of phones among male and female participants, and all participants owned a phone, with 22.5 percent owning more than one phone. Also, more than half of the participants had owned a phone for more than three years, and the money spent on phones credit per week on average was 3 CAD dollars.

5.1.1 **Types of health-related activities performed on mobile phones**

The study examines what constituted activities related to health for which mobile phones were used. On the descriptive statistics level, four key pointers (Table 7) were reported by the respondents. On the survey, I asked participants to indicate which of the health activities they performed using phones. Common information activities related to health that participants used mobile phones for consisted of making medical appointments at the hospital, finding information about a health concern, and looking for a medical doctor or a nurse. One other activity, which was not originally indicated on the list, but commonly came up as “other activities,” was the sending or receiving of health information through mobile phones.

On the bivariate level, independent variables such as education, age, and duration of phone usage were run to find out whether there is a significant relationship with the dependent variable, health-related activities performed on cellphones. In addition to descriptive and bivariate analyses, linear regression models are computed on various variables to predict their influence on phone usage for activities related to their health.

Table 7 displays some of the health-related activities that participants perform on their mobile phones, and various predictors for using the phone for health activities.

Table 7
Sample Characteristics of Selected Dependent and Independent Variables (N=92)

Dependent Variable	**Percentages**
Ever used phone for receiving/sending health information	
No	47.19
Yes	52.81
Ever used phone for medical appointment	
No	77.78
Yes	22.22
Ever used phone for health concerns	
No	51.11
Yes	48.89
Ever used phone for contacting medical doctor/nurse	
No	71.91
Yes	28.09
Independent Variables	
Education	
No Education	23.91
Primary	8.70
Secondary	35.87
Graduate	31.52
Age	
18–30	59.78
31–40	19.57
Over 40	20.65
Duration of phone use	
Less than 1 year	20.88
1–3 years	18.68
More than 3 years	60.44
Limited information source	
No	26.14
Yes	73.86
Lack of electricity	
No	41.86
Yes	58.14
Lack of funds	
No	42.53
Yes	57.47

Note: Data source: Fieldwork 2012.

This table indicates that 52.81 percent used their phones for receiving or sending health information, 48.89 percent specified they used the phone for health concerns, 28.09 percent used phones for looking for medical doctors/nurses, and 22.22 percent of the respondents reported using the phones for medical appointments.

Table 8 presents the results of bivariate analysis that indicates a significant relationship between some independent variables and the dependent variable on use of phones for receiving/sending health information.

Table 8
Bivariate Analysis of Phone Usage for Health Information Activities and Predictor Variables (N=92)

Independent Variables	**Co-Efficient**	**P-Value**
Education (no education)		
Primary	0.44	0.39
Secondary	1.06	0.00***
Graduate	2.36	0.00***
Age (18–30)		
31–40	0.28	0.51
Over 40	1.16	0.00***
Duration of phone use (less than 1 year)		
1–3 years	-0.15	0.76
More than 3 years	1.16	0.00***
Limited information source (no)		
Yes	-0.84	0.03**
Lack of electricity (no)		
Yes	-0.83	0.01**
Lack of funds (no)		
Yes	-0.63	0.06*

Note: ( ) = Reference Categories; Level of significance *p < = 0.1, ** p < = 0.05 & ***p < = 0.01
Data source: Fieldwork 2012.

On the bivariate level (Table 8), all the independent variables, such as age and education, have a significant relationship with the dependent variable such as ever used phone for receiving/sending health information. Whereas the level of education, age group, and duration of phone use have a positive relationship with phone usage for activities related to health, sources of health information have a negative relationship with the usage of phones for activities related to health. Also, lack of electricity, funds, and limited information sources, have a negative relationship with phone usage for health-related information. It is surprising that lack of funds, electricity, and limited sources of health information do not have a positive significant relationship with employing the phone for health-related activities. Generally, power outages in Ghana are among the major problems that most individuals face, especially in rural communities.

The nature of the dependent or response variable is a key in determining the kind of regression models that are used. Linear regression is used when the dependent variable is a continuous or count variable showing a linear relationship between the dependent and independent variables. However, logistic regression is used when the dependent or outcome variable assumes a categorical form. This could be binary where the probability of an event occurring or not occurring is examined. The logistic regression may also be employed to examine an outcome variable that is ordered. Each one of these categorical variables, either nominal or ordinal requires a specific form of logistic regression (Agresti & Finlay, 2009). In this study, the outcome variable for Table 9—health information activities—takes the form of a continuous variable; hence, the application of ordinary least squares in estimating the parameters in a linear regression model. Hierarchical

logistic regression is not appropriate for modelling this relationship because all the data were collected on a single level—individual level.

Hierarchical linear modelling is most appropriate when controlling for ecological fallacy, such as collecting data on a community basis. Although the addition of independent variables into models could be done using a forward or backward elimination method, the study considered the significance of the variables at the bivariate level, and evidence from the extant literature as the basis for the addition of independent variables. Education and socio-economic status have been found to be correlated with the usage of phones for health-information activities and seeking health information in general (Sarasohn-Kahn, 2010; Tu, 2011). Consequently, education was introduced into the model on its own merit and as a proxy of socio-economic status. Also, access to mobile phone, access to electricity and availability of funds and information do relate to the socio-economic status of an individual; hence, their introduction into the model in Table 9. The model was, however, a parsimony, taking into consideration Babyak's rule, which calls for reducing the predictors when the sample size is smaller in order to avoid overfitting (Babyak, 2004).

Table 9 presents coefficients for linear regression models that assist in predicting the usage of phones for activities related to health, based on socio-demographic factors, as the independent variables. Model 1 estimates the relationship between level of education and age, which are independent variables, with phone usage for health activities being the dependent variable. Model 2 finds the relationship among level of education, age, and duration of phone usage, which are independent variables, with phone usage for health activities being the dependent variable. Model 3 assesses the relationship

among level of education, age, and duration of phone usage, limited information source, lack of electricity, and lack of funds, which are independent variables, with phone usage for health activities being the dependent variable.

In these three models, the factors used are socio-demographic factors—education and age; duration of phone use; and the limitations associated with the usage of phones—limited information source, lack of electricity, and lack of funds. Dependent factors are the four main variables from the descriptive level—mobile phones for making medical appointments at the hospital, finding information about a health concern, looking for a medical doctor or a nurse, and sending or receiving health-related information. These four variables are then merged to form a *continuous variable,* using principal component analysis (PCA). This continuous variable becomes the dependent variable known as *health information activities.* These variables were merged because *they speak to the same concep*t of activities related to health; with a *cronbach alpha* of 0.78, which gives the *internal consistency* or average correlation of the *dependent variable*. Consequently, the socio-demographic factors mentioned above are used in predicting the types of health-related activities performed on mobile phones.

Table 9
Co-efficients from Linear Regression Models Predicting Phone Usage for Health Information Activities (N=92)

	Model 1		Model 2		Model 3	
Independent Variables	**Co-Efficient**	**P-Value**	**Co-Efficient**	**P-Value**	**Co-Efficient**	**P-Value**
Education (no education)						
Primary	0.81	0.11	0.49	0.36	0.58	0.28
Secondary	1.37	0.00***	1.10	0.00***	1.04	0.00***
Graduate	2.36	0.00***	2.06	0.00***	2.14	0.00***
Age (18–30)						
31–40	0.59	0.10	0.40	0.28	0.29	0.43
Over 40	0.96	0.00***	0.76	0.04**	0.79	0.02**
Duration of phone use (less than 1 year)						
1–3 years			0.04	0.92	0.12	0.79
More than 3 years			0.63	0.07	0.74	0.04**
Limited information source (no)						
Yes					-0.02	0.96
Lack of electricity (No)						
Yes					-0.09	0.75
Lack of funds (no)						
Yes					-0.26	0.36
Adjusted R^2	39.25		40.85		45.76	
Constant	-1.62	0.00	-1.75	0.00	-1.54	0.00***

Note: ( ) = Reference Categories; Level of significance *p < = 0.1, ** p < = 0.05 & ***p < = 0.01
Data source: Fieldwork 2012.

The results from Model 1, on the relationship between level of education and age, suggest that compared to respondents with no education, those with secondary and tertiary/graduate education have a positive significant relationship with the usage of phone for health-related activities. This suggests that the higher the educational level of

the respondents, the greater their use of the phone for health-related activities (Graduate: b = 2.36, p < = 0.01). Also, relative to respondents aged (18-30), respondents who are above 40 years old are significantly more likely to use the phone for health-related activities (b = 0.96. p < = 0.01).

Results from Model 2 on the relationship among level of education, age, and duration of phone usage reveal that when compared to those with no education, participants having secondary and graduate education are more likely to use the phone for health-related activities (Secondary: b = 1.10, p < = 0.01; Graduate: b = 2.06, p < = 0.01) after controlling for duration of phone usage. This control resulted in a partial mediation in the existing relationship, thereby reducing the magnitude of the coefficient for participants with graduate education by 0.30. This factor of duration of phone usage also appeared to be *significantly associated* with the *usage of phones for health-related activities*. Relative to those who had used the phone for less than one year, participants who had used phones for more than three years were more likely to use the device for health-related activities.

Model 3 results show a *positive relationship* between level of education and the use of phones for health-related activities after controlling for the limitations associated with the usage of phone for activities related to health. For instance, relative to those with no education, respondents with tertiary education appeared to use phones more for health-related activities (b = 2.14, p < 0.01). On the contrary, the limitations associated with phone usage (which included limited information service, lack of electricity, lack of funds) were negatively associated with the usage of phones for information activities

related to health on all three variables. All the other variables (age and duration of phone usage) have a positive association with the usage of phones for health-related activities.

Generally, the higher the level of education, the longer one had had a phone, and the older the users, the more frequently they had used a phone for health-related activities.

5.1.2 **Existing media for obtaining health-related information**

This section examines individuals' sources of health information. First, it provides general descriptions of respondents' perceptions on searching for health information, their ability to search for health information, and likely technologies for obtaining health information (Table 10). Second, it examines summaries of predictors for employing certain systems as sources of information (Tables 11–16).

Table 10
Descriptive Analyses of Perception of Health Information and Relevant Variables on the Source of Health Information

Variable	**Percentage**
Ability to obtain relevant health information	
Poor	16.30
Fair	13.04
Good	22.83
Very Good	25.00
Excellent	22.83
Ability to assess that health information obtained is trustworthy	
Very unlikely	16.67
Somewhat unlikely	5.56
Not sure	11.11
Somewhat likely	23.33
Very likely	43.33
Likely technologies to obtain health information	

Cellphone	14.29
Television	13.10
Internet	10.99
Mobile phone, radio, and television	31.87
Mobile phone, internet, radio, and television	29.67
Ability to use mobile phone for accessing health information	
Poor	17.58
Fair	16.48
Good	34.07
Very Good	18.68
Excellent	13.19

Most of the respondents indicate that they rate their ability to search for relevant health information as Good to Excellent. In addition, 67 percent indicate that they assess whether health information they obtain *is trustworthy* before employing it to their health needs. 43.33 percent of the participants were very likely to evaluate the information compared with 16.67 percent, who indicate they are very unlikely to evaluate the information. In addition to participants' ability to look for health information and their likelihood of evaluating the information, the respondents were also asked about their perceptions on the technologies (from mobile phones, televisions, Internet, and radio) likely to promote health information and improve the healthcare system. A combination of mobile phone, radio, and television were selected by less than half of the participants, followed by a combination of mobile phone, Internet, radio, and television, with the use of Internet scoring lower than mobile phones when considered as a single entity. Also, on the *place of mobile phone for looking and accessing information,* respondents reported a higher ability (Good to Excellent) in the use of mobile phone to search for health-related information.

In order to explore the relationship between gender and sources of information about their health, participants were also asked to indicate whether they have used hospital, Internet, family/friends, radio/television, posters, and other sources to obtain health information. A cross-tabulation between gender and use of various media for obtaining information about their health is indicated in Table 11.

Table 11

Cross-Tabulation of Source of Information by Gender (N=90), in Percentages

		Gender		
Health information sources		**Male**	**Female**	**Total**
Hospital	No	7	5	12
	Yes	36	42	78
Family	No	4	6	10
	Yes	37	41	78
Internet	No	18	30	48
	Yes	**24**	16	40
Television/Radio	No	3	2	5
	Yes	40	46	86
Poster	No	4	8	12
	Yes	37	40	77
Mobile phone	No	19	27	46
	Yes	**24**	20	44

Note: All Chi square (χ^2) test showed statistically significant association with $p < 0.05$ at 95 Cl.
Data source: 2012 fieldwork in Ghana. Respondents with missing responses are not included.

From the table, whereas women participants use posters, television, and radio, hospitals, and family/friends as sources of information more often than males, the males used the Internet and mobile phones as their information sources more often than females.

A cross-tabulation that seeks to ascertain a relationship between respondents' sources of information about health and their age is shown in Table 12.

Table 12
Cross-Tabulation of Source of Information by Age (N=90), in Percentages

Health Information Sources		**Age:**		
		18–30	31–40	Over 40
Hospital	No	9	2	1
	Yes	45	15	18
Family	No	7	1	2
	Yes	47	15	16
Internet	No	28	11	9
	Yes	25	5	10
Television/radio	No	5	0	0
	Yes	50	17	19
Poster	No	11	1	0
	Yes	43	15	19

Note: All Chi square (χ^2) test showed statistically significant association with $p < 0.05$ at 95% Cl.
Data source: 2012 Fieldwork in Ghana. Respondents with missing responses are not included.

Sources of information about health vary with age. With the exception of Internet (25), close to half of the respondents in the age group 18–30 indicated they have used each of these media for accessing information about their health: the hospital (45); family (47); television/radio (50); and poster (43). Further, with the exception of Internet (5), almost all respondents between the ages of 31–40 have also used each of these media for accessing information related to their health: hospital (15); family (15); television/radio (17); and poster (15). All the respondents over 40 employed television/radio (19) and

poster (19) in accessing health information. For the age group of over 40, this was followed by hospital (18), family (16), and Internet (10).

The cross-tabular results of age and source of health information reveal the following: the Internet is not as commonly used for all participants; participants aged 18–30 and 31–40 use all other sources almost equally; the Internet is largely employed by respondents between the ages of 18–30, with individuals between the ages of 31–40 employing the Internet as the least source of information about their health. The ages between 18–30, rather than those over 40, most use the Internet for obtaining information related to their health.

There is summary data on associations between demography and use of healthcare personnel as sources of information (Table 13). The intent of learning about this association is to find out which demographic characteristics associate with each of the health activities that are performed on mobile phones.

Table 13
Summary Statistics of Predictor Variables of Sources of Health Information (Ever Used Healthcare Personally as a Source of Health Information), in Percentages (N=92)

Independent Variables	**Healthcare Personnel**
Education	
No Education	66.67
Graduate	96.43
Secondary	90.91
Primary	87.50
Employment	
Unemployed	90.00
Self-employed	74.19
Civil Servant	100.0
Student	85.00
Total	**86.67**

Note: All Chi square (χ^2) test showed statistically significant association with $p < 0.05$ at 95% CI.

The relationship between demographic characteristics and use of healthcare personnel as sources of information about health shows a consistent increase with levels of education in the proportion of individuals who obtain health information from healthcare personnel. Compared to 67 percent of the respondents with no education, 96 percent of the respondents with graduate education mention that they have received information about their health from healthcare personnel.

Again, there is a consistent increase in the proportion of individuals who obtain health information from healthcare personnel, such as doctors or nurses, when education is taken into account. In terms of employment, all the respondents working as civil servants have received health information from healthcare personnel, followed by those who are unemployed (90 percent), students (85 percent), and self-employed (74 percent).

Next, a relationship between demography and use of mobile phones as a source of health information is analyzed (Table 14).

Table 14
Summary Statistics of Predictor Variables of Sources of Health Information (Ever Used Mobile Phone as a Source of Health Information), in Percentages (N=92)

Independent Variables	Mobile Phone
Education	
No education	20.00
Graduate	72.00
Secondary	46.67
Primary	62.50
Employment	
Unemployed	22.22
Self-employed	43.33
Civil servant	76.00
Student	36.84
Age group	
18–30	49.02
31–40	26.67
Over 40	70.59
Total	**49.40**

Note: All Chi square (χ^2) test showed statistically significant association with $p < 0.05$ at 95% CI.

Similarly, respondents with graduate education use mobile phones as sources of information the most (72 percent), followed by primary graduates (62.5 percent) and then the secondary graduates (46.7 percent), while participants with no education (20 percent) least use the mobile phone to obtain information about their health. Regarding employment, the highest proportion of respondents who obtain health information with their mobile phones are civil servants, followed by self-employed (43 percent), students (37 percent), and the unemployed (22 percent). Also, the proportion of individuals who use mobile phones as a source of information about their health is higher for participants

of ages over 40 years (71 percent), compared to those between the ages of 18–30 (49 percent) and 31–40 (27 percent).

Table 15
Summary Statistics of Predictor Variables of Sources of Health Information (Ever Used the Internet as a Source of Health Information), in Percentages (N=92)

Independent Variables	**Internet**
Education	
No education	0.0
Graduate	89.29
Secondary	40.63
Primary	25.00
Marital status	
Single	60.53
Married	31.11
Formerly married	60.00
Employment	
Unemployed	44.44
Self-employed	10.00
Civil servant	75.86
Student	55.00
Do you have children	
Yes	34.04
No	58.54
Total	**45.45**

Note: All Chi square (χ^2) test showed statistically significant association with $p < 0.05$ at 95% CI.

Cross-tabular results specify that there is a consistent increase in demographic variables such as education and marital status, and use of Internet as a source of information. When education is considered, respondents who access health information from the Internet are more educated. Thus, participants with graduate education access health information from the Internet the most (89 percent), whereas participants with no

education do not use the Internet at all. In terms of marital status, participants who are single and those formerly married equally access the Internet to obtain health information (60 percent), followed by those who are married (31 percent). When employment status is considered, compared with participants who are self-employed (10 percent), unemployed (44 percent), and students (55 percent), respondents who are civil servants have the highest proportion (76 percent) with regards to accessing the Internet to obtain information about their health. Similarly, the proportion of respondents without children who access health information from the Internet is greater than those with children. The percentage of male respondents is also higher than that of females on accessing health information on the Internet.

Overall, the use of the Internet as a source of information about health is determined by an individual's socio-demographic factors, including level of education, marital status, and employment status.

Table 16
Summary Statistics of Predictor Variables of Sources of Health Information (Posters as a Source of Health Information), in Percentages (N=92)

Independent Variables	**Posters**
Marital status	
Single	75.68
Married	93.62
Formerly married	100.0
Do you have children	
Yes	93.88
No	77.50
Age group	
18–30	79.63
31–40	93.75

Over 40	100.0
Total	**86.52**

Note: All Chi square (χ^2) test showed statistically significant association with $p < 0.05$ at 95% CI.

All the respondents who were formerly married obtained health information from posters, followed by those who are married (94 percent) and those who are single (76 percent). A greater proportion of respondents who obtain health information from posters are those with children (94 percent). The results also show that the percentage of respondents who identified posters as a source of health information increased consistently from 80 percent (18–30) to 100 percent (above 40) when age is considered.

To summarize, poster use appeared to increase with age, but varies with marital status and was higher for those who had children.

5.1.3 **Factors influencing use of mobile phones for health-related activities**

Tables 17, 18, and 19 in this section indicate factors that may influence individual use of mobile phones to perform health-related activities. Three questions on the survey solicit responses on the challenges participants face when employing mobile phones to perform activities related to their health. As well, as shown in Section 5.1.3, are the results on types of health-related activities performed on mobile phones.

Table 17
Bivariate Analysis of Factors Predicting Use of Phones for Health-Related Activities (N=92)

Independent Variables	Odds Ratio	P-Value
Education (no education)		
Graduate	4.35	0.004***
Secondary	2.52	0.073**
Primary	3.41	0.059**
Marital status (single)		
Married	1.40	0.289
Formerly married	2.71	0.102
Employment (unemployed)		
Self-employed	0.68	0.448
Civil servant	1.80	0.221
Student	0.55	0.288
Do you have children (yes)		
No	1.23	0.486
Duration of phone use (less than 1 year)		
1–3 years	1.00	1.00
More than 3 years	3.15	0.018**
Ever used phone for medical appointment (no)		
Yes	4.06	0.000***
Phone service cost (GH¢)		
GH¢ 10	1.33	0.456
GH¢ 15 +	1.48	0.277
Ever used phone for sending text messages (yes)		
No	0.59	0.188*
Interested in receiving health information on your phone (no)		
Yes	2.71	0.329

Note: ( ) = Reference Categories; Level of significance *p < = 0.1, ** p < = 0.05 & ***p < = 0.01
Data source: Fieldwork 2012.

5.1.3.1 Bivariate analysis

Table 17 is about the relationship between an individual's demography and usage of phones for health-related activities. On the bivariate level, the researcher examined the relationship between each one of the independent variables and the dependent variable (usage of phones for health-related activities). From the analysis, an individual's level of education is seen to have a significant association with the usage of phone for health-related activities. When compared with individuals' with no education, respondents who have graduate education are 4.35 times more likely to use phones for health-related activities. Also, the *duration of phone usage* is considered to have a significant influence on use of the device for health-related activities. Further, respondents who have used the phone for more than three years are 3.5 times more likely to use their phones for health-related activities compared to those who have used phones for less than one year. In addition, those who have employed the device in making medical appointments are 4.06 times more likely to use their phone for health-related activities than those who had never used their phones in making such appointments. Although non-significant, the following control variables (marital status, employment status, phone service cost, and interest in receiving health-related information on phone) are reported here because of their theoretical significance on the usage of phone for health-related activities.

Table 18
Odds Ratio and P-values from Logistic Regression Models Predicting Usage of Phone for Health-Related Activities (N=92)

	Model 1		Model 2	
Independent Variables	Odds Ratio	P-Value	Odds Ratio	P-Value
Education (no education)				
Graduate	5.77	0.011**	7.76	0.032**
Secondary	4.65	0.011**	12.99	0.005***
Primary	2.88	0.126*	6.11	0.028**
Marital status (single)				
Married	25.01	0.000***	89.60	0.000***
Formerly married	26.12	0.001***	37.94	0.000***
Employment (unemployed)				
Self-employed	0.82	0.729	0.76	0.705
Civil servant	0.83	0.775	0.87	0.869
Student	0.42	0.174	0.46	0.348
Do you have children (yes)				
No	14.91	0.000***	79.49	0.000***
Duration of phone use (less than 1 year)				
1–3 years			1.49	0.653
More than 3 years			2.86	0.076
Ever used phone for an appointment (no)				
Yes			3.59	0.021**
Phone service cost (GH¢ 5)				
GH¢ 10			0.78	0.628
GH¢ 15 +			2.13	0.189*
Interested in receiving health information on phone (no)				
Yes			7.77	0.043

Note: ( ) = Reference Categories; Level of significance *p < = 0.1, ** p < = 0.05 & ***p < = 0.01
Data source: Fieldwork 2012.

5.1.3.2 Multivariate Analysis

In examining the factors that influence the use of mobile phones for activities related to health, a number of variables are found to be statistically significant. This includes socio-demographic variables such as level of education, marital status, and employment status. The analysis shows that those who have attained graduate education are 5.77 times more likely to use phones in health-related activities relative to those with no education. The multivariate analyses show a positive relationship between education and the use of mobile phones for health-related activities. After controlling for other socio-demographic variables and phone possession and phone usage for related variables, the relationship between education and the use of mobile phones for health-related activities remained the same, with an increase in the magnitude to 7.76 ($p <= 0.05$). However, secondary-educated respondents had a higher odds ratio (12.99) than respondents with a graduate education. Those married (OR-89.6, $p <= 0.001$) and those formerly married (OR-37.94, $p < 0.001$) were significantly more likely to use cellphones for health-related activities than those who are single. Also, respondents with no children are significantly more likely (OR-79.49, $p <= 0.001$) to use mobile phones for activities related to their health compared to those with children.

Further, compared to those who have used mobile phones for less than one year, respondents who have owned mobile phones for more than three years are significantly more likely (OR-2.86, $p <= 0.1$) to use the device for health-related activities. Further, individuals who ever had used phones for medical appointments are more likely (OR-3.59, $p <= 0.05$) to use phones for health-related activities relative to those who have never employed the device for medical appointments. Also, respondents who have never

used mobile phones in texting messages are more likely (OR-3.32. p < = 0.1) to use phones for health-related activities compared to those who have used the device for texting messages.

Finally, respondents who are interested in receiving information about their health on their phones are more likely (OR-7.77, p < = 0.05) to use the device for health-related activities relative to those who are not interested in receiving information about their health on their phones.

Table 19
Sample Characteristics of Selected Factors Influencing Use of Phones for Health-Related Activities (N=92)

Limiting factors	**Percentages**
Limited information source	
No	26.14
Yes	73.86
Lack of understanding	
No	47.06
Yes	52.94
Lack of funds	
No	42.53
Yes	57.47
Lack of need	
No	42.86
Yes	57.14
Lack of electricity to recharge the battery	
No	41.86
Yes	58.14
Low network connectivity	
No	14.77
Yes	85.23

Note: Data source: Fieldwork 2012.

In addition to the factors associated with the usage of phones for health-related activities, a descriptive analysis of the limiting factors associated with the use of phones

for sending and receiving information on health were analyzed. These include: (i) limited information source, lack of understanding of phone usage; (ii) lack of funds in the purchase of air time; (iii) lack of need for a phone; (iv) lack of electricity to recharge the phone battery; and (v) low network connectivity. In all cases, the results show a majority of the respondents facing such challenges. For instance, 73.86 percent of the respondents show they have limited information source, 52.94 percent report that they lack understanding of the usage of phones, 57.47 percent indicate lack of funds for the purchasing of air time; whereas 57.14 percent report the lack of electricity to recharge their phone batteries, and 85.23 percent indicating the challenge of low network connectivity (Table 19).

5.1.4 **Perspectives about information that relates to health**

In examining health professionals' and other people's views about information that relates to their health in Ghana, respondents' beliefs about health and health literacy are analyzed on several variables (Table 20). This is done by employing SPSS to the descriptive on variables such as practising family planning and going for regular check-ups.

Table 20

Perspectives of Health Literacy by Respondents (N=92)

	Percentages
Being health literate involves:	
Practising family planning	
No	22.09
Yes	77.91
Going for regular check-ups	
No	4.44
Yes	95.56
Reducing drug abuse	
No	9.30
Yes	90.70
Taking proper medication	
No	8.24
Yes	91.76

Note: Data source: Fieldwork 2012.

From the descriptive analysis, variables that emerged out of the study for an individual to be considered as health literate were the practice of family planning, going for regular health check-ups, the reduction of drug abuse, and taking proper medication. From Table 19, out of the 92 respondents surveyed, 77.91 percent reported practising family planning as one of the indicators for health literacy; on the other hand, 22.09 percent did not consider the practice of family planning as being health literate. Also, the majority (95.56 percent) were of the view that going for regular check-ups implied a person is health literate. Further, 90.7 percent and 91.76 percent were of the view that the reduction of drug abuse and taking of proper medication, respectively, served as a health-literate person. This notwithstanding, there were a few (on the average 11.02 percent) who did not agree with these perceptions.

In order to examine the impact of employing the mobile phone to perform health activities, the researcher inquired of participants their views about the importance of being health literate. Findings reveal respondents' views about the importance of obtaining health information (Table 21).

Table 21
Obtaining Relevant Health Information (N=92)

	Percentages
Does ability to access and employ relevant health information:	
Reduce family pressure and stress?	
No	8.50
Yes	91.46
Promote healthy lifestyle?	
No	4.55
Yes	95.45
Improve understanding about health?	
No	2.27
Yes	97.73

Note: Data source: Fieldwork 2012.

In reporting on the significance of respondents' ability to obtain relevant health information, participants indicate that access to relevant health information reduces family pressure and stress (91.46 percent), promotes a healthy lifestyle (95.45 percent), and improves understanding about health (97.73 percent).

5.2 Qualitative findings and data analysis

The interview questions are used to further explore and expand upon what was found in the survey data concerning views about employing mobile phones to promote health literacy and access to health-related issues. Pre-existing categories from the interview questions were employed to form themes for the analysis. To make reporting of findings more manageable and brief, research questions were employed as the main

themes, with emerging themes being the subthemes. These subthemes were created using Weft QDA software to categorize similar responses from the interviews data.

These themes for the analysis were: (a) types of health-related activities performed on mobile phones; (b) existing media for obtaining health-related information; (c) factors that influence employing mobile phones in health; (d) perspectives about information that relates to health; and (e) impact of employing mobile phones for health activities.

5.2.1 Designation of participants interviewed

As indicated from the previous chapter, participants for the study were selected from three main groups of individuals. The first group entailed healthcare personnel and other individuals who were not involved in the MoTeCH program. These involved:

- Asare – a general medical practitioner at one of the hospitals in Ghana
- Edward – a pharmacist at one of the hospitals in Ghana
- Lartey – a laboratory technician at one of the hospitals in Ghana
- Alice – self-employed
- Clement – a student

The second group involved healthcare personnel—midwives and nurses—participating in the implementation of the MoTeCH program in designated hospitals in the regions. These were made up of:

- Midwives – Allison, Efiba, and Fatima
- Nurses – Emelia, Fausty, and Kafui

And the third group comprised selected mothers—nursing and pregnant mothers— from the nine communities in regions, who were enrolled in the MoTeCH program implementation. These involved:

- Nursing mothers – Aba, Adisa, Grace, Jane, Maggie, and Melissa
- Pregnant mothers – Mary and Martha.

Having provided summaries about participants interviewed, the next section analyzes data gathered during the interview session using both pre-existing categories from research questions, and subcategories emerged from the interview data.

5.3 Health-related activities on and with mobile phones

It may be recalled that the main aim of this study is to inquire about participants' views on the use of mobile phones as a tool for promoting health literacy among individuals living in rural communities. To achieve this objective, the researcher asked participants questions on the general views about mobile phone usage, as well as the device's usage for accessing health information.

It was revealed during the interview session that participants perceived the device as a useful tool that has come to close both distance and information gaps between individuals and healthcare providers and between those with easy access to health centres and those without. Aba, Efiba, Martha, and Mary view the device as a useful tool for obtaining information and receiving assistance during emergency situations. For instance, Efiba notes:

> Cellphones help us in various ways... you can be reached at work for urgent or important information... you can call and find out how your family is doing, without necessarily travelling to the place."

Martha adds:

> Maybe you were sleeping at night and you happened to fall sick... you can use the phone to call your sibling or any friend [of yours] to come to your aid... I experienced this sometime ago when I suddenly had a heart attack in the night, but managed to call a friend, and that saved my life.

This is not different from how Melissa perceives the device. “It’s easy to share information on it, especially if the person is far away from your location... in the villages, if there is any emergency, a person can use the phone to call the hospital for help.” Edward indicates that “the phone is basically what I use to relate to other people I cannot physically see... and also to give out information about meeting with people, programs, reminders, and other things.”

Inquiring about participants’ perspectives on usage of mobile phones in health, it appears that quite a number of participants view the device as a tool capable of transforming both healthcare deliveries in general and an individual’s access to healthcare services specifically. Fatima states that “patients can sit in their houses and text or call a healthcare worker to find out something about their health... if they need any advice, then we give it to them on the phone. So I think it’s good.” Thus, with the help of social groups, institutions, and agencies such as MoTeCH and healthcare personnel, participants are able to obtain information about their health, such as how to handle diarrhea. Fausty observes that the device has improved healthcare delivery:

> The cellphone usage lessens our work, even though we do compound visits every morning, it’s not every time that we can visit the whole community on a daily

> basis… but let's take for example, a pregnant woman defaults by not attending antenatal clinic for a day, we can find out what happened to her.

Participants enrolled in the Mobile Midwife Service program, a second of the health agencies indicate that they receive different types of information on their mobile phone, such as taking proper diet, how to care for themselves during pregnancy, items needed on the day of delivery, reminders of upcoming medical appointments for themselves or their babies. Aba, for instance, expresses how she finds the program helpful:

> When I came to the hospital, the nurses collected my number and told me the computer will call and give me information about my pregnancy. So the computer called and said if I haven't taken my tetanus injection, I should go for it, so I came for my first injection. It also said I should stay away from sweets and any food that contains sweets.

Edward uniquely finds the device to be a useful tool for scrutinizing importation of counterfeit medications:

> I know that there is a gentleman called Bright Simoons [sic] who introduced this, em... mPedigree software for checking counterfeit drugs, where you send a code on the drug through an SMS to verify the authenticity of the drug. I know the United States FDA has even bought the software... they see how useful it can be to check for counterfeit medication…, now that people are moving away from narcotic drugs into counterfeit medications as it's less risky. The jail term is much lower..., whereas narcotic drug can give you five years in jail, counterfeit

> medication you get maybe a three-year jail term. So many of them are now moving from narcotic business into counterfeit trades.

Although Lartey finds the device useful in health, he seemed to somewhat skeptical about its usage in health because, mostly, he argued the interest of one looking for the information may not be there.

> I think most people are just interested in using the cellphone to inquire if their laboratory results are ready... not interested in using it for any [other] health activities... It's the interest... they are just not interested in health issues.

In relation to health-associated activities that participants perform on mobile phones, participants with enthusiasm talked about the number of things they were able to use the device to accomplish. Rules in terms of calling and sending SMS, using the mobile phone to perform health activities—division of labour—ranged from scheduling medical appointments to inquiring about further information or clarifying information before diagnosing a patient. When participants were asked to share with the researcher some of those activities, Edward indicates that he usually uses his phone to clarify a prescription before dispensing the medication. He adds, "If you have a patient with you and there is an issue or a condition that you need a quick clarification on, you can use your phone to do that [clarify with the patient's doctor]...." Others also use the phone to clarify the prescriptions before handing it over to the patient.

Asare stated:

> If you have any concern, there is a phone number you could call and obtain information. For example, you may be at the theatre, operating on a client, then all of a sudden, an emergency situation happens, you just call a consultant on phone.

> Let's say, it's a gynaecological case, we just tell one of the nurses to call a particular gynaecologist on the phone, then you describe the situation and what you have done so far, then he [would] advise you as to how to go about it.

In addition, some participants note that the device is employed to send mass SMS to community members about a new medication being launched. According to Edward,

> Oh, like… in an outreach program, you know... if a drug is going to be launched on the Ghanaian market, the company sends messages on the Internet, televisions, and mobile phones to create awareness... some also use the cellphones to browse the Internet and check their emails.

Lartey, on the other hand, is not performing many health-related activities on his phone:

> Because it's expensive [to do so], and moreover, I have a computer... the handling of the phone to seek information is complex... the screen size, scrolling it up and down and all that, and the size of the information, you don't get it easily... the network too is not good.

Responses given by the respondents who are enrolled in MoTeCH are similar to those of the nurses. Fausty briefly states that "the motive of MoTeCH when it started was to improve the health service, especially in the rural areas." Efiba adds:

> The system is set in such a way that each client receives either a text message or a phone call once a week from the computer, informing her about her pregnancy status, next antenatal visit, date for tetanus injection, type of food to eat, and other similar information.

As stated earlier on in Chapter 1 regarding the aim of the program, through the MoTeCH program, pregnant women and nursing mothers were receiving health

information related to their pregnancies and the children's health from the MoTeCH server. The information was given in various languages of their choice including English, Senya, Kassim, and Nankam, which made it easy for mothers to understand in order to encourage them to make health-seeking options. This information ranged from taking recommended vaccinations during pregnancy and childbirth to maintaining proper nutrition. Jane, who has just completed the program, indicates:

> I think the program is a good idea and a new way of getting more information about health… it's not every information about health that you can obtain from the hospital, and when you receive the information, you can share with others... so I think it's very good.

During the interview session, I had a series of conversations with participants who were enrolled in the MoTeCH program, one of the health agencies, to inquire how they used the phone in the program. These inquiries include how the program: (a) calls to give information; (b) offers advice on your pregnancy; and (c) reminds individuals about their next medical appointment.

Jane, one of the mothers, indicates:

> The computer tells me to eat good food in order to be healthy... I shouldn't engage in hard labour... I should stretch my legs so that they are at the same level when am sitting. Em, when you're approaching your delivery period, the computer gives you information on items needed for delivery such as Dettol, baby's clothing, a bucket, and soap.

Mary explains the reason for stretching their legs: "The computer tells us that when we rest our legs on the pillow whilst sitting gives us easy blood flow to prevent numbness."

Adisa and Mary also note that they receive information about the kind of food to eat as pregnant women. For instance, Adisa states that "the computer tells us to eat food items such as eggs, fish, pumpkin seeds, kontomire (spinach), and others." In addition to the food item, Mary adds that "they also teach me proper baby-handling techniques so I would know how to go about it when I give birth."

Emelia and Martha note proper handling techniques to include how to feed, wash, and put the baby to sleep. Martha states, "I should put my baby under mosquito net when she is sleeping to avoid being bitten by mosquitoes… When I'm giving her porridge, I should add eggs or groundnut paste [for a protein source]." Emelia adds, "I have been receiving very usefulness baby-handling information… if someone wants to carry the baby, we should make sure that person's hands are clean due to various outbreaks of diseases such as cholera and typhoid."

Other participants indicate they receive information about taking good care of themselves and their family. Grace, a mother, talks more about the need to take good care of *themselves*:

> …for example, the computer tells me how we can take care of ourselves so that we don't get sick… when we are not feeling well, we shouldn't stay at home, but we should go to the hospital for a check-up. The reason is that when we stay at home, the sickness becomes worse and difficult to treat. They'll also tell us how to clean our environment so that we don't fall sick… they teach us those things.

In summary, Fatima indicates, "The aim of the program is to offer health education to people, especially pregnant and nursing mothers… when we interviewed some of the women, they confirmed that the program has really been helpful to them."

The interview also inquired from participants the kind of health-related activities they perform on their mobile phones. Kafui, a nurse, indicates that apart from calling and texting, "…I also go on Facebook... sometimes I read news online." Allison responded, "I remember I bought a drink and decided to read more about the ingredients, so I went online and read a lot about it… Also, if I read something about health and I want to understand it better, then I go online to find more information." Emelia also states, "Sometimes I use it to look for information about health."

After these inquiries moved to inquire about various media, respondents employ them to obtain health information needs in general. The next section examines these media in detail.

5.4 Existing media for obtaining information about health

In order to find out about various media that participants employ to obtain health information, participants are asked questions in relation to: when they look for health information; whether people seek information based on age or gender. As a way of appreciating why respondents obtain information from a particular source, the researcher also inquired about other means of receiving health information. Additionally, in order to find out whether participants have a preference when it comes to an information source for obtaining health information needs, the researcher inquired where participants first go when they have health issues. In order to be able to understand various health activities that are performed using a mobile phone, the researcher asked respondents about their top three health concerns. Below is how participants responded to the subquestions.

5.4.1 When do people look for health information?

Participants shared their views on when they usually look or search for health information. The circumstances under which participants who are not working in the medical field seek information about health, the object of the activity system under study here includes when there is illness in the family or when they need additional information on a health topic. For instance, Alice and Melissa state that they only look for health information when they or any member of the family is not feeling well. Melissa adds, "If I hear something about health, like HIV/AIDS, hepatitis B, on the television and would like to know much about that kind of sickness, I'll go to the Internet and read about it… HIV/AIDS and hepatitis B are deadly diseases." This differs for the medical practitioners: Asare, Edward, and Lartey, on the other hand, note that by virtue of their work, they look for health information all the time. Edward explains, "Because of where I find myself… I don't wait for a situation to arrive before I begin searching for information."

In summary, most participants seek or access health information when needed. Information sought on a regular basis is mostly done by participants who are in the medical fields, such as healthcare practitioners and pharmacists.

5.4.2 Seeking information based on age and gender: participants' views

As part of inquiring about participants' perceptions about health literacy, one of the interview questions asked whether participants thought health information seeking was based on age and gender. In this subsection, I report findings on this question. Overall participants' views differ on this question: Asare and Lartey are of the view that people search for information based on "their age, knowledge base, and their worry." In terms of age, Lartey was of the view that teenagers are more interested in information on

teenage pregnancy, and STDs such as HIV/AIDS, gonorrhea, and syphilis than adults. Asare adds:

> Recently, there are a lot of talks and concerns about cancers and liver diseases… most people after 40 years are becoming very anxious about high cholesterol, cancers, especially breast and cervical cancer… and the men, liver and prostate cancer. When you grow old, you become prone to various diseases and illnesses.

Adisa, on the other hand, indicates some of these diseases and illnesses that most adults in their 40s and 50s are more concerned about include high blood pressure, diabetes, whooping cough, hypertension, and arthritis. Other health information that most adults look for according to Fausty includes "…how to take good care of their children… the young adults are more concerned about becoming more fashionable… they look for information on how to lose weight… contraceptives and lifestyles."

Edward and Lartey, on the other hand, do not view seeking information about health to be based on gender or age. Below are their responses:

Edward: I wouldn't say so. I don't think you should seek information based on your age. So let's say, you are 13 years old and the only educated person in the family… I think the information that you seek should benefit the community and the society as a whole.

Lartey: Well, as far as I am concerned, it's not gender related… apart from specific health issues related to men and women, where men ask men questions and women ask women questions,… women more often tend to find out general information than men because they always have kids around them.

From the analysis, participants seem to have varied views when it comes to seeking health-related information based on gender and age. In terms of gender, women tend to seek health information more than men.

5.4.3 **Sources of health information**

On the question of existing media for obtaining health information needs, participants share their sources of health information ranging from newspapers, families, Internet through to community durbars. Asare, Edward, and Clement outline their sources of health information as including newspapers, textbooks, magazines, and the Internet. Asare states, “I look for health information from the Internet, magazines, textbooks, and all that. In fact the newspapers have quite a lot of information about health, but one of my best sources of health information is the *Awake* magazines.”

, such as Efiba, Martha, Jane, and Kafui note community durbars, radio, and television as a more potent means of disseminating health information. Highlighting on community durbar, Efiba adds that “healthcare professionals can be arranged to offer health talk during community durbars.” Mary shares similar views with Efiba, Mary, Jane, and Kafui, as she finds the use of durbar and radio as one of the effective means of sensitizing people on health. Mary states, “When they organize durbars, we will be able to go and listen to some of the information to help us improve our health.”

On asking respondents how the durbar is organized and the kind of health information they deliver, Kafui explains:

> Hmm!… they beat the gong-gong for the community members to gather at the durbar ground… then the healthcare personnel come over to give a talk about let’s say… how to keep the environment clean, importance of family planning, or

> information about personal hygiene. Many people in this community don't know how to keep their surroundings clean at all… sometimes people leave garbage close by where they sell food.

Melissa, on the other hand, mentions that she didn't use radio or television as a source of health information. She explains that many people may not have access to them or may not listen to news broadcast. "Radio, well, as for me, it's been a long time since I listened to radio… Anyway, maybe some people will listen." She suggests use of posters as one key way of disseminating health information. "I think when they make posters and paste them on the walls, [people] will look at them."

Although, Jane highlights the advantages of posters, she also explains why she would prefer the durbar approach to posters:

> Well, for people who have been to school, they can read… posters with pictures… the person who cannot read will look at the picture and try to understand what they are saying… with the durbar, since it's in the local dialect, everybody will understand it very well.

Grace holds a similar view as Jane's with respect to the use of radio and posters as sources of health information, and moves further to provide examples of diseases that the radio could broadcast: "I think if they are able to do radio broadcast on how to prevent disease such as cholera, gonorrhea, and other sexually transmitted diseases, it would help." She indicates that not everyone who can read the posters, but if they send the information to the radio and they translate it into the local languages, "at least people will listen."

In general, sources of information about health appear to be varied for most participants, but community durbars, posters, and families/friends appeared to be the most common among participants interviewed. Television and radio were rarely mentioned. The Internet, magazines, and textbooks were employed primarily by healthcare practitioners and students.

5.4.4 **Where participants first go when they have health issues**

With respect to the places where individuals first seek medical or health attention when they have health issues, most participants indicate they first go to the hospital or to their family members. Other participants state they initially go to the pharmacist or the native doctor, with few stating the Internet as their first health-information contact. Kafui, a nurse, identifies the hospital, family member, traditional health attendant, and the native doctor:

> Some first come to the hospital, others ask for help from their families and friends. For instance, some pregnant women come to the hospital to deliver… others stay at home to deliver and come to the hospital after delivery… when they come we check for the health status of both the mother and child… sometimes some mothers may be having hypertension, high blood pressure, and others. In fact, some women never come to the hospital to deliver… they prefer the traditional birth attendants… where most women tend to lose their babies and sometimes their lives from complications. Most pregnant women would wait till they are 36 weeks into their pregnancy before coming for antenatal care.

When asked the reason for seeking medical help from the native doctors, Adisa states that "sometimes the sickness may not be physical and so you need spiritual assistance."

In summary, some of the participants first contact the native doctors when they have health concerns, whereas others go to the hospital or the pharmacist. Overall, participants first go to the hospital or family members when they have any health concerns. Additionally, from the analysis it appears that first contact for health-related needs may also depend on the type of sickness.

5.4.5 **How information is assessed or evaluated before it is used**

Since the study involved three different categories of participants, certain questions required responses from specific participants. For instance, the set of questions for nurses (and medical personnel) differ from the set of questions for mothers participating in the MoTeCH program. This was done to obtain detailed responses from individuals who were specifically involved in certain programs. When asked a category of participants whether they evaluate the information they receive about their health before applying it, this is what Asare, a general medical practitioner, had to say:

> Oh yes, I have the advantage of having basic knowledge, but I can easily lose sight of something that I'm not sure of, so I try to cross-check them before I use them… when it comes to, let's say, I read an article on depression from *Awake* magazine and am not too sure about something, I go back to standard text or even go on the Internet to validate the information… if you check like four different sources, by all means, if one of them is really bad, you can tell… Sometimes there is a lot of junk on the Internet. So that one too, you should know where you are going and what you are looking for. Assuming I go and look up prostate cancer on the Internet, you will get all sorts of information concerning alternative medicine… people talking about their experiences… I have friends who have

knowledge about health issues in a particular field, so I just call them if I have any doubt.

Similarly, to Edward, a first-degree graduate in pharmacy, "it's prudent to always verify the information that you have received before you begin to share with others." He cites information about health on the Internet as a particular case: "You have to be very sure about the source and credibility of the information before you begin to apply it." Asare and Edward's perspectives here show that they are very conscious about the importance and need to do in-depth verification of health information, be it from the Internet or elsewhere, before applying it for their personal use or to benefit others.

Concerning where individuals search for the information, and the skills required to evaluating obtained information, medical practitioners appear to use more sophisticated sources and measures.

5.4.6 **Top three health concerns**

The study also inquired about participants' top health concerns about which they wished to obtain information. Most respondents indicate malaria, diabetes, cholera, personal hygiene, and cancer as their top health concerns. For instance, Asare is of the view that, "In fact, my family has a very long history of diabetes, and that is why you see me as obese… most of my family members are diabetic and concerned about how to deal with it… malaria, and probably illness related to hygiene." Other health concerns involve family planning. Kafui laments:

> …it's very sad that illiteracy is really killing a lot of people… family planning is a huge issue here… most women hide when coming for consultation on family planning because their husbands don't want them to practise it… some women

> keep their family-planning cards and call to check when their next appointment is, then come over for their injection.

Fatima adds that they [men] have the perception that family-planning practice has a lot of side effects, including difficulty conceiving when a woman is ready for another baby. Edward, on the other hand, is concerned about cancer, diabetes, and hypertension. He proceeds to state what he is doing about these and other health concerns:

> One would be *awareness*… we need to share knowledge with friends and families about the basic things to prevent them… let's say cancer, there are various forms of cancer, so I can tell them to vaccinate themselves against those diseases. *Cervical cancer*… about *80 percent is caused by the virus* and their vaccines are available… If it is hypertension and there is family history, then you advise the patients to reduce their salt intake and take more fruits and vegetables to prevent being overweight. In Ghana, we tend to have this *cultural perception* that the *fatter you are, the nicer you are* physically… Some people perceive that having a lot of cooking oil on top of stews and soups makes the food more tasty and attractive, without considering the number of illnesses and diseases they will be inviting for themselves.

This section of the chapter investigated participants' response to the research question on sources of health information. It examined when respondents seek health information and how information obtained is assessed or evaluated before it is used. It also probed from respondents whether seeking health information was based on age and gender. Further, it inquired about respondents' top health concerns about which they

would like more information. The next section will examine factors that may influence a respondent's use of a mobile phone for health-related activities.

5.5 Factors influencing mobile phone usage in mHealth

This section of the chapter inquires about some of the challenges faced with respect to the use of mobile phones for performing health-related activities in the rural communities. Connecting the system of activity theory with this study, rules could be represented as challenges that individuals may encounter when employing the mobile phone as a tool to obtain information about health-related issues.

5.5.1 Mobile phone challenges in health activities

Aba, a mother, Asare, a general medical practitioner, Edward, a pharmacist, Lartey, a laboratory technician, and Clement, a student, see numerous challenges with the use of mobile phones, ranging from call drop due to poor or unreliable network system, to service cost, to invasion of privacy.

Edward: I have noticed that we can easily get a call dropped… and suddenly the network drops… I still think the mobile phone service is expensive. [Also]... mobile phones are making some patients abuse our rights [as healthcare personnel]… Patients are always invading [our] privacy because they have access to [our] phone numbers.

Asare bemoans inferior phone types and a poor network system as hampering the smooth search for information on the Internet and the prompt delivery of service to patients: "...sometimes the service is slow, depending on the time of the day… you may not get the information as quickly as you desire...." Lartey observes other challenges he and his colleagues encounter in using the phone to enhance their (consultation) services

delivery to patients. The challenges range from the small nature of the mobile phone's screen size, level of education of patient users, to healthcare personnel not being technically savvy. Lartey states how in the effort to look for additional information online to help administer appropriate treatment to patients, some patients see that as a healthcare worker not being technically savvy in their professional duties or tasks:

> Oh you know, what I see is that sometimes people feel shy to use the device because they think that the client may get the impression that they [healthcare professionals] don't know what [they] are about and [yet we] need to check the information… it's in his/her own interest for [us] to be sure about what [we] are doing for her/him.

Jane, a mother, who is currently enrolled in the MoTeCH program, highlights other related challenges to using MoTeCH:

> …I think my main problem with the program is inability to clarify information given by the computer onto your phone. Sometimes when the computer is saying something that you don't really understand and you want clarification, you can't ask them questions.

Jane extends the challenges as captured in our Q and A interactive chat in Box 2 below:

Box 2: Interview between researcher and participant

Q. What other challenges did you face during the program and how did you deal with them?

A. Hmm, it's not everybody who has electricity [at home], so charging the phone becomes a problem. So if you send the phone to those who have electricity and they charge it for you, fine; if they don't, then you stay like that. But sometimes those who have electricity in their homes will charge it for them. Em, sometimes, too, the phone network is bad, so we cannot receive or make calls.

Q. What are some of the challenges you were facing with the use of the cellphone to access and receive health information?

A. Hmm, sometimes I want to ask questions to clarify the information that they are delivering, but I wasn't able to do so because the computer cannot hear me when I try to speak. For instance, if the computer tells me to sit up or raise my legs when I'm sitting, maybe I want to ask why I need to do that.

Q. How did you deal with this problem?

A. Because I had their contact number, sometimes I call and then ask them the questions that were bothering me. What I do not like about phone usage is the network problem. Sometimes you will call and there will be no network service on the phone. [Besides], most women do not have cellphones, so they can't receive the message.

Q. What are some of the challenges with the program?

A. Em, here phone network is very poor, so I don't receive most of the calls. Sometimes, too, they don't call at the right time.

Q. How did you deal with some of these problems?

A. ….sometimes I *flash* them when the network is working, then they call me back.

Fausty, Emelia, and Kafui, who are nurses in the MoTeCH program, notice other challenges affecting the use of mobile phones to include time for registering clients and uploading individuals' files from the phone onto the server. Fausty states:

> …I would say the main problem we face is poor network system… this makes the registration of clients a bit difficult. Another challenge is the time for registering clients and uploading individuals' files from the phone onto the MoTeCH server… the program is additional work.

Kafui expresses sentiments similar to Fausty's: "…you have to first write all the information down… type them one by one onto the phone before uploading them onto the system… I think this is very time-consuming."

Similarly, Allison notes a challenge to the use of phones for health-related activities as lack of personal phone:

> …if you own your own phone, then you can receive calls and text messages from the program… also, the keypad for the phones is difficult to type with them... For example, in the child welfare program, we have almost 150 children, and you have to sit down and enter them one after the other.

Again, Fatima has mixed feelings about the phone usage for health-related activities, especially in the rural communities.

> Em, yes... it's just the problem... in the cities, people will benefit more, but in this community, a lot of people don't have cellphones. So a place like this, how do they access or receive health information with their cellphones... Using the device for accessing health information is good for people who have cellphones

> and understand the system and are able to access it. In general, I think it's a good idea, especially in areas where they don't have clinics nearby.

In addition to general challenges, such as poor network, screen size, and cost of the phone, Melissa, a mother, has issues with her inability to recharge the phone battery because of widespread electrical power outages and the low level of education of individuals enrolled in the MoTeCH program, and sees these as critical challenges facing the program's smooth implementation. Efiba suggests a way of making the MoTeCH program more responsive to a target group: "One thing I would say is that if we could get another department in the hospital responsible for interacting with and registering the clients, I think the program will be much more fruitful."

From participants' responses on challenges faced regarding the use of mobile phones in performing health activities in rural communities, a majority of the participants speak about almost the same or similar issues. The analysis shows that level of education and level of income play important roles, in addition to a poor network system, lack of electricity, and limited information sources, as far as use of phones for health activities is concerned.

5.5.2 **Challenges with implementing health programs**

In order to comprehend factors that may influence the use of mobile phones in health-related activities, the researcher looked at some of the challenges involved with implementation of the mobile phone, based on other healthcare programs in general. Respondents share their views about factors hampering the smooth running of healthcare programs that have been put into place specifically for pregnant mothers, and generally for the entire populace, to enhance and promote the well-being of the people. Mitigating

factors cut across areas, such as funding and logistical resources, poor attendance of organized health programs, and a lukewarm attitude toward accessing health-related information. With regard to challenges facing health-related programs that are being run in community, Allison states:

> We have the mothers' support group for aspiring mothers… sometimes you will invite them for programs, but only a few people would attend. Currently, with the HIV/AIDS program, it's difficult for pregnant women to be informed about their status.

When asked about the funding of these health programs, Fatima indicates that some of the programs are supported and funded by both government and NGOs, especially those involving community durbars to educate people on, for example, HIV/AIDS, syphilis, and family planning, however, she did not make mention of specific programs that are separately funded by government or NGOs.

With respect to the challenges of implementing health-related programs in the community, the responses were similar to what respondents noted regarding the use of mobile phones for health activities. Participants were of the view that funding and availability of relevant resources to run the program were the main hindrance. Edward states, "The only thing is the resources… there is limited number of resources, so we are unable to meet a lot of people's needs." Asare indicates:

> …Funding is the main challenge… we are not able to provide free vaccination to adults with, say, hepatitis B. So sometimes it becomes even more difficult to screen them and tell them they have diabetes or hepatitis B because the person

cannot afford the medication. The other challenge is *attitudinal*… our level of denial is amazing… most people hate to know the truth.

As a way of understanding factors that may influence the use of mobile phones in health-related activities, the section investigated some of the challenges confronting organizing health programs in the rural communities in general. The next section will inquire about individuals' perspectives about health literacy and how their beliefs system influences their health and access to health information.

5.6 Perspectives about information that relates to health

To be able to examine the health impact of using mobile phones for health activities, the researcher inquired about participants' perspectives about health in general and health literacy in particular. Participants were interviewed about beliefs around their health in general, how culture and traditional beliefs influence their ability to seek medical attention, and access to health-related information. Hence, analysis of this section is presented under three subsections: the reasons people value their health and ways to stay healthy; cultural beliefs about health, health care, and health information in general; and views about health literacy.

5.6.1 Reasons people value their health and ways to stay healthy

In order to inquire about a participant's perspectives on health, the researcher asked participants the reason for valuing their health. Participants shared their views about why their health is important to them. Some of them mentioned that they would like to stay healthy in order to live longer to take care of their children. Other participants indicated they wanted to be healthy in order go about their daily activities without any stress. For instance, Aba, a mother, states, "If am not well, I can't work… also can't take

care of my baby." Clement, a student, adds, "I want to live longer to finish my education and work." On the other hand, Asare does not seem to value his health that much:

> I would say average, not that am not afraid to die… I am… am overweight, but I don't seem to worry that much… sometimes I wished I could take time off work to take care of myself, but I also think about my patients. I know it's not good, but at the same time, I'm more concerned about my patients.

To be able to appreciate the ways in which participants understand the concept of health, the researcher further asked participants what measures they put in place to keep themselves and their families healthy. Responses to this question ranged from going for regular check-ups, eating well-balanced meals, to keeping their utensils and surroundings clean and safe, to trying to stay physically fit.

Melissa, Maggie, Fausty, Fatima, and Allison state that they check what they eat, do regular exercise and take prescribed medications. Alice exemplifies**:** "I go for regular check-ups… also encourage my family members to do the same… when I see posters about health, I try to read and share the information with my family."

Jane admits that she makes sure her surroundings are well kept:

> I make sure that where the children go and ease themselves [pit latrines] is far from the house so that flies will not go there and come to the house with diseases… I make sure I wash the plates that we eat from as soon as we are done eating. Also, I make sure the drinking water is clean and covered.

Although Asare does not seem to care much about his health, he indicates that he tries to do the little that he can:

> I try to go to the farm on weekends as a form of exercise. I have bought books on nutrition to see if we can improve our diet to make it healthier… for personal hygiene, I work a lot on it when it comes to cleaning the house. In fact, when I have time, I try to do a lot of things to keep me active.

To summarize why respondents want to be healthy and what they do to stay healthy, respondents indicated they wanted to stay healthy in order to live longer so that they will be able to take good care of their family and also go about their normal duties.

5.6.2 **Beliefs about pregnancy and childbirth**

This subsection aimed at exploring participants' beliefs about pregnancy and childbirth in general. In order to solicit their views, the researcher posed questions around the importance of going to the hospital when a woman is pregnant. Martha, Jane, and Melissa indicate that when a woman is pregnant, she starts attending the hospital early so she would have a healthy pregnancy and safe delivery. Mary, a mother, on the other hand, appears to have a different view about going to the hospital when pregnant:

> As for me, when am pregnant, my belly doesn't come out early, so most of the time, I wait till the pregnancy is three months old before going to the hospital. This way, the pregnancy will be stable... when I come to the hospital early, people will know that this and that [about my pregnancy], and there are evil eyes around to terminate your pregnancy.

To have much understanding about their beliefs about health during pregnancy, I moved on to inquire from participants about the types of food items to be eaten by a pregnant woman, and why? Mary shares her views:

> Okay, like when you are pregnant, there are certain foods that you should stay away from, even if you are craving for them, because they could be dangerous for the baby or your health. You know that pregnancy is very delicate, so if you are not careful about what you eat, you can start bleeding or lose the pregnancy.

There is a widespread perception held by the community that eating egg and fish in particular is unhealthy for both pregnant mother and the developing baby. However, Mary seems to hold a different view: "Well, as for egg, I think it is good to eat… fish too. I don't think it will cause any harm to the pregnancy… What you should be careful about is fatty meat and those oily foods." Jane indicates:

> …In this community in general, there are some people who think we should not eat fish, but as for me, I eat everything. I don't believe in those things. In some houses, eating certain foods is a taboo, so when they are pregnant they don't eat those kinds of foods because they believe something might happen to them. Some of them, when they receive information [from healthcare professionals], they don't put it into practice. For example, when they tell them not to give their children water to drink for the first few months, the nursing mothers will say that it's too hot, so they need to give their babies water to drink. So what their own minds tell them to do is what they do. If they think that children may need water or food, then they give them, no matter their age.

In summary, most respondents appear to believe that pregnant women are not supposed to eat certain kinds of food items. There is also the belief that going to the hospital during the first trimester of the pregnancy may draw public attention, possibly that of individuals with *evil eyes,* who could send unkind wishes.

5.6.3 **Cultural beliefs about health, health care, and health information in general**

As part of inquiring about how access to health-related information could potentially impact a participant's views about health and health status the researcher solicited respondents' beliefs about health and health care. Inquiries were also made regarding the impact of the MoTeCH program in terms of access to health information. To begin, the researcher asked respondents whether cultural beliefs influence an individual's access to and use of health-related information. The next section presents the participants' beliefs in these areas.

Most participants are of the view that cultural beliefs have a great influence on an individual's health, as well as access to health care and information. Asare, Efiba, Emelia, and Kafui affirm this notion. So the researcher prompted the participants to talk about their beliefs about health and healthcare delivery in general. Participants were also asked to discuss how beliefs influenced their access to health information. Whereas Asare talks about beliefs about health in general, mothers and nurses in the MoTeCH program discuss beliefs about pregnancy and child care.

Asare indicates:

> …Hmm, I lost a cousin recently to a brain tumour. He didn't tell anybody he was not well because he was convinced by native doctors that the illness had a spiritual connotation… so it tells you how our cultural beliefs affect our health-seeking attitudes.

Efiba explains, "As for health and sickness, there are a lot of people who believe that certain sicknesses do not belong to the hospital, but rather, for spiritualists to treat them." Kafui exemplifies:

> When a person has been having swollen legs [elephantiasis] for a long time, the family will need to consult with a spiritualist and perform the necessary sacrifices [so as to be healed]… they believe that maybe the person has done something wrong and that is why he or she has swollen legs.

Emelia and Aba explain why some people believe certain diseases and illnesses may have spiritual connotations, and how such beliefs might have influenced their access to health care. For instance, Aba maintains, "Well, there are some diseases and sicknesses that may not be hospital sickness, so you need to go and look for solutions somewhere."

In summary, with respect to beliefs that individuals may have about health and health care, Emelia declares:

> [In this community] most people do believe in spiritualist, herbalist, and native doctors... A person may be sick, and instead of sending that person to the hospital, they would rather send him or her to the native doctor until there is an emergency.

The researcher inquired about the circumstances under which participants would believe they needed to seek spiritual assistance, and Maggie indicates:

> Sometimes you may have some exchange of words (verbal fight) with someone, and by the time you realize the person has sent you to a spiritualist to do something to you… you will then start having swollen legs or body. But when you're sent to the hospital for some time and there is no solution, then you know you need a native doctor.

Grace shares her view on why people with health problems sometimes choose the native doctor over hospitals: "When I come to the hospital and I don't fully get recovered, then I send the sickness to the native doctor and I get better."

Melissa and Jane, on the other hand, view health from a different perspective. For instance, Melissa states:

> As for health, I believe if you're not well, you cannot do anything, so it's good to go for regular check-ups. If you have any question about your health, you can go to the hospital to find out what is happening to you or get more information about what is happening to you or you can use your cellphone to look online for information about your health.

Jane: When you are sick, people will ask you to go to the native doctor. Although I will go, but because my heart and mind will not be there [sic], the sickness will not go no matter what they tell me do, until I take it to the hospital... Some people are more concerned about their health, whereas others are not. Now people go to the hospital more than before because of the phone. Only few people consult soothsayers nowadays.

On probing further, to find out whether their beliefs about the fact that certain illnesses may not be physical, I asked respondents whether the spiritualists are able to find out the cause of such illnesses. Aba responded, "Well, sometimes they see something, but I have never seen anything like that before or experienced anything like that."

When it comes to beliefs about pregnancy and delivery, Fatima, Grace, and Allison, respectively, provide instances where cultural beliefs influence health:

> Some people believe that [in this community] a pregnant woman should deliver at home instead of the hospital because the woman might die if she leaves the house

> for the hospital... Most of these beliefs are held by the old people in the house and they are transmitting them into the young ones.
>
> There is the belief that when a woman gives birth, she needs to stay at home until the child is 6 to 8 weeks old before probably going to the hospital for check-up… reason is that the child is too young to be seen by other people.
>
> When a woman becomes pregnant and the pregnancy is overdue, let's say for 10 months, they believe that that person has offended someone. That is why she is not delivering.

Overall, respondents' cultural beliefs appeared to have an impact on their health in general, and on the ability to seek medical assistance, as well as provide a source of health information. Interestingly, when respondents were able to receive health-related information on their mobile phones, most of such cultural beliefs on health seemed to have reduced, thereby improving their ability to obtain health information, and obtain the information from the right sources.

5.6.4 **Views about health literacy**

After enquiring from participants how cultural beliefs influenced health and access to health information in general, I proceeded to investigate their views about what constituted health literacy. This question allowed the researcher to further examine a respondent's sources of health information and the kind of health-related activities that they performed on their mobile phones. It appeared most respondents, especially participants with medical backgrounds, viewed health literacy as having knowledge or an idea about what is happening in terms of your health and being able to act upon it. Asare, a medical practitioner, states:

> When it comes to me, by virtue of my background, I would say I'm a health-literate person, but a person with no medical background can also read a lot about his or her medical condition, to have a good knowledge about it, and [then] we can say this person is quite literate about that.

Lartey views health literacy as a broad term that encompasses "having certain knowledge about your health… trying to know what is worrying you, and having an idea where to you go medical assistance." Fatima exemplifies by saying, "If a pregnant woman has a health issue and would come to the hospital instead of going to see an herbalist, even though her schedule for the next appointment is not yet up, [then she is health literate]."

Similar to Lartey, Aba, Grace, Fatima, Martha, and Maggie perceive health literacy to include being able to go for regular health checks, being conscious about what to eat, doing regular exercise, and keeping your surroundings clean. Mary adds that it is "when you are able to take good care of yourself, by checking what you eat, cleaning your surroundings in order to prevent yourself from diseases like malaria and outbreak of cholera."

From the analysis, most participants seemed to have a fairly good idea about health literacy and how to be health literate. Most respondents regarded health literacy to be an individual's ability to go for regular check-ups, and maintaining the cleanliness of surroundings in order to ensure healthy living.

5.7 **Impact of employing mobile phones for health activities**

I explored some of the outcomes of employing mobile phones as a tool to address health-related issues in participants' lives, especially in their communities, and the nation

in general. This exploration is important before recommending the use of mobile phones as a tool to promote health literacy and to improve healthcare delivery service among individuals living in the rural communities. Specific subthemes were identified from the interview: (a) misconception about pregnancy, childbirth, and child care; (b) enhanced understanding about certain illnesses and diseases; (c) improvement in ways of obtaining health information to save a life; (d) monitoring of pregnant and nursing mothers; and (e) enhancing the possibility of checking counterfeit medications in the market. In addition to the impact, participants were asked about other health information that they would like to receive, as well as the format of the information on their phones. This section of the analysis presents findings from participants interviewed in these areas.

4.7.1 **Misconception about pregnancy, childbirth, and child care**

Responses by interviewees reveal a number of misconceptions about pregnancy, childbirth, and child care among members of the community. These misconceptions range from nutrition for pregnant women to items that pregnant women may need on their day of delivery. On examining how the use of mobile phones for health activities has impacted participants' lives, the researcher inquired about participants' misconceptions about health care in general, and access to health information specifically after receiving information about their health via mobile phone. Responses revealed misconceptions about nutrition, engagement in physical work, care for newborn babies, and the role of native doctors.

There is the belief that a pregnant woman should not eat certain kinds of foods, such as eggs, okra, fish, and meat. For instance, Aba notes her beliefs and how receiving health information has changed these belief systems.

> When I was pregnant, some people were telling me not to eat okra and snails because when I deliver, the child will have a droopy mouth... I shouldn't eat eggs and meat because the child will become very big and have difficulty delivering on my own.

She goes on to say, "After listening to the health given by MoTeCH on my phone, I realized vegetables such as kontomire, agushi, and other protein foods like eggs, snails, and fish [sic] were rather nutritious for pregnant women and the unborn baby." Jane also indicates how the information has impacted her life:

> Hmm, as for me, I was following everything they told us not to do because I didn't know what would happen to me if I don't do them... Although I didn't like the idea, I had to follow until I began receiving the information on my phone about the food items that I need to eat.

Jane continues to express her surprise at the fact that she is able to eat almost every food:

> …I even thought something would happen to me or the child; rather, I gave birth to a healthy baby. Also, there is a belief that when a pregnant woman is in labour, she is supposed to stay calm and wait at home till her "water" breaks. Sometimes the elderly women encourage them to even deliver at home as a demonstration of their courageousness.

Fausty explains:

> …[in this culture], women don't really have much control on their own about the pregnancy, so unless their husbands give them the permission to come to the hospital, they cannot come on their own... so it doesn't give them the opportunity to learn certain things.

Jane and Martha indicate that some women also believe that "giving birth at home means you are stronger and braver than those who deliver at the hospital." Expanding further, to understand why some women prefer home delivery with the help of a traditional birth attendant to going to the hospital, Fausty explains that "most women opt for home delivery when they have rivals [a legal co-spouse or co-wife]." [The reason being that]:

> If a pregnant woman has a rival who always delivers at home, but she goes to the hospital to deliver, they will start making fun of her, that I deliver all by myself at home because I am strong, but you always go to the hospital for the nurses to assist you in delivery because you are not strong... so next time, she will also try to prove to them that she is strong by delivering at home.

She adds:

> Now these misconceptions are gradually clearing up because of the health talk we are giving them on the phone... now we also have a men supporting-group in the community, so whenever your wife is pregnant, the group encourages you to allow her to go and deliver at the hospital.

Another area of participants' [MoTeCH clients] misconceptions that has improved is how to care for newborns. Adisa states:

> At first we didn't know that it was a bad idea to use hot water to massage our newly born babies... in our tradition, we massage new babies with herbs and hot water [as a way of shaping their bodies]… now I realized that [that] was a bad practice… When I deliver, I give the baby water to drink because our village is very hot, [and the belief was that] if we don't give the baby water, he/she will fall sick or even die from thirst. I learnt from the information I was receiving that

> exclusive breastfeeding for six months was the best… the breast milk contains everything the baby needs at that time.

Adding to Adisa's response, Maggie specifies:

> Before I start breastfeeding my newly born baby, first I pump and throw away the yellow milk [colostrum] until I see the white milk... we thought that was dirty and may cause stomachache to the baby… Now I found out that the yellow milk [colostrum] contains something that protects the baby against diseases… and I can really see that this baby is much healthier than my previous children.

Martha also stated that:

> ...We didn't realize the need to wash our hands before handling the baby or even feeding the baby, but now, with this information, we have come to appreciate how important it is for us to wash our hands before handling the baby. So I can say that the information we are receiving from MoTeCH is really helpful and would like to receive more information from them.

In summary, Grace is of the view that:

> …the program has really helped us a lot… before the program, when people are sick or get pregnant, they go to the native doctor or the soothsayers for assistance and advice, but now most people go to the hospital for consultations. My previous pregnancies, I really suffered… my husband wouldn't allow me to rest… I do hard labour in the home, farm, or market... He believes that when a woman is pregnant she's not supposed to be sitting down that much because the baby will become too big to deliver naturally. But when the computer calls me, sometimes my husband picks and listens, so this time, he didn't allow me to do hard labour.

> Besides, since I started receiving the information from MoTeCH, I've learned that going for regular check is good.

4.7.2 **Enhanced understanding about certain illnesses and diseases**

Alice indicates in one of her responses during the interview that a mobile phone has been very helpful in terms of going online to seek further information. She provides an instance where her sister had an ectopic [pregnancy] and she wanted to find more information about ectopic and how it occurs. "...My sister had an ectopic, and I wanted to know much about it, so I went to the Internet to Google what an ectopic was all about."

4.7.3 **Improvement in ways of obtaining health information to save a life**

In situations where the device has been employed to save a person's life, Asare indicates:

> Yesterday I had a case, and then I sent a text to my colleague to inquire about something, after which he sent the feedback to me, and that was how we were able to use the phone to save a person's life... so I think it has improved healthcare service, and even [improved] the concept of telemedicine in Ghana.

On finding out how beneficial the phone has been in terms of people's access to information about their health, Fatima makes it clear that:

> Talking about benefitting, I wouldn't say the general community per se, but those who had phones, registered, listened to the messages, and implemented whatever they were told, really benefitted. The program was mainly for pregnant women and nursing mothers... it wasn't for everybody. I will say, those who took part in the MoTeCH program, now they know the importance of health and have benefitted from the program… they should try to educate others.

4.7.4 **Monitoring of pregnant and nursing mothers**

In line with the program benefitting pregnant and nursing mothers, most of the nurses and nursing mothers indicate that the program has been very helpful in promoting healthcare delivery services and access to information about health. Fausty indicates that the phone has helped them in their daily visitation for monitoring:

> ...like I said earlier on... we do compound [house-to-house] visits [in the community] every morning to find out how pregnant and nursing mothers are doing and also remind them about their next appointment… Those we are unable to visit, we call them on the phone. And this has really changed many perceptions about coming to the hospital when they have a problem, rather than going to see herbalists or native doctors... it has also changed the delivery system... you know if the woman is pregnant, from 36 weeks, she can deliver from any moment, so in case delivery sets in or there is an emergency and they are not able to come to the hospital, they can call the health centre, then we can go over.

4.7.5 **Enhancing the possibility of checking counterfeit medications**

Enhancing the possibility of checking counterfeit medications in the market, Edward indicates that “the device... Bright Simoons.... introduced... the mPedigree software for checking counterfeit drugs where you send the code [located] on the [medication] through an SMS to verify the authenticity of the medication.”

After inquiring how use of mobile phones has impacted participants’ knowledge and access to information about their health, I moved on to find out their recommendations regarding the device’s implementation in health, additional health-related activities, or information participants would like to access or use with their phones

and, as well, the format of information on the phone, especially among individuals living in the rural communities.

4.7.6 **Additional health-related information**

Almost every participant interviewed recommended mobile phones as a tool to perform health-related activities, both inside and outside the health sector. Fatima indicates "...It's helping the community, and the health workers are able to exchange information. There is free flow of health service in the community." Allison asserts that "...sometimes when we advise them, they don't really take us seriously because they think we are talking *too much*... now that the computer calls and gives them weekly messages, they listen and obey everything... so to me, I would say it is very helpful."

Asking participants about health information they would like to access or receive with their phones, most of them mention those involving health-related issues such as environmental and personal hygiene, proper nutrition, self-medication- and family-planning practice. Others include illnesses and diseases such as cholera, malaria, CSM, and HIV/AIDS. Fatima suggests that "the information about health coming to our phones should be general so that everybody can access and use it." Similarly, Emelia specifies:

> General information about health that will not be solely for a pregnant and nursing mother, but for everyone in the community... the youth in this community are highly sexually active and we all know that there are a lot of diseases out there... so health education on STDs would be very helpful... as the youth are not ready to abstain from sex.

In congruence with Emelia's views, Aba states:

> Health information on personal hygiene and HIV will be helpful... [For many] people have multiple partners,whereas some people are dying of cholera outbreak... I heard that you can get AIDS when you share personal items like toothbrush and blade with an infected person... a lot of people don't know these things, especially in the villages, so they share toothbrushes, blades, and other things.

Other critical health challenges faced by most individuals living in rural communities in developing countries are hygiene and family-planning practices. Jane indicates that "in this community, we don't really have enough knowledge about how to take care of ourselves." According to Fausty, "some mothers [are of the view that] exclusive breastfeeding for six months may not be enough for the baby, so they prepare porridge for the child morning, afternoon, and evening. As a result, Martha suggests:

> If we are able to receive more information about how to take good care of our children, that will be very helpful... Before MoTeCH, when a child is eating, and a goat or dog puts its mouth in the food, we still allow the child to eat the food... we don't realize that the animal may have some dangerous diseases that could be transferred easily onto the child.

On the object of family-planning practices, when the researcher asked the participants, which in the theory represents subject, the reason for not practising it, according to Kafui, "some women believe that practising family planning causes blindness, high blood pressure… to others, you will become barren and even develop a fibroid... so they don't want to have anything to do with family planning at all." Allison commented, "When you take ten women, I would say two will be practising family

planning... the reason is that most women are being controlled by their husbands [as far as health-related issues are concerned].” Fausty adds:

> Sometimes some women even hide from their husbands to come to the hospital for family-planning injections... others also keep their family-planning cards in the hospital because they could lose their marriages when their husbands find out. So when their appointments are due, then the nurse or midwife will call them to come for their next injections.

Martha notes some of the health challenges that most women face when they are not practising family planning, and the need for health education on the subject:

> ...there are a lot of women who don’t take any precaution against unwanted pregnancies, but I take contraceptive pills, and that has helped me to space my children. Others don’t take anything and have been going through unwanted pregnancy challenges… when we receive education on that, it will help prevent unwanted pregnancies for the mother to regain her strength to do other things.

There are other illnesses and diseases about which participants would like to obtain more information. Jane suggests:

> …if we can get the public education on cholera, malaria, diarrhea, especially now that we are entering into the rainy season, there will be a lot of mosquitoes around, so if we are able to know how to prevent malaria, that too will be very helpful. If they can also give information about how our husbands can help us care for the children I think it will be very helpful... most men believe that child care is only for women; therefore, they are not responsible for their upkeep.

Some men even don't provide pocket money for the children, so the women would need to struggle to feed the children, and that places a lot of stress on us.

Clement: I would like to receive more information about how to protect myself against diseases such as malaria or typhoid, cancer, so that I can live a healthy lifestyle and for long... a lot of people don't cover their foods, so they are always suffering from cholera and diarrhea.

Martha: Sometimes some of the adults complain of heart pains, and others suffer from stroke and Alzheimer diseases... though they complain, they won't go to the hospital, and rather, take herbs and other self-medications. For instance, when people suffer from diarrhea, instead of going to the hospital for proper medication, people will be advising them to drink coke and salt... or mix wood ash with water and drink. So they rely mostly on traditional herbs and orthodox, rather than the hospital treatments.

This section explored additional health information that participants would like to receive or access on their phone. From the analysis, it can be deduced that participants needed health information on a wide range of health-related issues, including medication and family-planning practice. Others included illnesses and diseases such as cholera, malaria, CSM, and HIV/AIDS. The next analyses suggested health information format on the phone.

4.7.7 **Suggested health information format on phone**

In an effort to determine the kind of health-related activities that subjects performed on their phones, I inquired about additional health-related activities that participants might like to perform in selected hospitals in communities, as well as their

preferred format for the information they access on and with their tools. The preferred format is an example of the rule in an activity system. Given that various rural communities in Ghana do not have access to medical facilities, and the fact that a low level of literacy is predominantly high among most individuals in these areas, I asked the participants about the format of health-related activity/information they would like to use or access on their phones. Most of the respondents suggested the format to include audio, pictorial, and video, with few SMS options. Aba, Asare, Fausty, Melissa, Lartey, and Jane suggest the use of a pictorial or video option for better understanding of the information they access. For instance, Asare affirms:

> I would say pictorial because the level of literacy is low in rural communities... for example, personal hygiene information, where you see a picture of a person washing his/her hand before eating, and cleaning the surroundings, will be good on the phone.

Recalling that the majority of subjects living in the rural communities have low levels of education and difficulty in reading and writing, Lartey suggested a rule for the mobile phone as a tool for health literacy that "in addition to the pictorial, the video will be great... When people are able to see what's happening, they will understand it better, but to me, I think the audio is also okay." Melissa explains that "when people see the video, they would be able to relate the video to real-life situations, which helps them to understand the information better." Again, since low income appeared to be an influencing factor for the use of the phone, Jane indicates that audio and SMS should be helpful, the reason being that "not everyone who can afford phones with such features…

we only have phone with basic features." Similarly, Adisa asserted, "Em, I think text message on the phone also helps us to understand information better."

Edward declares from all the summaries on the format phone, "I think a combination of audio, text, pictorial, and video will be more helpful… animations would be perfect, especially for those who have difficulty in reading, but that will involve a lot of cost."

In this section, major findings on the impact of employing the mobile phone for activities related to health indicate that most respondents have been able to use the mobile phone to improve healthcare delivery services such as daily monitoring of visitations of pregnant women and nursing mothers, and medical personnel responding to emergency calls from patients. Another major impact of using the phone in the health sector is that the device has improved the ability to track the importation of counterfeit medications into the country. Additionally, respondents share that the community and the health workers are able to exchange information needed to control and prevent outbreak of diseases and illnesses in the communities.

5.8 Summary

This chapter discussed how data from the study was analyzed. Quantitative and qualitative data were analyzed sequentially for each research question. In the quantitative data, SPSS was employed to generate descriptive statistical tables on variables such as use of phone for medical appointment, practising family planning, going for regular check-ups, and limited information source. Subsequently, regression analysis was performed on bivariate and multivariate levels to also examine participants' sources of

health information, what constitute health activities on their phones, and the factors that predict the use of mobile phones for health activities.

Major findings indicated that there is a significant relationship between gender, age, level of education, and use of mobile phones for health-related activities. The use of mobile phones for health activities was also found to be associated with duration of phone usage, marital status, and type of employment status. A comparison between gender and source of information about health indicated that women largely use posters, hospitals, and family and friends to obtain health information, whereas most men would prefer to use the Internet and the mobile phone as their information sources.

When it comes to the media for obtaining health-related information about an object, subjects who largely use the poster as the medium to obtain information include those who are married, formerly married, have children, and are over 40 years of age. Similarly, the use of the Internet as an information source was found to be largely used by males, respondents who were formerly married, without children, and those between the ages of 18 to 30 years. Likewise, mobile phone use as an information source was found to be more prevalent among males, respondents between the ages of 18 and 30, secondary/tertiary graduates, and civil servants. Others included respondents who were formerly married and those without children.

The interview questions were used to unravel and expand on the survey data. In the qualitative analysis, transcribed interview data from participants were analyzed by categorizing the emerging themes under the research questions. The next chapter discusses the study findings in relation to the research questions.

Chapter 6

5. Discussion of findings

Using activity theory (Engeström, 1999; 2008; 2009) and sequential mixed methods (Andrew & Halcomb, 2009; Tashakkori & Creswell, 2007), the study explored the potential use of mobile phones to promote health literacy and access to information about health in order to improve the healthcare delivery system among people living in rural communities. In Chapter 5, an analysis of both survey and interview data was presented. Reviewing the quantitative data, first, a summary of descriptive statistics showing participants' demography and other relevant study variables is presented in both frequencies and percentages. This is followed by a description of summary statistics of predictor variables for sources of information about health, and the use of mobile phones for activities related to health. Finally, summary statistics that examine relationships between study variables, including cross-tabulations and multiple regressions, are described.

Qualitative data was analyzed in line with the research questions. These are: (a) perspectives that people have about information that relates to their health; (b) existing media used for obtaining information related to their health; (c) the types of health-related activities performed on mobile phones; (d) factors that influence the use of mobile phones in activities related to their health; and (e) the impact of employing mobile phones for activities related to their health in remote and isolated communities in sub-Saharan Africa.

Findings from the study suggest that most participants consider an individual to be health literate when he or she does go for regular check-ups, practises family planning,

eats a balanced diet, and does regular exercise. However, a few participants, on the other hand, go beyond the shared notion of going for regular check-ups and reducing drug abuse, to understanding health literacy as an individual's ability to seek, evaluate and apply relevant health information to one's personal life in order to stay healthy. Since health literacy is viewed as a broader term than we anticipated, I would consider these practices of health literacy of participants to be health applications. Thus, when a person is health literate, he or she would be able to perform certain activities, such as obtaining relevant health information and going for regular check-ups.

Insights from the analysis suggest that although some respondents search for information irrespective of their age and gender, overall, women are more likely than men to seek health information about specific diseases. Likely available technological media for promoting access to health information include mobile phones, Internet, and television. Other likely media that would be a source of information about health also include community durbars, family, and healthcare providers.

Findings from the study indicate that there is a strong positive relationship between information source, use of mobile phones for health activities, and level of education. Factors that are associated with the use of mobile phones for health activities include an individual's demography, such as level of education, age, gender, and marital status, poor network systems, limited electricity, and lack of funds. Findings also suggest that the use of mobile phones for health-related activities depends on the duration of phone ownership, level of income, and availability of information. Overall, participants showed positive interest in the use of mobile phones as one of the technologies for promoting health literacy among individuals living in rural communities. This is aligned

with the broader understanding of health literacy in terms of individuals accessing and seeking information about their health from relatives, colleagues, healthcare professionals, or the Internet, and being able to critically analyze obtained information and then apply it to their respective health needs.

During the qualitative analysis, themes emerged, such as beliefs about health; when people seek health-related information; and health-related programs to promote health literacy are established. In the study, some questions were asked in the survey data to provide background information and also to ascertain whether there was any significant relationship between mobile phone use and health information. These questions focused on activities other than health-related activities (e.g., mobile phones for banking, selling products, and for organizing functions such as a funerals, naming and marriage ceremonies) that respondents performed on their mobiles. These findings were not reported in this study. This chapter discusses findings of the study in relation to the research questions.

6.1 Study objective

The purpose of this study was to explore participants' views about the use of mobile phones to promote health literacy through their ability to access, seek, and apply relevant information about their health to improve the healthcare delivery system and healthy living among people living in rural communities.

6.2 Health-related activities on and with mobile phones

The study employed activity theory to inquire into or about the kind of health-related activities that respondents perform on their mobile phones. Some findings are on the *tools* and *objects*. In order to respond to the research question on health-related

activities that participants perform on their mobile phones, the study gathered and analyzed data from both quantitative and qualitative sources. With the quantitative data, analysis was performed on three main levels: descriptive, bivariate, and linear and logistic regression models. On the descriptive level, four key pointers were reported by the respondents: (a) information activities related to health, using mobile phones, consist of making medical appointments at the hospital; (b) finding information about health concerns; (c) looking for a medical doctor or a nurse; and (d) sending or receiving health information through the mobile phones.

On the bivariate level, independent variables (e.g., education, age, and duration of phone ownership) were run to find out whether there was any significant relationship with the dependent variable (use of phones for health activities). In addition to descriptive and bivariate, linear and logistic regression models were created on various variables to predict an individual's use of mobile phones for activities related to their health. Qualitative data were analyzed under the following themes: views about use of mobile phones for health activities; health-related activities that were performed on the phone; and challenges associated with mobile phone usage in health-related activities. The data presented in this section of this chapter discussed health-related activities that respondents perform on the phone.

6.2.1 **Phones for mHealth**

The findings presented in chapter five suggest that more than half (52.81 percent) of the respondents have sent or received some form of health related information with and on their phones. In terms of specific health activities, fewer than 25 percent of respondents indicated that they have ever used the phone for making medical

appointments, whereas nearly half (48.89 percent) of the respondents had employed the device to inquire about health concerns in general.

Adding to health activities being performed on the phone, findings from the interview show the device is employed by pharmacists to "clarify prescriptions from the doctor before dispensing the medication to the patient." This process allows the dispenser to verify the authenticity of both the prescription and the medication before dispensing it to the patient. As noted in the literature concerning related challenges faced in Ghana with importation of counterfeit medication and the fact that many are losing their lives as a result of self-medication and drug abuse, it has become necessary to respond to at least some, if not all, of these health-concerning issues.

In the language of activity theory with the study, most of the findings are on the community, object, tool, and the division of labour, rules, and agency. As a way of preventing the importation of counterfeit medications, which are causing widespread death and illness, most pharmaceutical companies (community) are employing mobile phones (tool) to "scrutinize (division of labour) importation of counterfeit medications (object) into the country." This finding is consistent with literature on the use of mobile phones to verify a drug's authenticity. For instance, Ramey (2008) observes that many medications, specifically anti-malarial, that are exported from other continents to Africa, appear not to contain the right ingredients. To confirm mobile phone usage for drug verification, Edward indicates, from the interview, that a system/software called "mPedigree was developed by one of the health agents in Ghana, known as Bright Simoons [sic], to checking counterfeit drugs."

According to Glassman and Helgeson (2012), use of mobile phones to deliver health services has the potential to reduce costs, change the conditions of practice, improve quality of healthcare service, and improve access to health care in rural and other medically underserved areas. Apart from employing the device to verify drug authenticity, other respondents use phones to read more on the nutritional value of certain food items. Although most participants noted that they also use the device to clarify obtained information, one of the respondents indicated, “If I read something about health and I want to understand it better, then I go online to find more information.”

Insights into the study also reveal that most respondents employ the device to call or send SMS to healthcare centres and other helplines that address specific health issues, such as family planning, pregnancy and childbirth, and cholera outbreak. Others call to clarify any symptoms in the form of teleconsultation, and telehealth. Few participants state that they call the health facility for assistance when there is an emergency case, such as a woman in labour. I really find this fascinating. One of the midwives explains that “if a woman is pregnant from 36 weeks, she can deliver at any moment, so in case that happens or there is an emergency, they call the health centre, then we go to their aid.”

There are other respondents, especially those in the medical fields, who use the device to either obtain supplementary information from the Internet or clarify ideas during a patient’s consultation session. One of the respondents indicates that “if you have a patient with you and there is an issue or a condition that you need a quick clarification on, you can use your phone to do that [clarify with the patient’s doctor]....” According to Anta et al. (2009), the device is serving as a public health information gateway from patients to doctors and vice versa. Findings from this study are in line with the report by

WHO (2011), a global eHealth survey conducted in 112 member states, including Africa, which discovered that most mHealth initiatives performed by individuals comprise calling health centres, calling emergency toll-free telephone services, and calling for help during emergencies.

Similarly, the study also examined the MoTeCH program, which is considered from the activity theory as an *agency.* In this program, pregnant women and nursing mothers were receiving weekly health messages related to their pregnancies and their children. As stated in the literature review, MoTeCH, according to Awoonor-Williams et al. (2012), is the implementation of a *mobile phone-based health-promotion* module to provide pregnant women and nursing mothers with key information needed to enhance the quality and frequency of *patient–provider interaction.*

Findings from the interviews show that respondents receive information on their phones, ranging from personal care to nutrition. One of the pregnant women notes that she receives information on alerts and reminders about her upcoming or missed hospital events. She adds, "…I also receive on my phone food items that I should eat as a pregnant woman, my sitting posture, and items needed on the day of delivery." Other respondents indicated that they use the phone to inquire about health information from the healthcare personnel. Findings from the study reveal that although some respondents search for information, irrespective of their age and gender, overall, women were more likely than men to seek health information about specific diseases. Jane, a mother from MoTeCH, confirmed that "we were given a number that we can call for free [toll-free number], so I call when I have any issue bothering me or want some health information

for myself or my family… my husband doesn't care much as far as searching for health information is concerned."

According to WHO (2011), mHealth activities such as emergency toll-free telephone services and creating health awareness are less performed in Africa. It was encouraging to learn that MoTeCH has a toll-free number that people can call anytime to obtain health-related information. Consistent with Kalil (2010), mHealth in developing countries, specifically Africa, has improved healthcare delivery and saved most parents from commuting several kilometers to inquire about the health of their family. Ofosu (2009) adds that the device can also be used to inquire about information on a certain illness or disease. mHealth Ethiopia Report (2011) noted that health-related activities on mobile phones include using the device to transfer health information via SMS. Findings from this study add to the literature on telemedicine in the rural communities. Additionally, it is consistent with the use of the toll-free health services to promote prompt information access and healthcare delivery.

DeHart and Heckerman (2008) note that one of the biggest barriers to keeping up with a patient's medical history electronically is the ability to support a large user base—typically hundreds of thousands or millions. In Ghana, due to the limited healthcare resources, such as computers and storage facilities, most patients do not have updated medical records. The reason is that patients' medical records are kept in piles of paper folders. This makes it hard to retrieve patient information whenever someone comes to the hospital. Again, as time passes, these folders become difficult to store due to limited space. Hence, patients are always required to provide their personal information and medical history. Sometimes patients may even forget their own medical history.

Findings from the study suggest that mobile phones have replaced paper folders at the healthcare centres. Thus, patients' medical records are being entered by phone, and then ultimately transferred onto a server for storage. Hence, patients' information may be collected through mobile phones and stored electronically (DeHart & Heckerman). This process guarantees reduction in any previous medical errors, and inconsistencies in patients' profiles as a result of lost paper-based health records. This method serves to keep updated and reliable medical records of patients.

In summary, mobile phones are employed by individuals to perform health-related activities, including: (a) inquiring about health concerns from friends, family, or healthcare personnel; (b) calling healthcare centres and helplines that address specific health issues, such as family planning, pregnancy and childbirth, and cholera outbreak; and (c) clarifying any health symptom before travelling to healthcare centres. In terms of the healthcare sector, the device is employed by pharmacists to: (i) "clarify prescriptions from the doctor before dispensing the medication to the patient"; (ii) "scrutinize (division of labour) importation of counterfeit medications (object) into the country"; and (iii) gather demographic information from patients to store electronically.

6.3 Existing media/systems for obtaining information about health

When it comes to seeking information related to health, there are different media for obtaining such information. According to Clifford and Fraser (2008), however, often certain situations make it difficult for individuals to seek medical assistance at the right time. Clifford et al. list these situations to include: (i) limited access to healthcare centres and medical personnel; and (ii) poor road conditions and distance that patients may need to travel for medical care and consultation. Again, challenges such as a poor drug-

tracking system (Ramey, 2007), counterfeiting and drug theft (Cockburn, Newton, Agyarko, Akunyili, & White, 2005; Swaminath, 2008), and limited healthcare delivery systems (Igoumenidis & Zyga, 2011) with regard to health are becoming huge problems in most developing countries.

In relation to sources of information about health and the reason respondents seek information, some of the results indicate that information about health is sought for innumerable reasons, ranging from preventive measures, information on specific diseases, to information to broaden an individual's knowledge. Gore and Madhavan (1993) grouped sources of information about health under two main umbrellas: (a) professional sources such as print media, Internet, and television (Benigeri, 2003; Sanders Thompson et al., 2009); and (b) personal or impersonal sources (Elliott-Binns, 1986) including family, friends, and health professionals (Cutilli, 2010; Ford & Kaphingst, 2009; Redmond, Baer, Clark, Lipsitz, & Hicks, 2010). Cutilli observed countless issues, such as an individual's age, level of education, health literacy, and health status that could potentially influence use of these information sources.

In this study, individuals employ various media for seeking information related to health. These media include radio, television, family, and the Internet. Most of the time, individuals seek health information for different reasons, such as how to prevent outbreak of certain diseases, how to cure a particular illness, and how to lose body weight.

6.3.1 **When do participants search for health information?**

Due to the current proliferation of unexplained illnesses and diseases, seeking health information can occur at any given stage of an individual's life. Asare, one of the medical personnel, stated that "…individuals over 40 years are becoming very anxious

about high cholesterol and cancers and are now seeking constant information all over." From the study some participants do not wait until they are hit by unforeseen illness, as Asare indicates.

Recalling the results on the search for information, one of the mothers disclosed, "If I hear something about health, I quickly go to the Internet and read about it… HIV/AIDS and hepatitis B are deadly diseases and I don't want to be infected." There are other respondents who only search for information about their health when they need it. Aba, a mother and client of the MoTeCH program, states, "When I am not well or any of my children is sick, then I will go to the chemical store (pharmacy) to get some medicine… I go to the hospital when the sickness becomes serious, then *you* know I am really sick." Participants' responses on the behaviour of seeking information about health only when needed seem to be typical of that experienced in most rural communities. Thus, most individuals living in rural or small communities have the perception that once a person is able to go about his or her daily routine activities with no health interference, then he or she is not sick.

Results also indicate that most participants seek health information during certain seasons of the year. The reason for this search is that, in Ghana, especially in the northern and upper east areas of Ghana, communities suffer from seasonal outbreaks of cholera and cerebrospinal meningitis (CSM). One of the community nurses explains that "because we are in CSM zone, we organize community durbars and talk prior to the outbreak."

Additional inquiry about the search for health information was whether age and gender were determinants of information search, as well as the type of information

sought. When it comes to the type of health information sought, young adults between 18 and 40 years of age seek information on lifestyle, teenage pregnancy, and STDs, whereas those over the age of 40 expressed more interest in health information on specific diseases and health conditions, such high blood pressure, diabetes, and hypertension.

Underhill and McKeown (2008) observe that females are more likely than males to seek information about specific diseases irrespective of their age. One of the healthcare personnel was of the view that "apart from specific health issues related to men and women, where men are asking men questions and women are asking women questions… women more often tend to find out general information than men because they always have kids around them." One of the nurses also indicates that older adults were interested in "how to take good care of their children… the youth are more concerned about fashion… how to lose weight."

The data also suggest that women in general were more likely to search for health information than men. This is in line with findings from the literature on how men are less likely to look for health information. According to Doward (2012), a survey study conducted by the National Pharmacy Association (NPA) found that men in general are less likely than women to search for primary-care services, including community pharmacies. This finding is worrisome because it shows a practice among men that does not promote health literacy. This finding was similar to that of Fox (2011), found on the Pew Internet Project.

In 2009, Thompson conducted a study on African-American men's perceptions of factors influencing health information seeking and found that although Black men find healthcare providers as a valuable source of health-related information, they are less

likely than Black women to seek health information from either family members or medical personnel. Courtenay (2003) stated that men who do not seek medical help limit their chances of health promotion. Thompson, Talley, Caito and Kreuter (2009) view the practice of not seeking health-related information as resulting in Black men tending to have a shorter life expectancy than women.

Regarding short life expectancy, Norcross, Ramirez, and Palinkas (1996) state that at most times, women, especially married women, need to *push* their men to seek medical assistance, since they cannot afford to lose their husbands. Denner (2000) noted that men prefer to seek the information indirectly from either their friends, partners/spouses, and sometimes from healthcare providers. Doward added that men will only seek medical treatment in emergency cases. Sherman (2011) and Tudiver and Talbot (1999) attribute men's not seeking much health information on their own to their busy schedules, and reluctance to discuss personal issues due to privacy and embarrassment factors.

Relating findings from the study with other research conducted, these findings confirm the literature to a certain extent. When it comes to seeking health information, women do better than men. On the other hand, women in this study who were married do not push their husbands to seek medical assistance; rather, the women needed to obtain permission from their husbands before seeking medical assistance due to their cultural practices. Most of these cultural practices are gradually disappearing because of the presence of mobile phones, which allow women to easily call the healthcare centre to inquire about their health status.

6.3.2 **Sources of health-related information**

According to Mtega (2012), an individual's ability to identify the need for information becomes an important step in seeking that information. Mtega outlined this step to include identifying information sources, checking the sources, and accessing information.

Many of the sources of information about health were identified by the participants, but the most commonly used sources are community durbars, families/friends, and community healthcare personnel, with occasional use of radio, television, and print media. There are other small categories of participants who employ Internet, mobile phones, and books to supplement their information needs. These media are examples of *community* and *information agencies.* The use of mobile phones for searching for health information was largely employed by respondents who had some degree of formal education, and participants over 40 years of age, 72.00 percent and 70.59 percent, respectively. These findings are in line with the literature, with the exception that individuals with low educational background are more likely than educated people to employ healthcare centres as information sources. Results from the study did not show any significant difference between the two groups.

Radio and televisions were not largely employed for searching for information compared with community durbars. With radio and television, individuals may have less chance of controlling the kind of programs available, as well as the language used for the programs. Employing radio and television, especially radio, which is not visible to search and type on, could be difficult to use when searching for health information. This

explains why the community durbar and family members tend to be used frequently to obtain information about health.

Recalling from the analysis the use of the community durbar as a source of information, one of the healthcare personnel explains how a durbar operates: "…They beat the gong-gong to invite the community members to the durbar grounds, where health personnel give a talk about health-related issues pertaining to the community." Efiba states, "We organize durbars on various health-related issues such as family planning, personal hygiene, STD's…." One of the nurses states, "Family planning is a big issue in this community. When we take ten women, only two may be practising it." Besides family planning, other healthcare personnel indicate that:

> …on personal hygiene… we do home visitations in the communities, to find the kind of health information that people may need at that time… Like rainy season, and dry season, there are a lot of malaria cases, so we give a talk on how to keep your surroundings clean, and the need to sleep under mosquito treated nets to prevent malaria.

Data also reveal that some Ghanaians are using medications improperly. This health issue has called for health literacy programs that provide daily health talks, such as the OPD "outreach programs from time to time, and health talks on television on the importance of taking prescribed medication, and on time." Additionally, respondents indicated their top three health concerns to include diabetes, hepatitis B, malaria, family planning, personal hygiene, STDs, and tuberculosis. Findings on health concerns support the literature on most severe public health problems and three major global public health threats. The Center for Diseases and Control (2012) observes that malaria is one of the

most severe public-health problems worldwide and the leading cause of death among most individuals in developing countries. According to Lima, Granich, Phillips, Williams, and Montaner (2013), three major global public-health threats are HIV/AIDS, tuberculosis, and malaria.

Cutilli (2010) noted that the use of electronic communication devices such as Internet, television, radio, as well as other non-electronic communication materials such as posters, books, and family, serve as supplementary materials to healthcare providers. In addition to hospital and posters that were employed almost equally by both educated and non-educated individuals, participants with a high level of education access health information from both electronic communication devices and non-electronic communication sources, such as health brochures, Internet, and mobile phones. One of the healthcare personnel stated, "I look for health information from the Internet, magazines, and textbooks." These findings support what Kutner, Greenberg, and Paulsen (2006) and Dutta-Bergman (2004b) stated in the literature—that individuals with a higher level of health literacy seek supplementary health-related information from written sources (e.g., books, magazines, newspapers, and health brochures).

The literature reviewed indicated that individuals with low educational background and with basic health literacy tend to rely more on healthcare providers than educated people (see, for example, Kutner et al., 2006; Dutta-Bergman, 2004b). Surprisingly, results from the study do not find a significant difference between level of education and the use of healthcare providers as a source of health information. Community durbars that were organized by healthcare personnel and the community leaders probably tended to encourage more people to seek medical advice. Again, most

communities in the upper east area of Ghana have community-based healthcare centres, with a ratio of one health centre to six communities. Further, the majority of individuals are now able to use the mobile phone to inquire from healthcare personnel about certain illnesses and symptoms at any time of the day, without necessarily travelling to the health centre. This could explain why there is little difference between the educated and non-educated individuals on the use of a hospital as a source of information about their health.

Findings also suggest that although there are various information sources, obtaining relevant health information still remains an issue due to low level of literacy and inability to locate the right information. As a result, there is a huge gap in terms of health literacy and access to health information among most of the participants.

6.3.3 **Demography and Internet use as information source**

A study conducted by Dutta-Bergman (2004) disclosed that individuals who look for medical information on the Internet are more likely to be health conscious and engage in a lot of health activities and practices, compared with individuals who are not health conscious. Responses from participants reveal that individuals who are likely to use the Internet to perform any form of activity related to their health are the educated, and people who are employed as civil servants, with few self-employed and unemployed. These findings are consistent with observations that individuals likely to employ the Internet as source of information are those with higher levels of education (Flynn, Smith, & Freese, 2006; Cotten & Gupta, 2004). Bright, Fleisher, Thomsen, Morra, Marcus, and Gehring (2005) noted other predicting factors of Internet usage for seeking health information to include age and level of health literacy.

6.3.3.1 Age

Sources of information about health sometimes may be varied based on an individual's demography such as age, gender, and marital status (Cutilli, 2010). Considering an individual's age and sources of information, according to Health Information National Trends Survey (HINTS) (2005), young adults tend to use the Internet for most of their health information needs when compared with older adults. Cross-tabular results reveal that young adults are more likely than older adults, as predicted in the literature, to employ the Internet as an information source.

Currently, there are a lot of technological devices such as computers, tablets, or mobile phones that individuals own. These devices also have various application features including *health apps,* that can be installed on the devices to obtain health information. These devices are mostly used by young adults, and that could explain why young adults largely use the Internet for their health needs. Choi (2011) stated that older adults are not able to employ the Internet as an information source due to socio-economic factors facing them. Findings from this study contradict Choi's observation about young adults and older adults, that when middle-aged adults are compared with older adults, the results indicated older adults were more likely to employ the Internet for health-related activities. This could be due to the fact that, as people grow older and their health deteriorates, various health-related issues such as high blood pressure and/or diabetes also set in. As a result, they find various ways to seek medical assistance. In summary, use of the Internet as a medium for obtaining information about health is influenced by age.

6.3.3.2 Gender

Similarly, data from the study suggest that when it comes to the use of the Internet as a source of information about health, men are more likely than women to employ this medium. Relating Internet usage and gender to the literature, Cohen and Adams (2011) noted from a survey conducted on the use of the Internet for health information that females are more likely to use the Internet as an information source. Although the literature states that females are more likely than males to use the Internet for health-related activities (Drentea, Goldner, & Cotton, 2008; Underhill & McKeown, 2008) findings from the study do not support this literature. From the results, percentages for Internet usage for males and females were 57 percent and 34.8 percent, respectively. This could be attributable to the fact that most females, especially married women, were not allowed to use communication devices such as mobile phones and Internet.

Men in this study tend to use the phone for various activities more than the women. Hence, there could be a high possibility of them going online on their phones to obtain health-related information. This finding could be explained using the literature. HINTS Briefs (2005) noted that there are certain illnesses and diseases such as hypertension and diabetes, for which men would prefer to use the Internet, rather than hospital, families, and friends to seek information. In my opinion, that the reason for this behaviour is that men usually do not want their families to know they are not feeling well, or have certain medical conditions.

6.3.3.3 Marital status

Generally, from the study findings, respondents who are without children, and respondents who are divorced/separated, appear to look for health information more than

those who were married or who have children. Recollecting from the analysis on predicted variables for Internet as a source of information, it was revealed that participants who were formerly married tend to use the Internet, compared with married couples: 60.11 percent and 31.11 percent, respectively. Again, respondents without children are more likely than respondents with children to employ the Internet as a source of information about health: 58.54 percent and 34.04 percent, respectively. This finding is interesting to me. From my experience, I expected individuals with children to search more online for information on "how to take good care of their children" in order to promote healthy living among their families. From the findings, most participants, especially women who were married, were not allowed to own mobile phones or browse on the Internet. For instance, Grace, one of the mothers indicated, "I share the phone with my husband… he doesn't want people to call me that much, so when he is at home, then I call my family members… [and then] I can't go on the Internet." This finding explains why in this study few women with children were using mobile phones.

Additionally, from the perspective of the literature, Andreatta, Debpuur, Danquah, and Perosky (2011) noted that an individual's ability to employ mobile phones to access, evaluate, and use relevant information for their health service is an economic relief to the nation, as well as economic and emotional relief to the families. Most of the current mobile phones have countless features, including Internet capabilities that make searching online much easier and convenient for individuals with children. Unfortunately, the device was not largely used by married women and by individuals who have children. Rather, respondents with children tended to use healthcare providers as sources of health information when compared with those with no children. From my experience, however,

I believe that women who have no children may be visiting the Internet to look for more information on how to relieve their stress. In most African countries, especially in the rural communities, where culture and traditional beliefs are strongly held, when couples are unable to bear children, it becomes very stressful emotionally and psychologically for the family. As a result, searching for relevant health information from all avenues becomes the focus of these women.

Overall findings on the search for information suggested that age, level of education, gender, level of income, and marital status were more likely to influence the type of information search as well as information source. These findings support current literature that shows age, gender, and level of education as main demographic characteristics predicting an individual's ability to search for health-related information. Additionally, likely technologies for promoting access to health information included mobile phones, Internet, and television. Media other than technologies likely to promote information sources include community durbar, family, and healthcare providers.

6.4 **Factors influencing mobile phone usage in mHealth**

This section discusses potential factors associated with the use of mobile phones in performing health-related activities. Findings on this theme fall under the *rules* of activity theory. The outcome of this study indicated that the likelihood of employing mobile phones to perform health-related activities, such as contacting healthcare personnel or looking online for supplementary information, was predicted by respondents' demography (e.g., age, and level of education), duration of phone usage, and availability of the information. Thematic analysis of the interview transcripts offered

insight into the contributions of various demographic variables and other variables found to have correlations with use of mobile phones for health-related activities.

The analysis showed a positive correlation between level of education and the use of the phone for health-related activities. Data suggest that graduate respondents increase their likelihood of using the phone for health activities by 2.14 ($p < 0.001$) compared to respondents with no education, after controlling for other socio-demographic factors (Table 9). Education with other variables (age, duration of phone use, limited information source, lack of electricity, and lack of funds) accounted for 45.76 percent of variation in the dependent variable. Thus, the adjusted R^2 was 45.76 percent. From the results, we see higher education as a key factor when it comes to the use of phones for health-related activities. Thus, for every increase in the level of education, the usage of phones for health activities increases by 2.14. This finding is both consistent with results from interviews with other respondents and with the existing literature. For example, Melissa indicates, "Due to rampant electrical power outages and low level of education, we find it difficult to do a lot of health activities on our mobile phones." The situation shows that well-educated people in Ghana are more likely to use the phone for health-related activities. According to Kwon and Chidambaram (2000) and Rice and Katz (2003), the socio-economic factor is a major mediating factor that may have influence on the adoption of mobile phones for various activities including health. Taking level of education into consideration, Ojo (2006) stated that a high level of illiteracy prevents most people from adopting the device for these activities.

Findings from the quantitative analysis suggest that in addition to socio-demographic factors, other factors predicting respondents' use of mobile phone for

health-related activities were limited health information, lack of electricity, and lack of funds. Although these factors negatively influence usage of phone for health activities, they were not statistically significant. On the other hand, when results from interview data were sequentially integrated into the survey data to either elaborate on or confirm the findings, responses from most participants specified that diverse challenges with the use of mobile phones for health-related activities ranged from call drop due to poor or unreliable network system, to service cost. One of the respondents indicates, "I have noticed that we can easily get a call dropped… and suddenly the network drops." Another challenge that was found during the interview section among healthcare personnel working in the MoTeCH program was difficulty in entering client data on the phone and uploading files from the phone onto the MoTeCH server in order to send health information to the respective clients. Fausty points out, "…The main problem we face is a poor network system… this makes the registration of clients a bit difficult … we also spend a lot time for registering clients and uploading individuals' files from the phone onto the MoTeCH server." One of the nurses summarized some of the predicting factors for use of the mobile phone in executing health-related activities: "I would say lack of personal cellphones due to low income level and low level of education make it difficult for people to call or receive any health information." Lartey explains his not employing mobile phones to perform health-related activities, not only in the context of poor network system, but also the complex nature of the device: "...the handling of the phone to seek information is complex… more so, I have a computer that can do the same job." This implies that individuals may not like to use the mobile phone for doing any health-

related activities because they have alternative means of achieving the same goal and probably in a less stressful atmosphere.

Related studies on mediating factors on technological usage for any form of health activities (Biljon & Kotzé, 2008; Jeng et al., 2004; Ghyasi & Kushchu, 2004; Frempong, Essegbey, & Tetteh, 2007) show that a poor network system, cost of purchasing, and also maintaining, the device are some of the challenges for employing mobile phones for health-related activities. A poor network system, low education level, and low level of income as mediating factors in the use of mobile phones for health-related activities were not unique to this study. These factors, however, were consistent with findings from survey and interview data, as well as existing literature. DeHart and Heckerman (2008) identified the small screen and keypad as posing many challenges to the majority of users, especially when medical personnel are entering voluminous data, such as a daily summary of patients who may need medical care, or patient diagnoses, onto the phone.

In summary, there is strong positive relationship between respondents' socio-demographic (independent variables) and use of mobile phones for health-related activities (dependent variable). Although lack of electricity and low level of income are statistically not as significant as the findings from the quantitative analysis, they do have a negative association with the use of mobile phones for health-related activities.

6.5 **Perspectives about information that relates to health**

In an attempt to answer the research questions on an individual's perspectives about health literacy, the study examined health professionals' and other people's views about health literacy, health, and also beliefs about healthcare seeking in general. The study revealed three major findings. These involve: (a) how respondents view health

literacy; (b) reasons why individuals want to be healthy and what they do to stay healthy; and (c) how cultural beliefs influence access to respondents' health and health needs.

Findings from the study indicate that the majority of the respondents have a fairly good idea about health literacy and how to be health literate. Most of the respondents view health literacy to include an individual's ability to go for regular check-ups, take proper medication, practise family planning, and keep the surroundings clean in order to maintain healthy living. One of the respondents explains health literate to involve an individual's having "a general knowledge about health situations… Having adequate knowledge about health issues concerning what is happening to you."

One of the mothers indicated she views health literacy as "when you are able to take a good care of yourself, your eating habits, cleaning your surroundings, and tidying up your room." One of the students shares, "If a person knows what to do to keep healthy, then I guess he/she is health literate." This viewpoint is consistent with Nutbeam (2006), who lists examples of health-promotional activities to include searching online for health tips, reading medical brochures, and visiting healthcare centres to inquire about medications and proper diet. Other views about being health literate include those of people who are conscious about healthy eating; engage in regular physical exercise; share authentic information about health with others (in need); maintain a good standard of personal hygiene and clean surroundings; and are enthusiastic about looking for relevant health information from different sources, such as the Internet, for the purpose of their own health needs, that of others, or both.

As Dutta-Bergman (2004) has suggested that individuals who look for medical information on the Internet are more likely to be health conscious and engage in a lot of

health activities and practices. Having knowledge about who a health-literate person is and being health literate may profess to be two different practices altogether. In other words, individuals may be health literate, but may not actually be practising health literacy. As a result, asking respondents why they want to stay healthy and what they do as a way of achieving such a goal was one of the important aspects of the study's objectives.

Analysis reveals that people would want to stay healthy for two key reasons: to live longer and to be able to perform daily tasks such as selling and farming, and taking care of family. One of the mothers indicates that she wanted to stay healthy so that she would live longer and be able to take care of her child, whereas another mother explains, "When I'm sick, I cannot go to the market to sell, and that will make life miserable for me." This suggests that much of her livelihood depends on the income generated from engaging in daily sales at the market, and any health issue that tends to hamper her market activities is likely to have a devastating effect on her life and entire family. As a result, as Melissa puts it, "I check what I eat, [do] regular exercise and check-ups, and take prescribed medications." She seems to be of the view that if she is not healthy, "she wouldn't be here" [i.e., alive and granting an interview], so her own health, and that of her family and the entire community, is very important to her. With the above perspectives, as expressed by the participants, about health literacy, strategies that would help to enhance holistic health promotion become paramount.

Kinnon (2002) notes these strategies to include: (i) building healthy public policy such as environmental protection legislation and occupational health; (ii) creating supportive environments through community development and family support;

(iii) strengthening community action so that communities can identify needs and address them; (iv) developing personal skills that enable individuals and groups to address health issues; and (v) reorienting health services to be more client-focused and integrated.

Cultural beliefs appear to have an impact on respondents' health in general, the ability to seek medical assistance and the medium for obtaining information about their health. Findings indicate that some respondents do believe in spiritualist, herbalist, and native doctors for medical treatment. One of the nurses indicates that "sometimes a person may be sick, and instead of sending that person to the hospital, they would rather send him or her to the native doctor until there is an emergency." This finding suggests that people living in the rural communities do believe in the native doctors and herbalists more than the healthcare personnel in terms of seeking medical assistance. When it comes to addressing an individual's misconception about access to and ability to obtain health information as a result of cultural influence, from the findings of the study as well as my experience as an educator, a Ghanaian, I am of the view that the daily health information they receive on their phones, and from community durbar, where health personnel come over to offer a health talk, would help address most of these misconceptions. This finding is in line with what Young (2001) notes to be reasons individuals consult traditional healers and other native doctors when they have health challenges.

Sometimes certain factors such as cost of medication, and probably lack of medical personnel in the communities, may influence an individual's belief to opt for a particular medical treatment. For instance, in situations where the family cannot afford to

pay medical expenses, opting for a native doctor, an herbalist, or self-medication becomes an alternative means of receiving medical treatment.

Other respondents also believe that there are certain kinds of diseases and illnesses that may be worth treating outside the hospital. One of the respondents explains that "sometimes you may have some exchange of words with someone and by the time you realize the person had sent you to a spiritualist to do something to you… you will then start having swollen legs or body." Asare confirms how cultural beliefs influence access to health care: "…Hmm, I lost a cousin recently to brain tumour… he didn't tell anybody he was not well because he has been convinced that the illness had a spiritual connotation… so it tells you how our cultural beliefs affect our health-seeking attitudes." This finding is similar to what Vaughn, Farrah, and Baker (2009) and Helman (2007) found about how people of diverse cultural backgrounds attribute illness, health, disease, symptoms, and treatment to other sources. The finding also supports what Chipfakacha (1994) observed about how most Black Africans attribute illness to superstitious causes and therefore believe that disease is due to magic and evil spirits.

Similarly, most respondents are of the view that pregnant women are not supposed to eat certain kinds of food items, such as eggs, fish, and meat, to avoid the likely possibility of developing complications during labour. Also, attending the hospital during the first trimester of the pregnancy may draw public attention, especially from individuals with *evil eyes,* and that could cause you to miscarry. As a result, a pregnant woman needs to stay at home until she is into her second trimester of pregnancy. One of the respondents confirms, "I wait till three months before going to the hospital… this way, the pregnancy will be stable…." Interestingly, when respondents were able to

receive health-related information on their mobile phones, most of such cultural beliefs on health, pregnancy, and childbirth seem to have reduced, and improved their ability to obtain health information from the *right source* and at the right time. According to Engeström (2009), the task of activity theory is to "recycle the rubbish and turn it into diamonds" (p. 305). With the help of activity theory, individuals (subject) have been able to employ a mobile phone (tool) to *recycle the rubbish* (e.g., belief systems, not attending antenatal for the first trimester) into *diamonds,* where now individuals understand the need to seek health information (object) in order to promote health literacy (outcome) and improve healthy living.

6.6 **Impact of employing mobile phones for health activities**

In this section on the impact of mobile phones for health, most of the findings concern *rules* and *community* of activity theory. Generally, findings from the study present a positive perception about the use of mobile phones for health activities. Also, respondents view the device as a tool capable of transforming both healthcare deliveries in general, and an individual's access to healthcare services specifically. In healthcare delivery, for instance, the phone has "lessened healthcare personnel's work in terms of performing daily home visitation" in the communities. This is an example of one of the theory's components known as *community.* The use of mobile phones has made it possible for individuals living in a more culturally receptive rural community to understand the need for health information to promote healthy living. It has also brought about an individual's easy access to, and ability to obtain relevant information about, their health, especially in communities where there is a lack of or limited access to computers and the low penetration of Internet services.

In order to recommend the use of mobile phones as a tool to promote health literacy and improve healthcare delivery service among individuals living in rural communities, the researcher explored how the device has impacted the lives of participants in particular, and also their communities and the nation in general. From the analysis, the use of mobile phones (tool) for health-related activities (rules) was found to have impacted numerous lives, as well as healthcare delivery services. The impact is noted in diverse areas, including: (a) misconceptions about pregnancy, childbirth, and child care; (b) enhanced understanding about certain illnesses and diseases; (c) improvement in ways of obtaining health information to save lives; and (d) enhanced possibility of checking counterfeit medications in the market. In addition to the impact, participants were asked other health information that they would like to receive, as well as the format for the information on their phones. This section discusses findings pertaining to impact of employing mobile phones for health-related activities.

The use of mobile phones (tool) to receive information about health (rules) has reduced misconceptions and beliefs (object) that most individuals (subject) had about certain practices. Further, responses from participants reveal that pregnant women are not supposed to eat certain kinds of foods, such as eggs, okra, fish, and meat. The explanation given for this belief, according to one of the respondents, was, for instance, eating okra would cause the child to have a droopy mouth. One of the pregnant mothers affirms this explanation by saying, "...they said I shouldn't eat eggs and meat because the child will become very big and have difficulty delivering on my own." It is clear that if such misconceptions, misinformation, and disinformation associated with nutrition and child delivery were not addressed, their impacts could be detrimental to the health of pregnant

mothers and the overall development of baby, both before and after birth. An urgent need to initiate programs that can appropriately respond to the dire situation becomes crucial. It is heartwarming that some of the communities where this study was conducted are participating in the MoTeCH program and receiving health-related information on their mobile phones. This program helps to salvage what others would call a "misconceived-community" when it comes to health, and especially when it comes to pregnancy.

Central to operations of MoTeCH is the mobile phone that members enrolled in the program need to have. Jane discloses that she does not like the idea of "eat this and not that," as treasured in the community beliefs and practices, and expected of a pregnant mother. "Although I didn't like the idea I had to follow until MoTeCH program started operating. That was when I began eating everything. [And] I gave birth to a healthy baby." This is evidence that disrupting such unhelpful and unscientific widely held age-old community beliefs, and using programs such as MoTeCH, SMS For Life, and Millennium Villages Project, would be a step in the right direction. That direction holds a potential propensity for emancipating a lagging society as it regards trends of dispensing modern health care in line with twenty-first-century world health-service delivery, especially to a pregnant mother. This would be a step that contributes to the vision of eHealth strategy to promote healthcare delivery services in rural communities. The dream of eHealth is also to achieve the MDG by 2015. I strongly believe that a carefully designed and tactfully executed program using mobile phones can go a long way to not only sensitize communities to current trends of health care, but also increase knowledge level in order for individuals to successfully attend to healthcare issues, as well as to promote health literacy.

Moreover, responses from participants who are receiving information about pregnancy and child care from the MoTeCH program on their phones mention that they have healthier pregnancies and safer deliveries compared to their previous pregnancies. Strange as it might sound, unscientific as it might appear, and inconceivable as it might pique the human imagination, especially in these contemporary times, here we have communities that use hot water to massage newborns; give newborns tap water to drink on day one of their delivery tap water to drink; and many expectant mothers choose home delivery over hospitals. As well, the importance of colostrum in building the immune system of the baby was neglected, with the belief that "...the yellow milk [colostrum] was dirty and may cause stomachache to the baby." A captured conversation with one of the nursing mothers enrolled in MoTeCH reveals that this practice has been going on in most communities: "…when I deliver, I give my baby water to drink because our village is very hot… in our tradition, we massage newborns with herbs and hot water… [and] we didn't realize the need to wash our hands before handling the baby or even feeding the baby…." She indicates that, thankfully, the MoTeCH program has brought her knowledge and understanding of a new helpful and useful way of attending to all issues of crucial concern, as enumerated above. In another sense, we can see how the usefulness of mobile phone technologies can be harnessed to improve healthcare delivery to people, especially those living in rural communities.

Additionally, data from the study suggest that the use of mobile phones in health has improved the efficiency of communication between patients and healthcare workers, thereby reducing travelling cost and time and delays in the delivery of healthcare services. One of the midwives states that "...it has changed the delivery system... in cases

where women are in labour or there is an emergency and they are not able to come to the hospital on time for delivery, they call the health centre and we quickly go over to attend to them." Relating this finding with literature, the study adds to how use of mobile phones to perform health-related activities has transformed many lives across the world in general, and specifically for many low-income people and communities, by offering individuals access to health information and reducing the cost of transportation to access health information (Mechael, 2010; WHO, 2011).

Similarly, the study reveals that some participants use their mobile phones to search on the Web for information on diseases and illnesses afflicting them as individuals or their relations, such as friends and children. Others use the device to obtain confidential information about their health and healthcare services, such as family-planning practices, and causes and prevention of STDs, from healthcare personnel at the hospital. Alice indicates how she "wants to know much about" an ectopic pregnancy afflicting her sister, and for that matter, "went to the Internet to Google what an ectopic pregnancy was all about." Perhaps many individuals in communities such as those rural settlements where this study was conducted did not know about the possibilities of mobile phone use. Hence, creating awareness and exposing individuals to such uses of their phones likely impacts their perspectives on other potential ways of phone usage. Vodafone's (a mobile phone service provider) (2006) research study on mobile phone usage found out that young people employ features such as SMS and voice on the phone to access confidential health-related information from the health line.

Further, there are situations where medical practitioners employ mobile phones to obtain instant health information from colleagues who may be specialists in related fields

of practice, enabling them to handle medical emergency conditions of patients and successfully save a human life. Asare describes how the device has improved healthcare delivery service, and even [improved] the concept of telemedicine in Ghana: "…Yesterday I had a case at the theatre… sent a text to a colleague to inquire about something… the feedback helped to save the patient's life... in Ghana." Findings from the study contribute to literature on the concept of telemedicine.

According to WHO (2011), use of Mobile Doctors Network (MDNet), where the ability of medical personnel to communicate with each other with respect to managing a patient's health has improved healthcare services, thereby reducing the number of death cases among patients. WHO adds that implementation of MDNet facilitates the referral of patients to higher levels of care, especially in the rural communities. Chetley (2006) and Moore and Bloch (2009), explain that in health activities such as remote diagnosis and treatment, telemedicine could involve patients and health personnel, especially in hard-to-reach locations.

According to Young (2001), the impact of cultural beliefs, and probably lack of medical personnel, has caused most individuals to rely heavily on self-treatment or medication, consult traditional healers, or both. Similarly, the study indicates a huge pharmacovigilance improvement with relation to healthcare challenges, ranging from the possibility of checking for importation of counterfeit medications into the country to medication shortages in hospitals as a way of reducing health risks among many residents. According to WHO (2011), employing mobile phones in the health sector reduces most health challenges, such as decreasing medication shortages in hospitals, in order to increase clinical diagnosis and treatment. Ofosu (2009) notes that with the large

numbers of Java-enabled mobile phones in Africa, individuals can employ the device to obtain up-to-date lists of drugs and information on a disease. Bezold et al. (2006) also add that healthcare workers record information or convey bio-monitoring data from an individual to data storehouses or to their healthcare provider.

Sherwani, Tongia, Rosenfeld, and Ali (2006) stated that technological devices, particularly mobile phones, are suitable for non-literate populations, who find reading text more difficult than listening to voice and viewing visual messages. In conclusion, Glassman and Helgeson (2012) appreciate the mobile phone as a potential device to promote healthcare services and delivery and improve access to health care in rural and other medically underserved communities. Overall, putting the uses of mobile phones in perspective, and in relation to the views shared by participants, there is no doubt that the device stands as a potential tool that can be used to impact the healthcare (delivery) needs of people, especially those in rural communities.

This section of the chapter discussed how the use of mobile phones for performing health-related activities has impacted healthcare delivery and access to information about an individual's' health, in communities where access to healthcare service in limited. In the section, I discussed how using mobile phones for receiving health-related information has improved misconceptions and beliefs about certain health practices, thereby promoting a healthy lifestyle among individuals living in culturally receptive communities. I discussed also how usage of the device has improved telemedicine, by reducing travelling cost and providing improved prompt medical diagnosis of patients. Finally, this section examined the health impact of checking for importation of counterfeit medications into the country.

Chapter 7

7 Conclusion

The study posed the following questions: What views do people have about information that relates to health? What are the existing media used for obtaining information related to their health? What are the types of health-related activities that people perform on their mobile phones? What are the factors that influence employing mobile phones in activities related to their health? And, what are the impacts of employing mobile phones for activities related to their health in remote and isolated communities in sub-Saharan Africa?

To find answers to the questions, I employed sequential explanatory and sequential transformative mixed-methods designs (Andrew & Halcomb, 2009; Creswell & Plano Clark, 2011). With mixed-methods approaches as the research method, survey data was gathered from 92 participants, with follow-up interviews with 20 respondents on the perspectives about the use of mobile phones to promote health literacy among individuals living in the rural communities. This study was inspired by my interest in emergent tools that afford literacies in science and health education.

Data from interviews were analyzed using a computer software program known as Weft QDA, whereas data from the survey were analyzed using SPSS software. Data from both survey and interviews were analyzed to examine the potential use of mobile phones to promote health literacy and also improve healthcare delivery services among people living in rural communities. During the analysis, both data were sequentially integrated in the form of quantitative-qualitative approach. This helps the researcher to extract

adequate information from the data in order to increase the trustworthiness of the data and also to explain the findings.

Findings that emerged are grouped under four main sections: (a) health-related activities performed on and with mobile phones, and their impact on promoting health literacy; (b) challenges with the use of mobile phones for performing health-related activities; (c) systems for seeking and accessing information about health; and (d) perspectives on health literacy and information that relate to health. The subsequent section addresses the findings that emerged from the study in relation to the research questions.

7.1 Addressing the research questions

Employing an activity theory framework as a lens, data were analyzed to find out in what ways health literacy and access to health information answer my research questions. The study questions are asked to ascertain health-related activities that individuals perform on and with their mobile phones. My inquiry about the device's usage also involves challenges that individuals encounter when using mobile phones to seek, access, obtain, and evaluate health information in order to find a way, when possible, to address some, if not all, these challenges. The subsequent subsections focus on the findings that emerged through each of the questions posed.

7.1.1 Nature of health-related activities and their impact

From the study, I found out that participants employ mobile phones to perform health-related activities. In terms of patients and other individuals' activities, participants use the device to perform activities such as: (a) inquiring about health concerns from friends, family, or healthcare personnel by either calling or sending an SMS; (b) calling

healthcare centres and helplines that address specific health issues, such as family planning, pregnancy, childbirth, and cholera outbreak, in the form of teleconsultation and telehealth; (c) pregnant women and nursing mothers receiving weekly health messages related to their pregnancies and their children; (d) clarifying any health symptom before travelling to healthcare centres, and also calling the medical centre or family members when there is any emergency; and (e) obtaining supplementary information from the Internet, or clarifying ideas during a patient's consultation session.

In terms of the healthcare sector, the device is employed by pharmacists to: (i) "clarify prescriptions from the doctor before dispensing the medication to the patient"; and (ii) "scrutinize counterfeit medications coming into the country." Other healthcare personnel use the device to: (i) gather demographic information from patients and store it electronically; (ii) clarify information from their colleagues, who may specialize in specific fields of health care, before diagnosing a patient; and (iii) "send mass SMS to community members about a new medication being launched." Connecting back to Kickbusch's (1986) ways of promoting health education in a community with the idea of sending mass sms to community members, when healthcare personnel, in collaboration with mobile phone companies, send out mass health information to the community about personal hygiene practices, this will assist in educating a community's entire population.

The use of mobile phones in mHealth has various impacts on the participants as far as healthcare delivery and access to health information are concerned. There is no doubt that diverse health-related activities performed on mobile phones have improved not only access to health information, but also healthcare delivery through telemedicine and teleconsultation. In effect, this practice has not only attempted to bridge the

information and communication gaps between patients and healthcare providers, it has reduced death cases due to the fact that medical practitioners are now able to communicate with each other during emergency situations (WHO, 2011). Also the demand on medical practitioners in developing communities has decreased because of the practice of telemedicine and teleconsultation (Chetley, 2006; Mechael, 2009; Moore & Bloch, 2009). Above all, economically, delivery of healthcare services in the form of telehealth and teleconsultation, according to Centers for Medicare and Medicaid Services (2012), is perceived by both individuals and by government as more cost effective than the more traditional face-to-face way of providing medical care, especially in situations where patients may need to travel several kilometers to get to the healthcare facility. Although this is good, ethically there are some privacy issues (Burke & Weill, 2013) such as transfer of personal information from one healthcare centre to another.

7.1.2 **Factors influencing mobile phone usage in mHealth**

The use of mobile phones for accessing and seeking health information in this study indicates that most individuals face various challenges during this process. Such challenges include language barrier due to low level of education, limited health information resources, mobile network fluctuations, and lack of financial incentives (Déglise, Suggs, & Odermatt, 2012). These challenges are categorized under three groups: (a) socio-economic and demographic factors such as age, level of education, and income; (b) technological features and service impacts, which include mobile network systems, device's screen size, availability of information, and suitability of mobile health apps to patients; (c) cultural beliefs and practices, such as who needs to seek, access, and obtain health information, and at what time and at which location.

It is not surprising that Kwon and Chidambaram (2000) and Rice and Katz (2003) state socio-economic factors as a major mediating factor when it comes to the use of mobile phones for either health activities or any other activities. In Ghana, residents living in the rural communities are mostly farmers or operate micro-businesses and barely have enough to feed their families, let alone own a phone, and for that matter, purchase airtime or subscribe to a data plan to go online for health information. Another issue that I noticed among most participants was a high level of illiteracy (Ojo, 2006). Usually, when people have difficulty in reading or writing, it becomes hard to obtain written information about their health. This suggests that employing the device in rural communities would be somewhat difficult, given the financial barrier and level of illiteracy in terms of employing the device to search for information online.

Again, in most cases, it is believed that the older you are, the more health-related issues you have, and so the likelihood of seeking health information is high. In this study, however, that was not the case. Rather, younger adults were employing the device to perform health-related activities. Older adults, on the other hand, view the device as too complex to handle and therefore prefer the traditional "face-to-face" interaction with a medical practitioner.

In terms of technological factors, there are some barriers to the implementation of mobile phones in health sectors that are not unique to rural communities in Ghana, though they are common in those locations. When we consider the unreliable network system, most of the participants enrolled in the MoTeCH program indicate that due to poor network system, they hardly receive or send health information on time. Fausty laments that "…the main problem we face is a poor network system… this makes the

registration of clients a bit difficult." Even though I find a poor network system to be one of the barriers, this challenge does not appear to pertain solely to rural areas. Most of the findings from this study on factors to implementation of mobile phones for health-related activities are similar to what Mechael (2006) and other researchers have noted to include cost, reliability of telephone systems in health facilities, and privacy issues.

Information gathered from both survey and interview responses indicates that culture and traditional beliefs play a significant role when it comes to seeking and accessing information about health, as well as use of mobile phones in general. These traditional and cultural beliefs could be: (i) beliefs about pregnancy and childbirth, (ii) beliefs about illnesses and sicknesses; or (iii) beliefs about gender and access to health information and health care. On beliefs about pregnancy and childbirth, some of the nurses indicated that due to the high level of cultural practices and beliefs, a pregnant woman would stay at home till she was almost due for labour before attending antenatal health care. Other women would prefer home delivery in order to prove to their rivals they are strong and capable of delivering on their own. As a result, Vaughn, Jacquez, and Baker (2009) comment that "cultural issues have increasingly become incorporated into medical care as there has been greater recognition of the intimate tie between cultural beliefs and health beliefs" (p. 69). Fortunately, in the areas where the study was carried out, health information is being provided through community durbars by healthcare personnel and midwives performing home visitation on nursing mothers and pregnant women, and most of these beliefs systems are gradually disappearing. One of the midwives stated that "...receiving health information on the phone has really changed the delivery system... in cases where women are in labour or there is an emergency, and they

are not able to come to the hospital on time for delivery, they call the health centre and we quickly go over to attend to them."

With respect to beliefs about illnesses and diseases, there are other people who were of the view that certain ailments were of spiritual nexus and therefore needed to be treated as such. Kafui adds, "When a person has been having swollen legs [elephantiasis] for a long time… they believe that maybe that person has done something wrong and that is why he or she has swollen legs."

Besides beliefs about illness and sickness, in a culturally practised environment, use of the phone to perform health-related activities, or any other activity may be influenced by gender, especially married women. Thus, it was believed that, as a married woman, you were not "allowed" to communicate with "other" men, apart from your husband. Therefore, owning a phone may trigger any form of conversations between a married woman and "other" men. One of the married women said to this effect, "I share the phone with my husband… he doesn't want people to call me that much, so when he is at home, then I call my family members.…"

To summarize, use of mobile phones to perform health-related activities and seeking health information in general are influenced by various traditional and cultural beliefs. The beliefs range from causes of diseases and illnesses to gender and the type of information to access and at what time. To conclude, the factors influencing use of mobile phones in mHealth are very complex.

7.1.3 **Existing media for obtaining information about health**

The focus of the study was also to determine other media through which individuals seek and access information about their health. Inquiring about other media

for obtaining health information provides the researcher an idea that individuals who do not own mobile phones would at least be able to seek medical assistance in one way or another. Prior to inquiring about sources for seeking and accessing health information, participants were first asked when they look for information about their health. From the findings, most participants seek or access health information only when it is needed. The only individuals constantly on the move in search of health information were participants who were part of healthcare delivery services. In the healthcare delivery, information is sought by "virtue" of their work, but not necessarily because they are in need. These practices make it hard for individuals to develop health literacy, in the sense that most of them may not be health conscious on a daily basis and would rather wait till there is an emergency before acting.

Besides inquiring of participants when they seek health information, the researcher investigated whether seeking and accessing health information was based on age and gender, and also whether men seek health information more often than women, and vice versa. In response, participants seem to have varied views. In terms of gender, most participants were of the view that men and women seek health information that relates to them. However, when it comes to seeking health information in general, women tend to seek information more often than men. The reason for this, I believe, is that it is usually women who are taking care of the home and the family when it comes to health needs. Men are always on the go and sometimes even forget that they need to seek medical attention when they are not feeling well. When it comes to age, health information that is sought is entirely different. Thus, young adults tend to search for information related to "keeping up" with fashion, such as dieting, how to prevent

unwanted pregnancy, and also causes and treatment of STDs. In the case of older adults, Asare states, "…as a person grows old, he or she becomes prone to various diseases and illnesses, hence "…most people over 40 years are becoming very anxious about high cholesterol, cancers and other illnesses." To reduce this anxiousness about illness and disease, Edward suggests the need for public awareness in terms of posters and community durbars, among others.

Connecting to participants' sources of health information, surprisingly, seeking, accessing, evaluating, and implementing health information from a particular source appears to be varied for most participants, and these sources are also influenced by factors such as demographic and socio-economic status. The most common sources, however, are community durbars, posters, and families/friends. Contrary to my assumption and what the literature says about individuals with a high level of education as being the potential candidates in employing healthcare centres as their sources of information, amazingly, this was not the case in this study. Thus, individuals with or without education were equally seeking medical attention when needed from healthcare centres. The only sources of health information that I found different was the use of the Internet, magazines, and textbooks, which were mainly employed by healthcare practitioners and educated persons to supplement the information or knowledge they already have.

In summary, from this study, participants use various means or sources, such as television, family, healthcare personnel, and mobile phones, to seek, access, and evaluate health information related to their health. When it comes to using media, such as the Internet, magazines, or health brochures for health needs, these sources are mainly

employed by individuals with a high level of education due to their ability to read and write. However, media such as community durbar and family are usually employed by most participants with a low level of education. On the issue of when an individual looks for health information, it appears most participants seek information related to their health only when needed or in emergency situations. On the other hand, by virtue of their work, participants who are in the healthcare services seek health information on regular basis.

7.1.4 **Perspectives on health literacy and information that relates to health**

When it comes to information that relates to individuals' health, I am of the view that it is sorely lacking among individuals who live in the rural communities. The reason for my perception is that many participants in rural communities appear not to have an idea about their health or as far as health-related issues are concerned. As a result, seeking specific information that relates to their health, as well as appropriate medical attention, becomes an issue. Hence, most of such individuals fall victim to associating their illnesses and sicknesses to various sources because they do not pay much "attention" to their health and the symptoms they would be experiencing from the onset. One of the participants, a medical worker, stated, "…Hmm, I lost a cousin recently to brain tumour… he didn't tell anybody he was not well because he had been convinced that the illness had a spiritual connotation." This shows that there are many individuals in the rural communities who do not first seek medical attention when they are sick and would prefer last-minute medical assistance. Again, most individuals tend to ignore the symptoms of illness until the condition moves past the curable stage. This is where

individuals tend to attribute most illness and sicknesses to superstitious causes and try to believe that they are the result of magic and evil spirits (Chipfakacha, 1994).

From the study, the majority of the participants equate health literacy with an individual who is able to apply some degree of health applications to his or her life. Thus, when a person is health literate that means he or she goes for regular check-ups, takes proper medication, practises family planning when applicable, and keeps his or her surroundings clean. On the other hand, few participants view health literacy as a complex term that goes beyond an individual's ability to practise family planning or going for regular check-ups. One participant explained health literacy as a broad term to encompass "having certain knowledge about your health… trying to know what is worrying you, and having an idea where to you go for medical assistance." There is no doubt that health literacy is being equated to healthiness due to its complexity, as noted by the Institute of Medicine report (2013). Thus, health literacy, according to the Institute of Medicine report, includes the degree to which individuals have the ability to seek, access, process, and understand basic health information and services needed to make appropriate health decisions related to their health status in order to improve healthy living.

In this study, I found that some participants were knowledgeable about health, but were not health literate, in the sense that although most of the participants have knowledge about certain issues that relate to their health status, seeking the right remedy, making decisions, and applying the information were a major hassle due to a variety of factors including cultural practices and beliefs. Many times, when some of these individuals are sick, especially married women, they have to wait for their husband's approval before seeking medical attention.

To sum up, most participants in this study did not seem to have perspectives about health literacy, their health status, and for that matter, seeking medical assistance at the right time was not happening.

7.2 Research limitations

One main limitation might have affected the findings of this study: the sampling procedures. The study purposively selected rural communities, where mobile phones were utilized for health-related activities. Although participants were randomly selected for survey data, purposive and snowball sampling was employed for the interview data. As a result, participants who were interviewed on the potential use of mobile phone to promote health education were mostly individuals who were already utilizing the device to perform most of such activities. This sampling technique excluded individuals from other communities at the survey stage, and those who were not already utilizing mobile phones at the interview stage. This sampling procedure meant that views of individuals who did not own mobile phones were not gathered. Hence, their perspectives about the potential use of mobile phones to promote health education are not presented in the findings of this study.

Embarking on a study of this nature may have had both obstacles and opportunities. An occasion where I experienced what I term as a challenge to the study was when I felt participants were somewhat reluctant to respond clearly to some of the interview questions, due to their cultural practices. Carrying out a study in a profoundly culturally sensitive community can be quite challenging, especially when one is considered to be “outsider” to their culture. Also, language becomes a barrier for

communication between the researcher and participants, especially when participants communicate solely in their native language via a translator.

Taking ownership of a project has been somewhat of a development challenge because this form of accessing health information and educating individuals on health-related practices in rural communities is still in its infancy, both in the type of health information to be accessed and how to obtain and evaluate the information.

7.3 Research contributions, recommendations, and future research

This research is important in a number of areas. First, the study findings contribute to both literature and theory in eLearning and mHealth.

Considering that access to relevant information has a social-constructivist characteristic in terms of individual needs and differences (Hayes et al., 2007), mobile phones enable individuals to take centre stage in seeking, evaluating, and using health information to address assorted health issues.

This study contributes to educators' understanding in identifying various forms of learning, and seeking information and pedagogies for which activity theory is particularly appropriate. Some studies on mobile learning and mHealth have included the use of mobile phones (Traxler, 2007). However, research on broadening access to timely health information and healthcare services through technology, by the inclusion of mobile phones in rural communities with limited healthcare facilities, cultural domination in terms of access to healthcare services, and a low level of both general literacy and health literacy rate, is almost non-existent. As a contribution to theory on eLearning and mHealth, this study adds to how technological devices have the potential to "transcend the limits of the original utilitarian profit motive" (Engeström, 2009, p. 305) of the

designer and subscriber of the tool. Thus, individuals (subject) are able to employ a mobile phone (tool) to inquire about their medical conditions or access information about their health (object) in order to promote healthy living (outcome).

The study findings are in line with the literature on the use of mobile phones to perform health-related activities in order to promote access to health information and improve health and healthcare delivery services (see, for example, Kalil, 2010; mHealth Ethiopia Report, 2011; Ofosu, 2009; Ramey, 2007). Results of the study are also in line with Glassman and Helgeson (2012), who appreciate how the device's usage in health has improved healthcare delivery and access to health care in rural and other medically underserved communities. In addition, my study contributes to the literature on challenges with the use of mobile phones in health-related activities (see, for example, Adams & Kirova, 2007; Flanagan & Miranda, 1995). Again, this study contributes to how a mobile phone serves as a health educational tool for individuals from diverse cultural backgrounds, where illness and seeking medical attention are influenced primarily by cultural beliefs and practices (Helman, 2007; Vaughn, Farrah, & Baker 2009). Additionally, the study explores some of the challenges of using the device in performing such activities as a way of contributing to data for future research.

Second, the study findings add to literature on ways of addressing health inequities in remote communities through conducting capacity-building projects. It also assists development agencies and policy-makers in developing understanding on ways of promoting adult education and means of addressing issues related to patients' privacy and confidentiality. These beneficial development agencies include African Network Campaign for Education For All (ANCEFA), African Medical & Research Foundation

(AMREF), Canadian International Development Agency (CIDA), and International Development Association (IDEA), The African Platform for Adult Education (TAPAE), United Nations Development Programme (UNDP), The United Nations Children's Fund (UNICEF), and World Health Organization (WHO). Findings from this study would help foster interaction among local and foreign development agencies, as well as government and local residents in the quest for good governance and citizens' empowerment regarding strategies to use in planning and implementating mHealth through the fanciful features on mobile phones.

Third, another vital sector that this study contributes to is gender participation in decision making when it comes to healthcare needs. Gender participation in development intervention is a slogan in Ghana, especially in the rural communities, and probably would be as well in other culturally responsive countries such as India and Pakistan. The government, through radio and other community durbar programs, is constantly reminding men and women to be involved in decision-making processes, particularly when it comes to seeking medical assistance. Obtaining information on the phone related to health, and employing the device to inquire about health information, would in one way or another reduce the traditional beliefs and practices where a woman would need the consent of the husband or the head of the family before seeking medical help. My recommendation on factors that hinder/promote men's and women's participation will serve as input to the development of mHealth and access to information planning in their future rural projects in this technological age.

Further research could draw from a larger sample from both rural and urban communities to compare health-related activities individuals perform with and on their

devices. Also, individuals both with and without mobile phones could be included in the study. This would help to understand the reason for not owning the device and, as well, obtain diverse views about health literacy. The study may include focus-group discussions with different key informants from each category—mother, healthcare personnel, and policy-makers. This would offer deeper insights into whether use of mobile phones for health-related activities is mainly needed in the rural communities or in both urban and rural settings. Also, focus groups would show whether challenges with the device's usage for health activities pertain to only rural communities, or to both rural and urban communities. In order to make a generalization on certain practices and challenges in terms of access to health information and mHealth in rural communities in Africa, a comparative study between two or more countries would be important to undertake. In terms of data analysis, a technique that may be worthwhile conducting, would be a hierarchical logistic regression, whereby data is gathered from various groups of people and analyzed hierarchically in a single study. These groups may include medical practitioners, farmers, students, and lawyers.

Additionally, it occasionally becomes difficult for a researcher to obtain certain kinds of information from participants, possibly because of their cultural practices. One example would be about inquiring as to why married women are not allowed to practise family planning. Hence, a study like this could take the form of ethnography where the researcher stays in the community for a longer period. This helps the researcher to familiarize himself or herself with community members, learn about their culture, how they use mobile phones to perform health-related activities, and how they access health information from other media.

There is much more to investigate on the use of mobile phones by individuals as a tool to seek, obtain, and access health information in order to promote health literacy and improve healthcare delivery. Findings from this study offer both academic and non-academic researchers data and literature for future studies.

My recommendations for development projects on mHealth involve the use of pictorial images to tell health stories as a way of promoting health status in rural communities, for instance, use of pictorial images to explain the importance of personal hygiene and how to practise it. Again, creating health awareness among individuals, both in the rural and urban communities, could be done by assigning health information as ringtones. This may be done effectively when healthcare agencies collaborate with mobile phone companies to assign given health-promotional information as ringtones.

7.4 Concluding remark

This is how I see my work in terms of what surprised me, major findings, and obstacles encountered during the research. Besides the obstacles and opportunities, conducting a study of this nature was interesting and full of surprises. These surprises range from the media used for accessing health information, to the kind of health information an individual may need to access.

When it comes to employing healthcare as a source of information, individuals with limited or no education tend to use the hospital as their main source, compared to the educated. This is a bit of a surprise in the sense that we may have thought that in most cases, individuals with a high level of education would rather seek medical attention because they would better understand the value of the hospital than those with limited or no form of formal education. On the other hand, the educated tend to read health

magazines, go online to find additional information about their health status, and then go to the hospital when the need arises. With respect to the tools used to obtain health information, participants who were formerly married and those with no children employ the Internet and phone the most. In fact, I was of the view that women with children would rather employ mobile phone to call healthcare personnel and other healthcare agencies for health-related information for their family.

Another interesting finding from this study was that individuals who have never sent text messages with their mobile phones were keen on receiving health-related information on their devices. This is indeed fascinating to learn, because one may wonder why not people who exchange SMS on their devices, since they should have the a high tendency to communicate via text messages. This was not the case in this study, and I think it would be worth investigating further to understand why.

This research is significant in several ways. These significant ways may be viewed, first, from how the use of the mobile phone to perform health-related activities improved both the quality of healthcare delivery services and access to health information. From the findings, it was revealed that the mortality rate has dropped dramatically as a result of mobile phone usage to obtain timely healthcare services and information during an emergency. In addition, use of the device in the healthcare sector as a means of communication among healthcare personnel, and between healthcare personnel and patients, has minimized the spread of illnesses and diseases among individuals living in the communities with limited access to healthcare facilities.

Second, as mobile phones are employed to access and obtain information about health, in one way or another, this process has educated most individuals in various ways,

especially in the area of how diseases and illnesses are attributed to superstitious beliefs. Now most participants tend to understand why certain diseases and illnesses, such as cholera and malaria, are contracted, without attributing them to evil spirits. From the study, there were numerous traditional superstitious beliefs and concerns about evil spirits as being the cause of illnesses and diseases, such as the belief that a pregnant woman choice of home delivery signifies courage, especially when she has a rival who is going through the same process.

Given that the study took place in a rural setting, where cultural practices and traditional beliefs are prominent, seeking health information becomes a bit of an issue. From this study, the primary source of information about health is the consultation of a family member, especially individuals with limited or no education. Adding to cultural practices and how they influence health-seeking behavior vis-à-vis decision making about health, be it obtaining information about health status, family planning, or whether a pregnant woman may deliver at the hospital, is the fact that it is the husband who usually makes the decisions. Men decide when a woman needs to seek medical attention or not, and at what time. Women, especially married women, have no control over their health or when to conceive. As a result, many women conceive against their will and sometimes try to terminate the pregnancies on their own when they feel too depressed about taking care of the children on her own. Now, with the help of the mobile phone, many women are able to consult with midwives and other medical personnel for family-planning options, without their husband's permission.

Third, findings from the study show that many participants consider health application, such as individual's ability to take proper medication and go for regular

check-ups, as health literacy. Even though I was a bit surprised to learn that health literacy was considered as individuals' ability to go for regular check-up, and eat a balanced diet, on the other hand, I found the concept of health literacy in general to be very complex, with diverse definitions. Being health literate involves an individual's ability to access, seek, obtain, evaluate, and apply obtained health information to the health needs.

Hence, I would conclude by saying this study has been tremendous in diverse ways in terms of beliefs about health, source of health information, and perceptions about health. As a result, this study was indeed worth investigating.

This research was conducted in a location and with communities that are rural and remote, and where cultural beliefs still play a major role in the promotion of health. I found this study to be an opportunity in several ways: It offered to me, as an outsider/insider, various opportunities to understand not only cultural diversity, but the ability to delve into issues pertaining to other parts of rural Ghana, specifically health issues confronting individuals living in both remote and overly culturally-sensitive countries. This provides an avenue for policy-makers to employ findings from the research to develop strategies and working policies to assist individuals in rural and remote areas, not only in Ghana, but also in other sub-Saharan countries.

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Appendices

Appendix 1: **Letter of Information**

The Role of Mobile Phones in Health Education for Rural Communities in Ghana: An Exploratory Study on Digital Technologies

Introduction

My name is Kinful Lartebea Aryee, a PhD candidate in Curriculum Studies at the Faculty of Education at The University of Western Ontario, Canada. I am currently conducting research into how mobile phones can be used to seek and access health information and would like to invite you to participate in this study.

Purpose of the study

The aim of this study to examine the potential use of mobile phones to promote health literacy and access to information about health in order to improve the healthcare delivery system among people living in rural communities, and I would like to invite you to participate in this study.

If you agree to participate

If you agree to participate in this study, you will be asked to respond to survey questions that will be followed by an interview session to obtain detailed information on questions such as health activities that are usually performed on and with the mobile phone, factors that may influence these activities, and views about using the device to improve health literacy. The estimated total time for the interview will be 45 minutes to 1 hour each and will take place in your home or at a place convenient for you. Your time commitment will be up to two hours at a time mutually agreed upon by you and other participants. The interview will be audio recorded. Audio records will be transcribed and analyzed. You will be given a copy of your typed interview to look over, and you will be able to make any changes you deem necessary.

Confidentiality

The information collected will be used for research purposes only, and neither your name nor information which could identify you will be used in any publication or presentation of the study results. You will be asked to select a pseudonym that may be used to identify your questionnaire. All information collected for the study will be kept confidential. Your data in the form of an audio record, transcripts of audio records, and questionnaire data will be kept under lock and key at the researcher's home. Electronic transcripts and files will be stored on a password-protected computer. The list on which your pseudonyms are matched with your actual name will be kept separate from the data in a locked file. The data will kept until April 2014, after which it be destroyed.

Risks and Benefits

There are no known risks to participating in this study. Findings from this study will be useful for designing various ways of disseminating health information to individuals in rural communities where health centres and medical professionals are limited.

Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions, or withdraw from the study at any time, with no effect on your relationship, if any, with the researchers.

Questions

If you have any questions about the conduct of this study, or your rights as a research participant, you may contact the Manager, Office of Research Ethics, The University of Western Ontario at 519-661-3036 or ethics@uwo.ca.

Thank you for considering this request. This letter is yours to keep for future reference.

Appendix 2: Consent Form

The Role of Mobile Phones in Health Education for Rural Communities in Ghana: An Exploratory Study on Digital Technologies

I have read the Letter of Information, have had the nature of the study explained to me, and I agree to participate in the face-to-face interview. I agree that the interview conversation will be audiotaped during the discussion. All questions have been answered to my satisfaction.

Name (please print):

Signature: Date:

Appendix 3: Survey Questionnaire

Title: The Role of Mobile Phones in Health Education for Rural Communities in Ghana

NAME: _____ Male or Female (Please circle)

Please respond to all questions as best as you can. **Duration: 30 minutes.**

A. Demographic information

1. **Age group** *(Please check)*
   - □ 18–30
   - □ 31–40
   - □ 41–50
   - □ Over 50

2. **Marital status** *(Please check)*
   - □ Married
   - □ Separated
   - □ Divorced
   - □ Never married
   - □ Other (please specify) _____

3. Do you have children?
   - □ Yes → How many? _____
   - □ No

4. **Highest level of education** *(Please check)*
   - □ Graduate education
   - □ Secondary education
   - □ Primary education
   - □ Informal education
   - □ No formal schooling
   - □ Other (specify) _____

5. What is your current employment status?
   - □ Self-employed
   - □ Civil servant
   - □ Unemployed
   - □ Student
   - □ Other (please specify) _____

6. **What other language(s) do you speak apart from your local dialect?**
   - □ Akan
   - □ English
   - □ French
   - □ Other (*please specify*) _____

B. <u>Phone possession and phone usage in general</u>

7. Do you own a cellphone?
   - □ Yes
   - □ No

If yes, how many cellphones do you have?
   - □ One
   - □ Two
   - □ More than two

8. What is the total number of cellphones in your family/household?
   - □ Two
   - □ Three
   - □ Four
   - □ More than four

9. How long have you had your mobile phone?
   - □ Less than 1 year
   - □ 2 years
   - □ 3 years
   - □ 4 years
   - □ More than 4 years

10. Do you enjoy using your cellphone?
   - □ Yes
   - □ No

If yes, why?

_____

11. **How much do you spend per week to top up your phone credit?** (Please check)
   - □ 5 Ghana cedis
   - □ 10 Ghana cedis
   - □ 15 Ghana cedis
   - □ More than 15 Ghana cedis

C. Views about phone usage

12. Would you say that men and women use their cellphones for different purposes?

- ☐ Yes
- ☐ No

If yes, how?

_____

13. Do you think women use cellphones more often than men?

- ☐ Yes
- ☐ No

14. Do you send or receive text messages with your cellphone?

- ☐ Yes
- ☐ No

15. Name some of the activities that you use your cellphone to perform.

_____

_____

Please respond to all questions as best as you can. Please check (√) the response that best describes your perspective about the following statements.

SD = Strongly Disagree, **D** = Disagree, **N** = Neutral/No opinion, **A** = Agree,

SA = Strongly Agree

16. Cellphones are considered to be useful tools to:

	SD	**D**	**N**	**A**	**SA**
Communicate with friends and families					
Access any kind of information at any place and any time					
Ask and receive information from the hospital					
Assist with employment activities					

D. Views about health and health literacy

17. Do you value your health?
    - ☐ Yes
    - ☐ No

18. A person is considered to be health literate when:

	SD	D	N	A	SA
Practising family planning					
Going for regular check-ups					
Reducing drug abuse					
Taking proper medication					

19. When would you say you are practising a healthy living?

_____

E. Views about health information

20. How would you rate your ability to look for health information to prevent you and your family from contracting unwanted diseases and illness? **(Please circle one)**

Excellent	Very Good	Good	Fair	Poor
5	4	3	2	1

21. How likely are you to know whether the information you obtain is trustworthy before following it?

(Please circle one)

Very Likely	Somewhat likely	Not sure	Somewhat unlikely	Very unlikely
5	4	3	2	1

22. Ability to obtain relevant health information

	Yes	**No**	**Don't Know**	**Not applicable**
Reduces family pressure and stress				
Promotes healthy lifestyle				
Improves understanding about health				

Other (*please specify)* _____

23. Why is it important for individuals to look for health information?

_____

24. Do you practise family planning?

- Yes
- No

If yes, why? _____

_____

If no, why not? _____

_____

F. Sources of health information

Please check (√) the response that best describes your perspective about the following statements.

25. Have you used any of the following to obtain health information?

	Yes	**No**	**Don't Know**	**Not applicable**
Hospital/physician/nurses/public health				
Internet (e.g., Google, Yahoo, and YouTube)				
Friends and families				
Radio/television				
Posters				

Other (*please specify)* _____

26. **Which of the following sources are you most likely to contact *first* when you have any question about your health?**

- □ Health brochure
- □ A healthcare provider
- □ A family member
- □ A friend
- □ Internet
- □ An herbal doctor
- □ Other (*please specify)* _____

Usage of phone for health activities

27. Have you ever sent or received health information via your cellphone?

- □ Yes
- □ No

If no, why not? _____

28. Would you like to receive health information through your cellphone?

- □ Yes
- □ No

29. What kind of health information would you like to receive?

_____

30. Name three (3) health concerns that you want more information on.

_____

31. Who encouraged you to use the cellphone to inquire about health information from the hospital? (Please select all that apply)

- ☐ My family
- ☐ My friends at work/church
- ☐ My neighbours
- ☐ Other (please specify): _____

32. **Have you ever used your cellphone to perform the following activities?** Please check (√)

	Yes	**No**
Make a medical appointment at the hospital		
Find information about a health concern		
Look for a medical doctor or nurse		
Look up for something that I heard from the news or a friend		
Send/receive money or banking		
Receive market information about my farm products		
Arrange for social functions like funeral, naming ceremony, or marriage ceremony		

Please specify other activities, if any.

_____

_____

Views about employing phone to access health information

33. **I believe that emerging technologies likely to promote health understanding and improve healthcare system is/are** (Please check all that apply)
   - ☐ Cellphones
   - ☐ Televisions
   - ☐ Internet
   - ☐ Radio

Please respond to all questions as best as you can. Please check (√) the response that best describes your perspective about the following statements.

SD = Strongly Disagree, **D** = Disagree, **N** = Neutral/No opinion, **A** = Agree,

SA = Strongly Agree

	SD	**D**	**N**	**A**	**SA**
Cellphone has become a new way of learning.					
Using cellphone to look for information from nurses and doctors is easy and accurate.					
Lack of health information is as a result of low literacy level.					
Cellphone can promote health education among individuals in the rural communities.					
I am more likely to use the phone to ask more about my health status and any relevant health information.					

34. On a scale of 1 to 5, where would you place the mobile phone as a tool for searching and accessing health information? (**Please circle one)**

Excellent	**Very Good**	**Good**	**Fair**	**Poor**
5	4	3	2	1

Challenges involving employing phone to perform health activities

35. **Using a mobile phone to acquire information from the Internet/private website is very costly and time-consuming. (Please circle one)**

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5	4	3	2	1

36. **Have any of the following limited you from using your cellphone to look for or receive health information? Please check** (√)

	Yes	No	Not Sure	Not Applicable
Limited information source				
Lack of understanding				
Lack of funds				
Lack of need				
Lack of electricity to recharge the battery				
Low network connectivity				

37. Please check (√) the response that best describes your perspective about challenges involving access to health information in regard to the following statements.

	Always	Often	Sometimes	Occasionally	Never
I need hospital reading materials.					
I have problems learning about my medical conditions.					
I have difficulty understanding written information from a doctor.					
I have difficulty taking the right dosage of my medication(s).					

Appendix 4: Demographic information for survey participants

	Pseudonym	Gender	Age	Marital status	Highest level of education	Employment status
1	Fausty	Female	18–30	Single	Post-secondary	Civil servant
2	Iddrisu	Female	18–30	Married	No formal education	Self-employed
3	Edward	Male	Over 40	Married	Graduate	Civil servant
4	Cobby	Male	18–30	Never married	Secondary	Civil servant
5	Asare	Male	Over 40	Married	Graduate	Civil servant
6	Comfort	Female	18–30	Never married	Secondary	Student
7	Lartey	Male	Over 40	Married	Graduate	Civil servant
8	Melissa	Female	18–30	Married	Secondary	Self-employed
9	Mohammed	Male	18–30	Never married	Secondary	Self-employed
10	Boakye	Male	18–30	Never married	Graduate	Civil servant
11	Mary	Female	Over 40	Married	No formal education	Self-employed
12	Teni	Male	Over 40	Married	Secondary	Civil servant
13	Muri	Female	Over 40	Other	No formal education	Self-employed
14	Martha	Female	18–30	Married	No formal education	Self-employed
15	Clement	Male	18–30	Never married	Post-secondary	Student
16	Abraham	Male	18–30	Never married	Secondary	Student
17	Isaac	Male	18–30	Never married	Secondary	Student
18	Lydia	Female	18–30	Never married	No formal education	Self-employed
19	Bernard	Male	18–30	Never married	Secondary	Self-employed
20	Adwoa	Female	18–30	Married	Primary	Self-employed
21	Tagoe	Female	18–30	Never married	Secondary	Unemployed
22	Kafui	Female	18–30	Never married	Post-secondary	Civil servant
23	Emelia	Female	31–40	Never married	Post-secondary	Civil servant
24	Matnub	Male	Over 40	Separated	Graduate	Civil servant
25	Efiba	Female	18–30	Married	Post-secondary	Civil servant
26	Aba	Female	Over 40	Married	No formal education	Self-employed
27	Vic	Male	18–30	Married	Secondary	Self-employed

28	Fatima	Female	31–40	Married	Post-secondary	Civil servant
29	Francis	Male	18–30	Never married	Graduate	Self-employed
30	Kwabena	Male	Over 40	Divorced	Graduate	Civil servant
31	Gladys	Female	18–30	Never married	Graduate	Student
32	Amankwaa	Male	18–30	Never married	Graduate	Student
33	Abdul- M	Female	18–30	Never married	Secondary	Student
34	Adam	Male	18–30	Never married	Secondary	Student
35	Abigail	Female	18–30	Never married	Graduate	Student
36	Akua	Female	18–30	Never married	Graduate	Civil servant
37	Kofi	Male	18–30	Never married	Graduate	Civil servant
38	Ama	Female	18–30	Never married	Graduate	Civil servant
39	Akosua	Female	31–40	Never married	Graduate	Self-employed
40	Afia	Female	18–30	Married	Primary	Self-employed
41	Yayaa	Female	Over 40	Married	No formal education	Self-employed
42	Atoobey	Male	31–40	Married	Graduate	Civil servant
43	Joanna	Female	Over 40	Married	Graduate	Civil servant
44	Charles	Male	18–30	Never married	Graduate	Civil servant
45	Hussein	Male	Over 40	Married	Graduate	Civil servant
46	Naa	Female	Over 40	Married	Graduate	Civil servant
47	Allison	Female	Over 40	Married	Post-secondary	Civil servant
48	Nancy	Female	18–30	Married	Primary	Unemployed
49	Lizzy	Female	18–30	Married	Secondary	Self-employed
50	Alice	Female	18–30	Single	Secondary	Self-employed
51	Sulemana	Female	18–30	Never married	Secondary	Student
52	Kande	Female	18–30	Married	Primary	Self-employed
53	Sela	Female	18–30	Married	No formal education	Unemployed
54	Grace	Female	31–40	Married	Primary	Self-employed
55	Asana	Female	Over 40	Married	No formal education	Self-employed
56	Ninnag	Female	Over 40	Other	Secondary	Civil servant
57	Mohamed	Male	Over 40	Married	Graduate	Civil servant
58	Adisa	Female	Over 40	Separated	No formal education	Self-employed
59	Wuni	Female	18–30	Married	Graduate	Civil servant

60	Solomon	Male	Over 40	Married	Graduate	Civil servant
61	Nafisa	Female	31–40	Married	No formal education	Self-employed
62	Azaratu	Female	31-40	Married	No formal education	Self-employed
63	Mary	Female	Over 40	Married	No formal education	Farming
64	Agbenator	Male	Over 40	Married	Graduate	Civil servant
65	Raymond	Male	18–30	Never married	Graduate	Civil servant
66	Abdulai	Male	18–30	Never married	Secondary	Student
67	Azara	Female	18–30	Never married	Secondary	Student
68	Kwara	Female	18–30	Never married	Secondary	Student
69	Asana	Female	18–30	Never married	Secondary	Student
70	Abiba	Female	31–40	Married	Secondary	Unemployed
71	Mumuni	Male	18–30	Never married	Secondary	Student
72	Joyce	Female	18–30	Never married	Secondary	Student
73	Adam	Male	18–30	Never married	Secondary	Student
74	Mustapha	Male	18–30	Never married	Secondary	Student
75	Yakubu	Male	18–30	Never married	Secondary	Student
76	Abdul	Male	31–40	Married	Secondary	-
77	Baba	Male	31–40	Never married	Secondary	-
78	Akosua	Male	18–30	Married	No formal education	Self-employed
79	Kwaku	Male	Over 40	Married	No formal education	Self-employed
80	Maggie	Female	Over 40	Married	No formal education	Farming
81	Rashid	Male	31–40	Married	Graduate	Unemployed
82	Tohit	Female	18–30	Married	No formal education	Unemployed
83	Jane	Female	Over 40	Married	No formal education	Farming
84	Abukari	Male	18–30	Never married	Secondary	Unemployed
85	Sumani	Male	18–30	Never married	Secondary	Unemployed
86	Seidu	Male	18–30	Married	Primary	Civil servant
87	Mohamidu	Male	31–40	Married	No formal education	Self-employed
88	Damba	Male	18–30	Married	Primary	Unemployed
89	David	Male	31–40	Married	No formal education	Self-employed
90	Abdullah	Male	18–30	Married	No formal education	Self-employed

91	Hassan	Male	18–30	Never married	No formal education	Self-employed
92	Ndrisu	Male	31–40	Married	No formal education	Self-employed

Appendix 5: Interview protocol

Cellphone possession and general usage

1. Tell me about your use of cellphones?

   Subquestions:
   - How long have you had your phone?
   - What is the total number of cellphones in your family/household?
   - Do you like using your phone(s)?
   - What do you usually use your cellphone for?
   - How much you do spend on your cellphone per week?

2. What are some of the activities for which most people are currently using their phones?

   - What do you usually use your cellphone for?
   - What about your friends/neighbours?
   - What do the community members use their cellphones for?

Beliefs about health and health literacy

3. Is your health of important value to you? If yes, why? If no, why not? Who else's health status do you value?

4. Can you share with me what you think health literacy is?

   Prompt questions:
   - When do we consider a person to be health literate?
   - What are some of the ways/systems by which health literacy is or can be promoted among individuals in the community? (Answe: patient education, school education, adult education, broadcast media and print media communication).

Access to health information and beliefs

5. Can you share with me **when** and **how** you **look for**, and **receive** health information?

   Prompt questions:
   - How do you evaluate the information before applying it?
   - What would be the top three health concerns for you and your family?
   - What do you do to maintain your health and that of your family and friends?
   - Do you think individuals search for a variety of health information based on their age? If yes, what kind of health information do you intend to search for?

6. Do you think cultural beliefs and practices may influence your ability to inquire about any form of health information? If yes, can you share with me some of these beliefs and practices? And if no, why not?

Cellphones and health information, challenges/factors to access to health information

7. What are your views about using cellphones to promote health education?

    - What are some information activities related to health that people use their cellphones to perform?
    - Can you share with me some of the problems that people are likely to face when using cellphones to look for or receive health information?
    - How do you employ cellphones to obtain health information to promote both your own and your family's health?
    - Tell me how the device helps you in your job.
    - What problems do you usually face when using the cellphone to look for or receive health information?

8. Tell me about the health policies and programs currently in place to promote health education among individuals?

    Prompt questions:
    - How many of these programs are governmental initiatives and how many are non-government initiatives?
    - What is the participation rate?
    - Do you see the programs as effective? If yes, why? If no, why not?
    - What are some of the challenges with setting up these programs?

Recommendations for promoting health education

9. Can you tell me about any health-promotional activities that you would like to see taking place?

    Prompt questions:
    - What kind of health information would you like to receive? (include health conditions, diseases, health promotion)
    - In which format would you prefer the information? (e.g., videos, books, pamphlets, audiocassette, magazines and newspapers, computers and CDs, cellphone voice and text communication)
    - What other health information do you wish you had?

10. Do you have any more information you would like to share with me about promoting health education? Do you have any question for me?

Interview for nurses

1. What are your views about cellphone use in general?
2. Could you share with me how the MoTeCH phone operates in sending out and receiving health information?
3. What are/were some of the challenges with the phone's implementation?
4. How has this process helped the people in the community in terms of accessing health information?
5. Do you recommend the use of the mobile phone for accessing health information be continued? If yes why? If no, why not?
6. What other health information would you recommend be added to the existing information?
7. What are some of the health concerns about which you wished you had more information?
8. What other activities related to health do you wish you could use the cellphone to perform?
9. Is your health of important value to you? If yes, why? If no, why not? Who else do you value their health status?
10. Can you share with me what you think health literacy is?
11. Do you think cultural beliefs and practices may influence your ability to inquire about any form of health information? If yes, can you share with me some of these beliefs and practices? And if no, why not?
12. Could you share with me some of the health policies and programs currently in place to promote health education among individuals?

    Prompt question:

    - How many of these programs are governmental initiatives and how many are non-government initiatives?
13. Can you tell me about any health-promotional activities that you would like to see taking place?

    Prompt questions:

    - What kind of health information would you like to receive? (include health conditions, diseases, health promotion)
    - In which format would you prefer the information? (e.g., videos, books, pamphlets, audiocassette, magazines and newspapers, computers and CDs, cellphone voice and text communication)
    - What other health information do you wish you had?
14. Do you have any more information you would like to share with me about promoting health education? Do you have any question for me?

Appendix 6: Demographic information for interview participants

Pseudonym	Level of education	Gender	Age range	Employment status
Asare, medical doctor	Post-secondary	M	Over 40	Civil servant
Edward, pharmacist	Post-secondary	M	Over 40	Civil servant
Lartey, lab technician	Post-secondary	M	Over 40	Civil servant
Allison, midwife	Post-secondary	F	Over 40	Civil servant
Efiba, midwife	Post-secondary	F	18–30	Civil servant
Fatima, midwife	Post-Secondary	F	31–40	Civil servant
Emelia, nurse	Post-secondary	F	31–40	Civil servant
Fausty, nurse	Post-secondary	F	18–30	Civil servant
Kafui, nurse	Post-secondary	F	18–30	Civil servant
Clement, other	Post-secondary	M	18–30	Student
Alice, other	Secondary	F	18–30	Self-employed
Aba, mother	No formal education	F	Over 40	Self-employed
Adisa, mother	No formal education	F	Over 40	Self-employed
Grace, mother	Primary	F	31–40	Self-employed
Jane, mother	No formal education	F	Over 40	Self-employed
Maggie, mother	No formal education	F	18–30	Self-employed
Melissa, mother	Secondary	F	18–30	Self-employed
Mary, mother	No formal education	F	Over 40	Farming
Martha, mother	No formal education	F	Over 40	Farming

Curriculum Vitae

Post-secondary Education and Degrees:	Kibi Training College Kibi, Ghana 1995–1998, Teacher's Cert. A.
	University of Cape Coast Cape Coast, Ghana 2002–2006, B.Ed.
	The University of Western Ontario London, Ontario, Canada 2007–2009, M.Ed.
	The University of Western Ontario London, Ontario, Canada 2009–2014, Ph.D.
Honours and Awards:	Society of Graduate Students Travel Award, UWO 2009
	Society of Graduate Students Travel Award, UWO 2010
	Faculty of Education Internal Travel and Research Award, UWO 2010
	Society of Graduate Students Travel Award, UWO 2011
	Faculty of Education Internal Travel, UWO 2011
	Province of Ontario Graduate Scholarship (OGS) 2011
	Africa Institute Student Mobility Funding Award, UWO 2012
	Western Graduate Research Scholarship (WGRS) 2007–2013
Related Work Experience:	Junior High School Teacher – Ghana Education Service 1998–2002; 2006–2007
	Research and Teaching Assistant – The University of Western Ontario 2007–2013

RESEARCH AND CONFERENCE PROCEEDINGS

Aryee, K. L. (2012). *Mobile telephony: Investigating the use of mobile phone devices to promote health literacy in developing countries*. Paper accepted at 118th Annual Conference of the Michigan Academy of Science, Arts, and Letters (MASAL) Conference, Alma, Michigan 48801 U.S., March 2, 2012.

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Aryee, K. L. (2011). *Beyond the definition of M-Learning: The case of learning through mobile phone devices in Ghana.* Paper accepted at 55th Annual Conference of the Comparative and International Education Society, CISE 2011, Montreal, Quebec.

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