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COLLEGE OF AGRICULTURE AND RENEWABLE NATURAL RESOURCES

FACULTY OF AGRICULTURE

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ENHANCING ACCESS TO RURAL HEALTHCARE TO ACHIEVE SUSTAINABLE DEVELOPMENT GOAL 3: A CASE STUDY OF TELEMEDICINE PROJECT IN BONSAASO MILLENNIUM VILLAGE OF AMANSIE WEST DISTRICT

BY

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A THESIS SUBMITTED TO THE DEPARTMENT OF AGRIC. ECONS, AGRIBUSINESS AND EXTENTION

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN SUSTAINABLE AND INTEGRATED RURAL DEVELOPMENT AFRICA

NOVEMBER, 2016

DECLARATION

I hereby declare that this thesis is the result of my own research, except for references which have been fully acknowledged. It has never been presented anywhere either in part or full for the award of any degree.

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DEDICATION

I dedicate this work to my parents, Very Rev. Richard Kwaku Amankwaa and Mrs Rebecca Amankwaa, and my siblings, whose support has enabled me to reach this height, and also to my dear friend, Betty Amankwaa-Frempong for her prayer support and encouragement.

ACKNOWLEDGEMENT

Glory be to the Most High God for His grace and mercy that has brought me this far. I would also like to say, "Thank You" to my supervisors Dr. Nana S.E. Edusah and Dr. Dadson Awunyo Vitor, for their corrections and reviews that enabled me to produce this work, as well as Mr. Ebenezer Owusu Addo of BIRD, K.N.U.S.T and Dr. James Mensah of Department of Agricultural Economics, Agribusiness and Extension. I also appreciate the support of Mr. Bright Asare Boadi (CHWs Manager of the Bonsaaso MVP), Miss Theresa (CHW at Datano), and all the staff of the Teleconsultation Centre, especially Mrs Esther Oforiwaa, for their selfless support during the interview section of the data collection process.

ABSTRACT

'Ensuring healthy lives for all at all ages' represents the third goal of the global Sustainable Development Goals (SDGs) which were endorsed by the UN in 2015, after the MDG era. Despite efforts to increase access to quality health care, most of the world's population found in rural and remote areas still have challenges accessing health care. Telemedicine interventions have been identified as effective means of addressing health care access barriers, particularly geographic barriers. This study therefore sought to explain how telemedicine helps to increase access to rural health care in the Bonsaaso Millennium Village Communities of the Amansie West District of Ghana. The study was specifically aimed at: Identifying dimensions of access barriers that are tackled by telemedicine in the cluster communities; Identifying contextual factors which enhance Telemedicine Health Care delivery; Identifying problems with telemedicine mode of health care delivery and; Seeking to know how the work of Community Health Workers and Health Care Staffs at the Teleconsultation Centre help to address the health care needs of patients. The researcher used the Exploratory Case Study design and the Mixed Methodology, for the research. Sixty (60) Community Health Workers (CHWs) were engaged in questionnaire administration, while a further Five CHWs, The Manager of CHWs, and two Health Care staff at the Teleconsultation Centre were purposively sampled for key informant interviews. Statistical Package for Social Scientists (SPSS) software was used to analyse quantitative data from, and results were presented in the form of histograms and frequency tables, while the Relative Importance Index (RII) tool was used to analyse the factors that enhance Telemedicine. The Qualitative Data Analysis (QDA) Miner Lite software was used to analyse transcribed interviews to identify, analyse and report patterns for development of themes. The research revealed that apart from geographical barriers to health care, the Telemedicine intervention also helps to address Financial barriers, Availability barriers, and Acceptability barriers of health care for people in the rural communities. The study also revealed that CHWs and staff at the TCC played key roles in enhancing patients' access to Telehomecare and Teleconsultation services through regular household visits and health consultation by mobile phone communication. Some of the contextual factors identified from the research included Collaboration among health workers; Adequate health care personnel, Health ICT Education and Training for Health care personnel, Technical Quality of Communication Network Services, and A good software to enhance data collection. Some problems identified by respondents related mainly to Network and Connectivity Problems,

Alienation from Clinical Practice, Technical Problems and Communication and Information Sharing problems.

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LIST OF ABBREVIATIONS

AMD:	Advanced Micro Devices
ATA:	American Telemedicine Association
CCHP:	Chinese Community Health Plan
CHPS:	Community-based Health Planning Services
CHWs:	Community Health Workers
CIA:	Central Intelligence Agency (United States)
GHS:	Ghana Health Service
GoG:	Government of Ghana
GPRS:	Ghana Poverty Reduction Strategy
GLSS:	Ghana Living Standards Survey
HIS:	Health Information Systems
HIV/AIDS:	Human Immune Virus/ Acquired Immune Deficiency Syndrome
ICT:	Information Communication Technology
ICT4AD:	Information Communication for Accelerated Development
ILO:	International Labour Organization
ITDP:	International Trade and Development Program
IoT:	Internet of Things
MoH:	Ministry of Health (Ghana)
MDG:	Millennium Development Goal
NACCHO:	National Aboriginal Community Controlled Health (United States)
NGO:	Non-Governmental Organization
PHC:	Primary Health Care
RANZCP:	Royal Australian and New Zealand College of Psychiatrists
SDGs:	Sustainable Development Goals

UHC:	Universal Health Care
UN:	United Nations
UNICEF:	United Nations Children's Emergency Fund
UNEP:	United Nations Environment Programme
UNCTAD:	United Nations Conference on Trade and Development
WHO:	World Health Organization
WiMAX:	Worldwide Interoperability for Microwave Access

CHAPTER 1

INTRODUCTION

Background

According to the Cocoyoc Declaration of 1974, development, whichever dimension, must aim at meeting basic human needs which include food, clothing, shelter, safe drinking water, health and education. 'Good Health', identified as one of the basic needs for human development, has therefore been attracting concerns at international conferences like the Alma-Ata Conference on Primary Health Care (W.H.O, 1978), The United Nations Conference on Environment and Development (UN, 1992), The Millennium Summit (UN, 2000), and The 2015 United Nations Sustainable Development Summit which brought into being the Sustainable Development Goals (UN, 2015).

Although some strides have been made to reduce the global prevalence of poor health conditions like ; HIV/AIDS, Maternal and Infant mortality, Tuberculosis and other Communicable diseases, lack of access to health care still remains a major challenge to achieving all the health related MDGs, now SDGs. To ensure healthy lives and promote well-being for all at all ages, concepts like Universal Health Coverage and Universal Access need to be promoted, just as enshrined in the eighth target of the Universal Sustainable Development Goal 3, which is to achieve Universal Health Coverage (UHC), including financial risk protection, access to quality essential health care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all. Sadly however, several access barriers continue to hinder health care in countries all over the world, particularly in rural areas of developing countries. Access to quality healthcare,

particularly for rural areas, is hindered by one or more dimensions of access barriers including, geographic access barriers; financial barriers; acceptability barriers; and unavailability of healthcare facilities, basic amenities, equipment, essential medicines and healthcare workforce.

Lack of access to Primary Health Care is therefore a major problem for rural areas everywhere in the world, and the health status of people in rural areas is usually worse than in urban areas. The ILO report for April 2015 showed huge differences in health care access between rural and urban areas worldwide, as 56 percent of people living in rural areas worldwide did not have access to essential healthcare services. Sadly, the highest number of people in rural areas who are not covered by essential health care services was in Africa where it amounted to 83 percent (ILO, 2015).

Among accessibility barriers is financial burden of relatively high cost of healthcare which makes it difficult for the rural poor to access quality healthcare, or for governments and development agencies to ensure sustainable implementation of healthcare interventions in rural areas. Insufficiency of health workforce to deliver healthcare services to the ever increasing population of the world, particularly in Sub Sahara Africa, also pose a major challenge to quality healthcare delivery, especially for rural areas. In Ghana for instance, although about 50 percent of the population lives in rural areas, the distribution of health workers is skewed in favour of the more affluent regions where highly skilled health professionals like medical doctors, nurses, pharmacists and other Allied Health workers are concentrated (W.H.O, 2010). More to the problem of rural health care accessibility is geographic isolation from quality healthcare services which are mostly available in urban and district healthcare facilities. In Ghana for instance, most rural communities are difficult to be reached by health officers because of bad road conditions, especially during

the rainy seasons. The effects of health care accessibility barriers are really huge and to a large extent determine the ability of most countries to achieve SDG 3.

Health Information Technology, including; mHealth, Telemedicine , Telehealth and ehealth, which together constitute ICT health domains (Bashshur et al., 2011), have a great potential of addressing different dimensions of access barriers such as mitigating some of the rising cost of healthcare delivery (including the cost of transportation to healthcare facilities borne by patients, and the opportunity cost of time spent accessing healthcare services) ,and in-absentia interaction with a physician. Shortage of healthcare officers is also addressed by the mobile technology world through Telemedicine. One of the advantages of mobile healthcare for instance is better communication with patients for increased access to information. ICT health domains like Telemedicine , as a tool for addressing access barriers, is however not a popular intervention in Ghana despite its adoption by most developed countries and the numerous opportunities it presents to developing countries to close the health inequality gap. Although Telemedicine offers great opportunities in general, developing countries are at an advantage of benefitting more due to the high concern for access to basic care. The new age of ICT in health care therefore presents exceptional prospects for both seekers and providers, but scholars like Stanberry (2000) cautions against overdependence on technology to the disadvantage of traditional provider-patient relationships, and the dissatisfaction regarding threats and obligations that distant medical interventions related to Telemedicine carry.

1.2 Problem Statement

Lack of access to health care is a major problem for most rural and remote communities all over the world, owing to several access barriers. These access barriers negatively affect all efforts to ensure healthy lives and promote well-being for all rural dwellers, in connection to the third goal of the SDGs. Ill-health on the other hand represents livelihood stress which makes it difficult to ensure sustainable livelihoods for the rural poor, a situation which also hinders progress towards ending rural poverty in all of its forms. The Bonsaaso Millennium Village communities, typical of most rural and remote communities around the world, have challenges with access to healthcare, including roads in poor condition which make it risky for patients like pregnant women to access health care, as well as insufficient health care facilities that serve a population of about 32,000 people. These problems and others related to high cost of transportation are common problems faced by the communities, a situation which led to a Telemedicine project by the Novartis Foundation for Sustainable Development in partnership with other stakeholders, as part of the Millennium Village Projects to curtail health care accessibility problems. The evidence of the intervention's success after a base-year survey however points mainly to health outcomes of increased access and utilization of Primary Health Care services, with insufficient data on how the intervention helps to enhance access to rural health care, and problems with how the intervention works, in the rural context. These gaps in knowledge about how Telemedicine helps to enhance access to rural health care, factors that enhance Telemedicine health care delivery, and problems associated with Telemedicine, need to be filled to provide sufficient information about Telemedicine health care delivery as a new introduction to Ghana's Health Care System.

1.3 Research Objectives

The main aim of the research is to explore how Telemedicine helps to address health care accessibility barriers in the Bonsaaso Millennium Village.

The specific objectives are to;

1. Identify dimensions of access barriers that are tackled by Telemedicine in the cluster communities.
2. Assess how the work of Community Health Workers (CHWs) and Health Care Staffs at the Teleconsultation Centre help to address access barriers.
3. Identify contextual factors which enhance Telemedicine Health Care delivery from the perspective of CHWs.
4. Identify problems with Telemedicine health care delivery from the perspective of CHWs and health care staff at the Teleconsultation Centre.

1.4 Significance of the Study

The study will contribute to knowledge by explaining how Telemedicine helps to increase access to quality health care in rural areas, in order to complement existing evidence about its effectiveness, thereby helping policy makers of the health sector, which is the Ministry of Health and other stakeholders, to identify ways of improving services delivery. Being aware of the factors that enhance or hinder the quality of services will also help stakeholders in developing better models of Telemedicine health care that are suitable for the health care needs of rural communities.

1.5 Organisation of the Study

The Thesis is organized into Five (5) Chapters. The first chapter of the study gives the background of the study, the problems which gave rise to the research, as well as the research objectives.

Chapter Two of the study is basically a review of related literature on topics like Sustainable Rural Development and Rural Health, Dimensions of Access Barriers in Rural Health Care, and Taxonomy of Telemedicine.

Chapter Three provides a brief background to the study area. The Methodology of the research, with respect to the research design, sampling techniques, and methods of data collection and analysis, as well as the Analytical Framework of the study, are also presented in this chapter.

Chapter Four represents the section for results presentation and discussion, based on the research objectives.

The final chapter, which is chapter five, gives a summary of the entire research work. This chapter also includes a page for conclusion and recommendations outlined by the researcher.

1.6 Limitations of the Study

The main limitation of the study was related to literature on studies conducted on Teleconsultation and Telehomecare, which constituted the main Telemedicine Functionality and Application for the Telemedicine project. The research also focused exclusively on providers of Telemedicine health care, that is Community Health Workers and other Health Care Staff, and not patients who are the main beneficiaries of the intervention. This therefore gives a one-sided view of the evidence presented.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter represents reviews of related concepts and topics connected to Sustainable Development and Health, Rural Health Care, Accessibility Dimensions and Barriers of Healthcare, as well as ICT Health Care Domains and Taxonomy of Telemedicine.

2.2 Linking Sustainable Rural Development and Rural Health Care

Sustainable Development became an issue of great concern following the 1987 World Commission on Environment and Development report dubbed, 'Our Common Future'. The Commission defined Sustainable Development as, "Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs." (UN, 1987). This was followed by the Rio Declaration (Rio +20) on Environment and Development, also called 'AGENDA 21' of the UN Earth Summit of 1992. Chapter six of 'Agenda 21' calls for 'Protecting and Promoting Human Health', an agenda which focuses on meeting Primary Health Care needs, particularly in rural areas (UN, 1992). The first principle of the Rio Declaration therefore laid emphasis on the need to be concerned with human health and wellbeing by this statement, "People are entitled to a healthy and productive life in harmony with nature" (UN, 1992). 'Health' and 'Well-being' have therefore become a concern for almost every sector and for development in agriculture, industry and energy sectors to be sustained, the health of labour force must be a major priority.

The Sixteen Universal SDGs cover primary dimensions of development, which are;

Social, Economic and Environmental. Health care, a social dimension of development, is therefore given a priority concern in the SDGs. With nine target areas, SDG 3 which is to ensure healthy lives and promote well-being for all at all ages, combines three of the MDGs into one goal. Maternal mortality, Infant mortality, HIV/AIDS and other Communicable diseases therefore constitute three of nine target areas under SDG 3. With evidence of the prevalence of diseases resulting from climate distortions, new strategies are required to step up efforts to promote healthcare delivery for majority of the world's population in rural areas who are highly susceptible to changes in climate conditions. The livelihood of most rural folks is also affected by ill health which represents one of the livelihood stresses (Grant, 2005), hence the need for efforts to be stepped up to improve access to rural health care for sustainable rural development. Rural dwellers are also exposed to poor environmental conditions, including unhygienic water sources, poor sanitation, and malnutrition which endanger their lives and ability to move out of poverty, a situation which makes it necessary to initiate health care reforms and interventions which would suit the rural context (Corvalán, Kjellström, & Smith, 1999).

2.3 Some SDG 3 Targets and Problems that Access Barriers pose to their Achievement

SDG 3 involves nine target areas and the first is to reduce global maternal mortality ratio to less than 70 per 100,000 live births by 2030 (Osborn, Cutter, & Ullah, 2015). Although global maternal mortality ratio has reduced considerably with the implementation of programmes to achieve the previous MDG 5, there still remains much to be done to bring the ratio to the lower target set by SDG 3. For instance, the 2013 estimates by W.H.O

revealed a world average of 210 maternal deaths per 100,000 live births, with developed countries at 16 and developing countries at 210 per 100,000 live births respectively. The highest estimate was Sub-Saharan Africa with 510 per 100,000 live births (W.H.O, 2014). A major barrier to achievement of the first target of SDG 3 relates to different access barriers including; Lack of maternal health care facilities and amenities (Tsawe & Susuman, 2014), Unavailability of maternal health care workers particularly in rural areas (W.H.O, 2010), Geographical barriers that make it difficult to access maternal healthcare (Gething et al., 2012), Socio-cultural beliefs hindering access (Ganle, Otupiri, Parker, & Fitzpatrick, 2015), and Unavailability of essential medicines, commodities and tools to provide maternal health care. Global health workforce shortage is also a major problem and about 44 percent of W.H.O member states reported to have less than 1 physician per 1000 population (W.H.O, 2015). Although half of the population of the world lives in rural areas, only 23 per cent of the global health workforce is represented in rural areas (ILO, 2015), a situation which has led to only half of the world's women giving birth with a skilled professional, and only a third of rural women having a health professional at birth (MoH, 2008).

The second target of SDG 3 is to end preventable deaths of new-borns and under-five children by 2030. Under-five mortality ratio, including mortality ratio of new-borns and infants, remains high globally and is especially higher among developing countries (UNICEF, 2013). Meanwhile, the problem of new-born deaths and still births is closely related to lack of access to maternal health care. Factors responsible for under-five mortality include lack of access to vaccines and immunization against childhood killer diseases, as well as malaria, pneumonia and other diseases that put the lives of newborns and infants at risk (UNICEF, 2013). Since vaccines and immunization usually come at

zero cost to patients, financial accessibility is not a major problem on the demand side. However, lack of access to communities for vaccination and immunization, and unavailability of vaccines are some of the factors that stall the progress of immunization and vaccination campaigns in terms of coverage. Delayed postnatal care for infants and mothers also contribute to the high rate of new-born and neonatal deaths. This delay could be attributed to insufficient skilled workforce to visit babies and mothers especially in the first week of delivery as recommended by the W.H.O, and lack of monitoring systems (W.H.O, 2015). Many countries have already started the fight against under-five mortality by developing policies towards achievement of this target, and Ghana's National New-born Health Strategy and Action Plan for the period from 2014 to 2018 outlines measure to deal with major access barriers and factors which contribute to under-five mortality (MoH, 2014). Ending the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combating hepatitis, water-borne diseases, and other communicable diseases by 2030, represents the third target of SDG 3. Malaria is one of the major causes of under-five or child deaths in Africa (UNICEF, 2004), while AIDS and tuberculosis remain two of the world epidemics despite the enormous success achieve through the Global Fund to fight AIDS,

Tuberculosis and Malaria. Accessing health care, in all forms related to Prevention, Curative, Promotion and Rehabilitation, is hindered by various barriers which include all the dimensions of Access barriers identified by Jacobs et al. (2011)

2.4 Dimensions of Access Barriers in Rural Health Care

Healthcare is considered as both a social good and a human right (Gullifod et al., 2002) ,but access to healthcare in rural areas is hindered by several barriers. These barriers refer to factors that affect availability of an adequate supply of health care services, and an individual's opportunity to obtain health care when it is needed (Gullifod et al., 2002). It also refers to factors that affect the ability of a population or part of it to reach, afford, and obtain entrance to services in a timely manner to achieve the best possible health outcomes (Parker, 1974; Kan & Bhardwarj, 1994; Institute of Medicine, 1993).

Access barriers can be categorized into spatial and non-spatial barriers (Wang & Luo, 2005). While spatial access barriers deal with geographical factors which hinder access to health care between consumers and providers or caregivers, non-spatial barriers constitute socioeconomic, demographic and cultural factors such as age, sex, ethnicity, income, social class, education and language ability (Joseph & Phillips 1984, cited in Wang & Luo, 2005). Another categorization of access barriers is demand-side barriers and supply-side barriers (Ensor & Cooper, 2004; O'Donnell, 2007). Demand-side barriers represent, "Determinants of use of health care that are not dependent on service delivery or price or direct price of those services. They include distance, education, opportunity cost, and cultural and social barriers" (Ensor & Cooper, 2004). These factors influence the ability to utilize health care services at individual, household or community levels (Jacobs et al., 2011). Supply-side barriers on the other hand are, "aspects inherent to the health system (system characteristics) that hinder service uptake by individuals, households or the community" (Jacobs et al., 2011). According to O'Donnell (2007), access to healthcare in developing countries has four dimensions: Availability, Geographic accessibility,

Affordability and Acceptability, and therefore barriers to access are related to these four dimensions.

2.4.1 Geographic Dimension Barriers

'Geographic Isolation' as a concept of rural health (Burke et al., 2012), represents spatial demand-side barriers between health care consumers and providers (Wang and Luo 2005; Huber et al., 2008). Spatial barriers are determined by the physical distance or travel time between the service delivery point and the user (Munoz and Källestål, 2012). Since there are vast differences in geography and transportation infrastructure amongst and within countries which makes measures of distance to healthcare facilities difficult to compare, the W.H.O recommends using travel time, rather than distance, to access geographic accessibility (W.H.O, 2001). The travel time between service location and household location however depends on the nature of road, mode of transportation, and access to a mode of transportation. Poor road networks linking rural areas to health care facilities in urban areas pose a major challenge to access to health services. The nature of road networks also determines the mode of transportation. Hence, where the road is in a poor state, patients are likely to walk or use bicycles, since vehicular movement will be difficult (ITDP, 2005). This situation increases the amount of travel time, therefore making it unpleasant and difficult for patients in bad health conditions, like pregnant women with birth complications, to access health care on time during emergencies. Geographic barriers therefore represent one of the common barriers that limit access to health care in most rural settings (The Lewin Group, 2000).

2.4.2 Availability Dimension Barrier

Availability dimension of access comprises availability of health workforce, facilities and basic amenities, medical supplies including drugs and beds, as well as essential medical services (W.H.O, 2013). Barriers related to availability therefore embrace factors like 1) lack of adequate health workforce to enhance care delivery 2) inadequate health care facilities like hospitals, clinics, health centers, and basic amenities including electricity, improved water source, sanitation facilities, communication equipment, and emergency transportation. 3) lack of essential drugs and other medical supplies needed to facilitate cure, prevention and rehabilitation and 4) lack of essential services like

Family Planning, Maternal and Newborn care, Child health, HIV/AIDS, Malaria, Tuberculosis and other Non-communicable diseases (W.H.O, 2013).

2.4.3 Affordability Dimension Barrier

Healthcare cost analysis involves Cost-of-Illness estimates which take into account the direct medical and non-medical costs of healthcare, as well as indirect costs related to a health condition (Briss et al., 2005). Rising costs associated with direct medical care include costs such as clinical services, diagnostic tests and medication, while indirect medical costs like transportation, accommodation, and the opportunity cost of time spent by patients and their families, as well as intangible costs of pain and anxiety, together affect access to health care. In the U.S and other developed countries, several strategies have been adopted, including Health Insurance Policies, to solve the problem related to affordable healthcare, but these strategies have done little to bring a decline in healthcare cost (Kaiser Family Foundation, 2012). The cost situation therefore puts a lot of stress on families with low and fixed incomes, robbing them of the opportunity to seek health care (Segall et al., 2000).The direct health and non-health cost of care are high on the average for all health related problems including mental health (RANZCP, 2014). And for the

average person in developing countries, especially the poor in rural communities, the cost of healthcare is too high to bear. Vulnerable and Highly vulnerable households with little or no source of livelihood income always find it difficult to afford the cost of healthcare (Goudge et al.,2009). While some of these groups rely on social capital in the form of financial support from friends and family relatives, others sell their livelihood capital and natural assets which is usually not able to meet their health care expenditure, and drains them of their means of livelihood (Chambers & Conway, 1991). For most poor and vulnerable households in rural areas, chronic diseases are either treated with local herbs which do not cost much, or taken to local spiritual doctors in times of emergencies as alternatives to proper medical care (Adjei, 2013).

2.4.4 Acceptability Dimension Barrier

For most people, access to health care is hampered by other demand side factors including social, religious and cultural variables, and not only financial barriers (Ensor & Cooper, 2004). While health beliefs affect acceptability of interventions like vaccination (Fazekas, Brewer, & Smith, 2008), other barriers like; systematic changes in health care delivery and practice; unwelcoming healthcare provider attitude and poor interpersonal skills (Paphassarang et al., 2002); low self-esteem and stigma associated with certain diseases (Storla, Yimer, & Bjune, 2008) ; and community cultural preferences and norms, equally put people away from accessing healthcare. Research by Adedini et al. (2014) for instance reveals that culture is one of the key barriers to health care utilization in Nigeria, as the percentage of under-five deaths was significantly highest for children whose mothers were affected by cultural barriers. ByfordRichardson et al. (2013) also cite fears associated with

HIV testing or disclosure of HIV status, gender inequalities, and attitudes towards facility-based care as major obstacles for rural mothers to access healthcare in Kenya.

2.5 Evolution of ICT in Health Care Management and Health Care Health care management is an umbrella term for all the activities and processes through which planning, organizing, staffing, controlling, directing and decision making related to all the elements involved in health care, that is; care givers, customers, drugs and other medical devices as well as facilities and amenities, are facilitated to ensure proper functioning of the health system (Thompson, Buchbinder, & Shanks, n.d). In scientific terms, it is an intersection of information science, computer science, information technology and healthcare (Burney, Mahmood, & Abbas, 2010). I.C.T in healthcare and healthcare management therefore deals with the resources, devices, and methods required in optimizing the acquisition, storage, retrieval, transmission, reception and use of information in health and biomedicine (Burney, Mahmood, & Abbas, 2010; Mishra, Kalra, & Choudhary, 2013; Goldschmidt, 2005). Methods of communication have changed significantly over the past centuries, but these changes have become very rapid and more sophisticated in the 21st century. Mobile telephony, electronic mail and video conferencing have been offering new and better ways of sharing ideas and perspectives on health, while digital technologies are also making visual images and the voice of people more accessible through devices and media like radio, television, video, portable disk players and the internet (InfoDev, 2006). It is therefore becoming 'easier and better' with ICT to diagnose, develop and prescribe treatment, as well as prevent and cure certain diseases and health conditions which some centuries ago could not have been done or could be done with greater challenges. The notion that ICT presents a solution to Universal Health Care

challenges have been supported by many scholars in the academia and practitioners alike. In his address on the 67th Annual New Year School, dubbed "Promoting Universal Health for a Sustainable Development in Ghana: Is ICT the Game Changer", Professor Richard Adanu, the Dean of the School of Public Health of the University of Ghana said the application of Information Communication Technology (ICT) to the healthcare industry would help address Universal Healthcare challenges (GhanaWeb, 2016). The evolution of ICT in healthcare began with basic telecommunication, followed by Telehealth as an expansion of the scope of Telemedicine, ICT networking or e-health, and most recent of all being m-health and uhealth (Bashshur, Shannon, Krupinski, & Grigsby, 2011). ICT has helped to improve healthcare through Health Information Systems, "a software solution for appointment scheduling, patient data management, work schedule management and some other administrative tasks related to healthcare." (Mishra, Kalra, & Choudhary, 2013). The definition of healthcare systems has however changed over the last few decades as a result of advancement in ICT (Burney, Mahmood, & Abbas, 2010). According to Haux

(2006), the milestone of the advancement for Health Information Systems involves: 1) Shifting from paper-based to computer-based processing and storage, and an increase of data in health care settings; (2) A shift from institution-centred departmental and, later, hospital information systems towards a broader regional and global HIS; (3) Inclusion of patients and health consumers as HIS users, apart from health care professionals and administrators; (4) The use of HIS data for health care planning, clinical and epidemiological research, instead of only patient care and administrative purposes (5) A focus on problems arising from change management and strategic information management, instead of technical HIS problems; (6) Advancement in information

technology regarding the use of images and data on the molecular level, away from dependant on only alphanumeric data; (7) A gradual increase of new technologies, starting to include ubiquitous computing environments and sensor-based technologies for health monitoring.

In the area of communication technology, since Bell's invention of telephone, healthcare delivery has witnessed new modes of delivery from 'face-to-face' interaction between physicians and patients to in-absentia healthcare which has evolved from letters to telegrams and fax, telephone and most recently e-mails. Within these means and mediums of communication, there have been massive re-inventions aimed at making communication better.

2.6 Overview of Ghana's ICT Health Care Policies

Ghana's healthcare system has utilized ICT in various ways, especially in the last few decades. The relevance of ICT in health care is gradually gaining support as training and workshops are being organized to educate and help health workers to acquire the skills and practical experience of ICT healthcare delivery. Although Ghana has not witnessed the increased pace at which ICT is transforming most developed countries, there have been steps to help move the country along the path of ICT in development in all the sectors of the country. Unlike the developed world where ICT was birthed through inventions like the computer, telephone and other devices since the 18th Century industrial revolution, Ghana like most developing countries has had to slowly but gradually adopt the new-age of ICT.

2.6.1 The ICT4AD Policy

In 2003, Ghana made a step towards accelerated development through ICT after efforts had been made to liberalize the telecommunication sector. A major factor in this reform was the formulation of the Telecommunication Accelerated Development Plan of 1994 (Frempong, 2002). This desire was expressly revealed in the country's ICT4AD policy, a comprehensive and multi-sectoral policy which sought to infuse ICT into the development ideologies and practices of all the sectors of the economy. The policy's overall objective was therefore to plan a socio-economic development which is ICT-led and would help to transform the country into a middle income, information-rich, knowledge-based and technology-driven economy and society, and this was to be achieved through eleven broad strategies and fourteen pillars (GoG, 2003).Concerning health care, three of the Policy's pillars: Deployment and Spread of ICT in communities; Rapid ICT and enabling physical infrastructure development and; Promotion of National Health, would help to improve the health care system and enhance ICT-health interventions (with regard to Telemedicine) in rural and underserved communities. One of the initiatives to promote national health aimed at ensuring the widespread deployment and use of ICT to improve the activities and operations of the delivery system of health care, included implementation of a national Telemedicine programme aimed at supporting a nation-wide health service delivery. With respect to 'Rapid ICT and Enabling Physical Infrastructure Development', deployment and usage of modern telecommunication and communication infrastructure was regarded as a necessary prerequisite for sustainable economic growth of which health care is very paramount. Towards this end, more telecommunication networks were needed to spread mobile communication access across the country, particularly to rural and deprived communities. It is good to note that, twelve years along the line, Ghana's telecommunication industry has seen tremendous improvement with network coverage far

greater than the early years of the twenty-first century, due to increased number of operational telecommunication networks providing both mobile communication services and internet services to a large number of the population. By 2012, there were 285,000 fixed telephone lines and 25.6 million mobile cellular lines (CIA, 2014). There is however much to be done in the area of electricity extension to rural areas and reliable power supply, which are necessary to ensure that the vision of ICT4AD and other ICT policies are realized.

2.6.2 The Health Sector ICT Policy

In 2005, a health sector ICT policy was prepared to transform the health sector and improve health care delivery in general. This was guided by the Ghana ICT4AD policy of 2003. The policy was to address challenges related to; 1) ICT Infrastructure and Services 2) ICT Human Resource Capacity 3) The Private Healthcare Sector and 4) Planning and Funding of Healthcare interventions. Networking within and among various units in the health sector, at the National, Regional and District levels, needed to be improved and the policy sought to do this by building a health sector network infrastructure as part of a national agenda for accelerated development. This would help to enhance health behaviour, facilitate exchange of information among colleague health workers, promote evidence-based decision making, enhance financial management, improve efficiency in health care delivery, and empower various communities to make informed choices about their health needs. The objectives of the ICT4AD for the health sector therefore served as a guide to the Health Sector ICT policy under the four themes outlined above.

2.6.3 National E-Health Strategy

The National E-Health Strategy aims at systematically deploying ICT to ensure improvement in the health status of residents of Ghana, by enhancing communication between patients and healthcare providers. The E-Health strategy is based on four strategies, that is; 1) Streamlining the regulatory framework for health data and information management, 2) Building the health sector's capacity for a much wider application of e-health solutions, 3) Increasing access to healthcare and bridging the gap of inequity in the health sector by using ICT, and 4) Moving towards a paperless records and system of reporting.

2.7 ICT Health Domains and Their Benefits to Health Care Delivery

Traditionally, healthcare delivery is through face-to-face interaction between a health care provider and a patient, but ICT has presented new and comparatively better modes of healthcare delivery, where a patient is not limited by distance, but can access healthcare services in any form from providers in what is popularly called in-absentia health care (Wikipedia, 2015). These new modes of delivery come in different types or domains and keep improving. ICT health domains have been developed as a result of the evolution of ICT over the past few decades, leading to confusion about the definitions, differences and similarities among the domains (Bashshur, Shannon, Krupinski, & Grigsby, 2011). While the distinction between the major ICT health domains has not been clearly established by literature (AMD Global Telemedicine, 2015), there seems to be some basic themes which run through all the concepts and definitions. The emphasis or primary focus is always on 'ICT applications' and 'Ability to solve healthcare accessibility problems related mainly to distance'. Four major domains of ICT health (Bashshur, Shannon, Krupinski, & Grigsby, 2011) or 'Connected

Health' (Wragge and Co LLP, 2014) are predominant in the literature on ICT's application in health care in the modern era.

2.7.1 Telehealth

Telehealth is one of the major domains of ICT healthcare (Bashshur, Shannon, Krupinski, & Grigsby, 2011), defined by the U.S Centre for Connected Health Policy as, "A collection of means or methods for enhancing health care, public health, and health education delivery and support using telecommunications technologies" (CCHP, 2014). This ICT domain employs a wide range of means and methods including video transmissions and mobile communication to facilitate diagnosis, consultation, treatment, education, care management and self-management of patients' health across distance.

Although Telehealth is closely associated with other ICT health domains like Telemedicine, it differs with the other ICT domains in terms of its components, which according to Bashshur et al (2011)are; Health behaviour or Health education, Health and disease epidemiology, Environmental or Industrial Health, as well as Health Management and Policy. Telehealth therefore refers to not only the use of ICT to deliver clinical health services, but also includes non-clinical services as well (Dinya & Toth, 2013; Miyazaki & Liu, 2012).

2.7.2 e-Health

'eHealth' or 'e-Health' is a simple form for electronic health. However, the precise meaning of the term varies with the context in which it is used, hence making it difficult or impossible to find a universally acceptable and applicable formal definition (Oh et al., 2005). Although there are many definitions of this term in the literature, the W.H.O provides one of the clearest definitions as, "The cost-effective and secure use of information and communication technologies in support of health and health-related fields, including Health-care Services, Health Surveillance, Health Literature, Health Education, Knowledge and Research" (W.H.O, 2005). The term is used by some in a narrow sense to imply health care practice via the internet, while in its broader sense could refer to electronic or digital processes in health care. E-Health comes in different forms but includes two types namely; front-end and back-end exchange of electronic or digital data (Wikipedia, 2015). Front-end exchange is when a patient sends an electronic or digital data about his or her health condition to a specialist or physician by any electronic means including e-mail. Conversely, back-end exchange involves a physician requesting access to a patient's health or medical records from any of the following sources, in order to make clinical decisions which include real-time diagnosis and treatment recommendations**;** 1) PAS (Patient Administrative System), 2) EMRs

(Electronic Medical Records) or 3) EHRs (Electronic Health Records) (Burney, Mahmood, & Abbas, 2010). All of these are long-term records for a patient, which gives details of a patient's involvement with individual healthcare organisations and episodes of care (Don et al., 2011; Health ICT Industry Group, 2009). Components of eHealth therefore include: Electronic Health Records, Health Information, Clinical Decision Support Systems and Physician Order Entry (Bashshur et al., 2011).

2.7.3 MHealth

'mHealth' refers to the use of mobile communication technology to facilitate access to healthcare through the combinations of wireless technologies such as mobile phones and PDAs (Personal Digital Assistants) with other ICT domains like e-health (Bashshur et al., 2011; Burney, Mahmood & Abbas, 2010). In the words of the WHO, mHealth as a component of eHealth is defined as, " Medical and Public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices." (W.H.O, 2011). Its application therefore involves the use of the core utility of mobile phone including; voice and short messaging service (SMS), general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G) services global positioning system (GPS), and Bluetooth technology (ibid). The W.H.O's Global Observatory on eHealth survey of 2009 was based on six categories of mHealth namely: 1) Communication between individuals and health services-; includes Health call centres or Health care telephone help lines and Emergency toll-free telephone services created to provide health care advice triage services with the help of trained health professional on the telephone; 2) Communication between health services and individuals-; involving treatment compliance, appointment reminders, community mobilization, and awareness raising over health issues; 3) Consultation between health care professionals-; an example being mobile ; 4) Intersectoral communication in emergencies which is only used during emergencies; 5) Health monitoring and surveillance-; comprising mobile surveys, surveillance, and patient monitoring; 6) Access to information for health care professionals at point of care-; information and decision support systems, and patient records (W.H.O, 2011). Bashshur

et al. (2011) therefore proposes four components of mHealth namely: Clinical Support, Health Worker Support, Remote Data Collection, and Helpline.

2.7.4 Telemedicine

Telemedicine and Telehealth are two terms which are closely associated with each other and are sometimes used interchangeable in the literature (W.H.O, 2010). According to the American Telemedicine Association, Telemedicine refers to, "The use of electronic communications and technologies to provide clinical services when participants are at different locations" (ATA, 2006). The W.H.O in its 2nd Global Observatory Report on eHealth considered Telemedicine broadly as, "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities" (W.H.O, 2010). Telemedicine therefore represents a new and more efficient way of providing health services through the use of ICT to bridge the gap between care providers and patients. The original form of Telemedicine services delivery was through telephone conversation, television conferencing and radio communication. However, the scope has increased with advancement in ICT to include web-based applications and other multimedia approaches. Telemedicine application can be classified into two types: 1) based on the time period for transmission of information (instant exchange or time lag) between the sender and recipient, and 2) based on the individuals involved (health professional-to-health professional or patient-to-health professional) in the interaction. Synchronous Telemedicine, also referred to as real-time

Telemedicine, involves a patient or health professional sending health data to another health professional for immediate response to the health care needs of a patient at the other end. An asynchronous type of Telemedicine application, also called 'store-andforward', does not involve instantaneous exchange of information between the people involved in the process. Telemedicine services can be categorised into five fields namely; Teleradiology, Telepathology, Teledermatology, Teleradiology and Telepsychiatry (W.H.O, 2010), although new fields keep emerging for other medical specialties like TeleECG (Electrocardiography) in Norway.

2.8 Taxonomy of Telemedicine

Telemedicine, as a multidimensional concept, requires a clear and precise taxonomy to aid researchers and other agencies to be able to identify and understand the different contextual variables which define a particular Telemedicine intervention, and services delivered or to be delivered in a particular setting. Bashshur et al. (2011) outlines three dimensions in development of Telemedicine taxonomy; Functionality, Technology and Application.

Figure 2.1: Taxonomy of Telemedicine (Source: Adapted from Bashshur et al. 2011)

2.8.1 Functionality

This dimension integrates all the activities involved in health care delivery, such as preventive, curative and rehabilitative care processes. It therefore includes diagnosis of diseases, prescription of drugs for healing processes, treatment of diseases and ailments using different methods, and rehabilitation, all of which form part of Primary, Secondary and Tertiary Healthcare. All forms of Telemedicine services involve at least one of the activities of health care delivery.

Telemedicine functions therefore fall under four components namely; Consultation, Diagnosis, Monitoring and Mentoring (Bashshur et al., 2011).

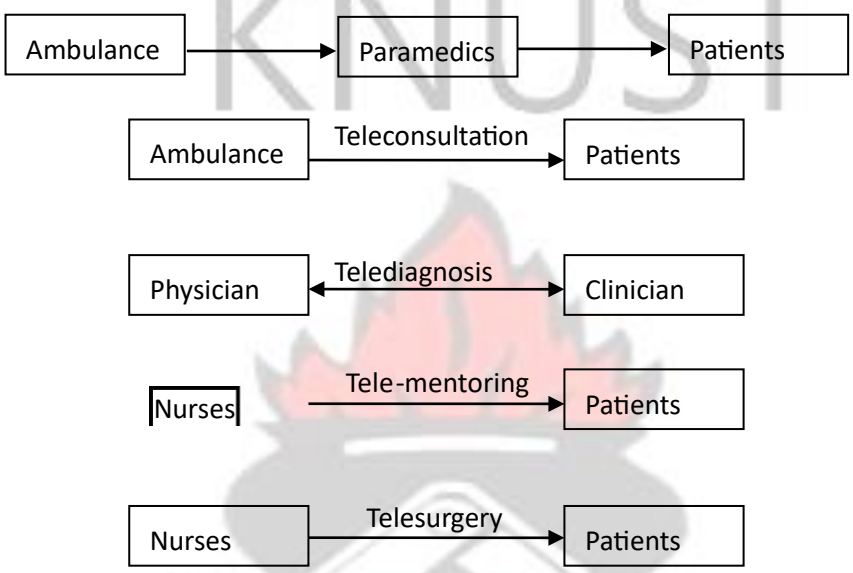

Figure 2.2: Some Telemedicine Functionalities and Flow of Care

(Source: Fong, Fong and Li 2011)

Consultation

Teleconsultation is a very popular functional component of Telemedicine, and is the basis of most Telemedicine services. It refers to the connection of one or more healthcare professional with another, who is usually a specialist or has some valuable information regarding a patient's health care needs, or with a patient, in order to facilitate diagnosis and treatment or learning. It is therefore, "A general term for any consultation, between doctors or between doctors and patients, on a network or video link" (Segen's Medical Dictionary, 2012). Remote medical consultation, which represents a knowledge-sharing process between healthcare workers focusing on specific cases, represents a vital factor

for improving access to specialist healthcare in rural and remote areas where specialists are unavailable (Luk, Ho, & Aoki, 2008). Consultations with healthcare professionals are either 'store-and-forward' or 'real-time'. Store-andforward teleconsultation, also called asynchronous teleconsultation, includes monitoring and delivering feedback through internet, cell phones, automated messaging systems, or other IT equipment without face-to-face contact, whereas synchronous teleconsultation involves real-time face-to-face communication between parties simultaneously
(Verhoeven et al., 2010).

Diagnosis

The function of Telemedicine also involves using ICT equipment and media to send clinical data of laboratory specimen to a specialist for evaluation and reporting. This type of Telemedicine function is called Telediagnosis, and is defined by the Dorland
Medical Dictionary for Health Consumers as, "Determination of the nature of a disease at a site remote from the patient on the basis of transmitted telemonitoring data or closed circuit television consultation" (Dorland's Medical Dictionary, 2007). While Telediagnosis has been proven to be effective in some clinical dispensations, its effectiveness in an area like Teledermoscopy, measured by the degree of diagnosis accuracy, has been challenged in comparison to face-to-face diagnosis (Fabbrocini et al.,
2008).

Monitoring

Telemonitoring represents, “The ability to record, store and, as necessary, forward detailed information about the vital signs of a patient at any particular point in time, where vital signs are measures of various physiological statistics, traditionally taken by health professionals or support staff, in order to assess the most basic body functions.” (Rice, 2011). Monitoring of patients with chronic illness or patients discharged from hospital, is a way of ensuring that the healing process is completed or conditions of patients are well stabilized. This provides healthcare providers with enough data to determine the progress of a patient’s recovery process. Telemonitoring is used for a number of services comprising; rehabilitation and home care therapy for children with disorders in communication development (Parmanto et al.,2008) and monitoring of the condition of patients with chronic heart failure or Cardiovascular dysfunctions, especially among the elderly (Lobodzinski & Jadalla, 2010). In general surgery, Telemonitoring is effective during anaesthesia as a way of closely observing physiologic responses, vital signs during surgery, as well as preoperative screening and perioperative interventions (Cone et al., 2004).

Mentoring

Mentoring is a common health care practice in surgical medicine, a practice which demands continuous real-time audio and video connectivity, as well as interactive consultation (Rosser, Gabriel, & Herman, 2001). Telementoring in surgical medicine aids in clinical aspects, educational aspects and technical aspects of surgery (Augestad et al., 2012). Mentoring also involves remote guidance, especially by surgeons and other specialists, to other surgeons performing new or complex procedures (Bashshur, Shannon, Krupinski, & Grigsby, 2011).

2.8.2 Technology

Another dimension of Telemedicine is the technology used in information transmission and data generation. technologies include wireless networks and mobile computing solutions including cellular 3G, Wi-Fi mesh and WiMAX, radio frequency identification (RFID), Bluetooth, ZigBee, and other wireless sensor networks (Ng, Sim, Tan, & Wong, 2006). Advanced mobile communication devices like i-phones have picture and video application software that enable people to take pictures or record videos that can be easily transmitted through wireless networks, including social media networks like whatsapp- although the level of information security and patient privacy is low when such media are used. Three sets of variables are recognised by Bashshur et al. (2011) with regard to the technology dimension of Telemedicine, namely: 1) Synchronicity 2)

Network 3) Connectivity.

2.8.2.1 Synchronicity

This refers to the time and technology used to transmit data from one person to the other at different locations. Two basic types are recognized in the literatures which are synchronous and asynchronous Telemedicine (Smith, 2012; Allely, 1995). Synchronous Telemedicine, also referred to as 'real-time' Telemedicine, includes video telephony, mobile telephony and videoconferencing technologies. Live video communication between two health care professionals is used to diagnose a patient's health condition, with both parties able to interact at the same time. This is enhanced by the use of technological devices or tele-imaging tools such as digital microscopes, digital X-Ray and Ultra sound, digital Mammography, and digital Transparency scanner. Live interactions can also take place on the phone where no visuals are involved, only verbal communication.

Asynchronous Telemedicine, also referred to as 'store-and-forward', on the other hand relies on stored and transferred data in the form of still images, videos or even voice mail. Popular among these is however still images and videos which are used in fields like dermatology, radiology and pathology.

2.8.2.2 Network

Telemedicine Network design or configuration includes three modalities which are Virtual Private Networks, the Open Internet, and Social Networks (Bashshur et al., 2011).

Virtual Private Networks

Virtual Private Networks (VPN) are private networks which are constructed or simulated within a public network infrastructure, such as a global internet, in order to enhance security of files on networked computers (Ferguson & Huston, 1998; Scott, Paul, & Erwin, 1999). VPNs fall into two broad categories, Site-to-site and Remote Access. Siteto-site VPNs allow connectivity between a Tertiary healthcare facility and other geographically dispersed sites of care, and could be Intranet or Extranet. Whereas intranet site-to-site VPNs connect different primary sites of care to a tertiary healthcare facility like hospital, extranet site-to-site VPNs allow connectivity between healthcare facilities or a single healthcare facility and their patients. Remote access VPNs enable mobile or home-based users to access a health care facility's resources remotely (Tyson, n.d).

Open Internet

With respect to health care, the phrase 'internet of things' and 'internet of everything', have become popular expressions which explain a network of physical objects or 'things'

embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. IoT, in relation to health care delivery, is therefore the direct connection of devices with each other to gather and share data, making it possible to collect record and analyse new data streams faster and more accurately to improve access to care, increase healthcare quality, and reduce cost of care (Niewolny, 2013).'Things' in the 'internet of things' could also refer to devices and applications such as sensors, actuators, microcontrollers, mobile-communication devices, and nano-pumps which can ensure that health monitoring, diagnosis and treatment becomes more personalized, timely and convenient for people (Logvinov, 2014). The open internet acts as a medium that connects these devices and applications, most of which already exists (Logvinov, 2014). Homecare telemonitoring for patients with chronic heart problems, especially 'seniors', is enhanced by this network which represents the future of (Ram, 2015).

Social Networks

Social Networks such as Twitter, Facebook, Youtube, Whatsapp, Viber and Imo, although known to be unofficial networks, promise an effective and cheaper means of transmitting media data such as videos, still images and audio sounds. Such networks depend on networked users' connectivity and the ability of the internet to break the barrier of time and location to form virtual communities sustained by information sharing (Keckley & Hoffmann, 2010). While some healthcare organizations avoid the use of social media, tagging it as unofficial and unprofessional, there is a growing use of social media networks by patients, especially the younger generation to, for the purpose of healthcare, discuss health issues and share information about rare and common diseases (Belbey,

2015; Fox, 2011). Healthcare professionals can also use the social media for education and consultation with other professionals. There is however a problem with the level of professionalism expected to be exhibited by health care professionals when dealing with patients via social media (Chretien & Kind, 2013)

2.8.2.3 Connectivity.

Connectivity to Telemedicine services refers to how patients are linked with service providers. Wired and wireless connections are the two types of connectivity used to deliver Telemedicine services across distance. While wired networks offer high speed and bandwidth, and connectivity is possible only to or from those physically located within the extension of network cabling, Wireless networks have low speed and bandwidth, but connectivity is possible beyond the boundaries of physical network cabling (Kaur & Monga, 2014). The most common type of wireless connectivity is the

Digital Services Lines (DSL), otherwise known as "Broadband". Other types includes 3G and 4G mobile broadband using devices like portable modem or phones, satellite connections, Integrated Services Digital Network (ISDN), Coaxial Cable, Fibre optic Cable, and Wi-Fi (NACCHO, 2012). In applications, wired networks are used in teleconferencing, the simplest application where a telephone is used to connect two or more people separated by distance, and videoconferencing involving two or more people engaged in a face-to-face non-physical meeting where cameras and a computer or any display unit, facilitated by videoconferencing software, are used. Wireless networks include Home Area Networks and Wireless Sensor Networks that are used for home telemonitoring of patients with chronic health conditions (Kaur & Monga, 2014). Remote connectivity, using either wired or wireless networks, therefore enhance or expedite health

care services by transmitting data between health care facilities or between a health care facility and a different site of care.

2.8.3 Applications

Telemedicine applications are based on the particular field of medicine or health care service rendered. Components of Telemedicine application include; Medical Specialties and sub-specialties, Specific disease entities, Site of care, and Treatment modality (Bashshur et al., 2011).

2.8.3.1 Medical Specialties and Sub-specialties

As an umbrella term for many specialties of services and health professions like nursing (Fishman, 1997), Telemedicine applications can be classified according to their application in different specialties of services. These specialties include Teleradiology, Telepathology, Teledermatology, Telepsychiatry, and Telenursing among a host of others.

Teleradiology

Teleradiology refers to electronic transmission of radiographic images such as X-rays, Computed tomography (CTs) and Magnetic Resonance Imaging (MRIs) from one health facility to another through network technologies such as the internet, telephone, wide area network, local area network, and the latest being computer clouds (Wikipedia, 2015; ESR, 2004). This allows radiologists access to a patient's radiological images for examination and prescription without the physical presence of the patient. Teleradiology based on store-and-forward approach, involves a healthcare practitioner sending patients' radiographical images to a radiologist for examination and interpretation to be given after a period of time, but not simultaneously (Thrall, 2007). Teleradiology applications include: On-call applications which enable radiologists to provide more rapid

consultations and; Coverage for free-standing imaging centres, outpatient clinics, nursing homes, and smaller hospitals with common themes like improved coverage, improved access to subspecialist radiologists, and lower cost of service provision (Boland, Schlankman, & Thrall, 2006). Risks associated with Teleradiology are directly related to the technical limitations of the field itself (Thrall, 2007), while some of the barriers to a successful implementation of Teleradiology are generally related to all Telemedicine applications, such as problems with telecommunications, energy infrastructure problems, high price and/or unavailability of internet (Babic, Milosevic & Babic,2012).

Plate 2.1: A Teleradiology examining an X-ray image of a patient (Source:http://www.hhmglobal.com)

Telepathology

This form of Telemedicine involves, "the use of telecommunications technology to facilitate the transfer of image-rich pathology data between remote locations for the

purposes of diagnosis, education, and research." (MedicineNet.com, 2015). Telepathology systems are divided into three major types: static image-based systems, real-time systems, and virtual slide systems (MedicineNet.com, 2015; Krishnappa & Ling, 2012; Swetha et al., 2015). Telepathology applications include; clinical practice, intraoperative consultation, and education (Krishnappa & Ling, 2012). Since Telepathology involves capturing and sending microscopic images in a static system, image quality is very necessary to enhance quality diagnosis. While potential benefits of Telepathology include rapid provision of expert opinion, provision of urgent diagnostic service, provision of an on call service, as well as education and training, issues relating to legality and quality can affect effectiveness of Telemedicine application (Swetha et al., 2015). On the issue of quality, Desai et al. (2004) identifies standards like image resolution, colour depth, speed with which images should be transferred, and other essential qualities at the viewing station which would ensure that the captured information is not degraded at the remote site.

Plate 2.2: A Telepathology fluorescent microscope for viewing and capturing images (Source:http://www.mahekpathlab.com/shortcodes/instrumentation.html)

Plate 2.3: A group of Pathologists examining an image in Telepathology

(Source:http://www.pathologyinpractice.com/Print.aspx?Story=1140)

Teledermatology

As one of the most active applications of in the United States (ATA, 2012), Teledermatology is the use of communication technology to connect patients and dermatologists, involving referring an image of the skin or the skin appendage of a patient together with relevant history of the condition to a clinician for advice (PCC, 2013). Three types of teledermatological services are identified by the PCC; 1) Triage Teledermatology – uses triage tools to ensure that the right person sees a patient in the right place and promptly, 2) Full Teledermatology – an alternative to face-to-face consultation, although patients are not seen in person, and 3) Intermediate Teledermatology – a mixed form of both Triage and Full Teledermatology (PCC, 2013). Irrespective of the advantages of Teledermatology which includes, quick diagnosis and treatment and cost effectiveness, legal and ethical issues relating to privacy and security of patients need to be considered. A written consent for storing and transmitting patients information is therefore considered a good practice and individuals' identities must also be concealed when records are used for administration, audit or performance review. In

his research, Elford noted that patients with genital rashes are among a group of patients who are less tolerant of being videoed since they feel shy and embarrassed (Elford, 1997).

Plate 2.4: Using Teledermascope and iPhone to capture image of skin diseases. (Sources:http://medcitynews.com/2014/12/kaiserteledermatology/**&**http://piel.telederm.org/)

Plate 2.5: A Dermatologist analysing an image in Teledermatology
(Source: http://www.jahangirskinclinic.com/teledermatology.php)

Telepsychiatry

It is the application of to the specialty field of psychiatry (Wikipedia, 2015). It involves a wide range of services, such as consultation between psychiatrists, educational clinical programs, diagnosis and assessment, medication therapy management, and routine follow-up meetings. Telepsychiatry helps to improve patient outcomes including, reduction in length of stay in the emergency rooms for patients waiting to be discharged to inpatient treatment, while reducing travel time, enhancing collaboration among staff and easing the pressure of mental health work force shortage, as well as ensuring that patients in distress are seen more quickly to reduce relapse events (Holton, Brantley, &

Duda, 2014).

Telenursing

"Telenursing refers to the use of telecommunications and information technology in the provision of nursing services whenever a large physical distance exists between patient and nurse, or between any number of nurses" (Wikipedia, 2015). Telenursing is used in many applications, distinctively home-care, where a nurse uses the Telemedicine technology as a support for decision making and treatment, delegation and learning, in order to enhance interaction with patients while maintaining quality of healthcare

delivery (Jönsson & Willman, 2009).

2.8.3.2 Disease Entity

Telemedicine applications are also based on the type of disease, illness or injuries which the application seeks to cure or deal with. The health condition of a patient, to a high extent, determines the technology to use and aspects of the medical care process to apply. A lot of diseases are being treated using different Telemedicine technologies with popular

ones being stroke and skin infections. When an accident occurs and triage services are required, a patient's pulse and organ functionalities including brain and heart can be constantly monitored by the use of devices which can send information in the form of still images and videos for quick response. Telemedicine is being applied to a wide range of disease treatment processes.

Mental disorders

Patients with mental health disorders like depression, dementia, Alzheimer's disease and schizophrenia can be treated through programs that use telephones and interactive voice response in a real-time interaction with trained clinicians. This can be achieved through Telepsychiatry.

Stroke

Telestroke is another form of Telemedicine application which derives its name from the health condition of patients with signs of stroke. When signs of acute stroke are identified by a clinician during diagnosis, emergency medical doctors or neurologists can be contacted through digital video conferencing, Internet telecommunications, robotic telepresence, smartphones; tablets and other technology to know the extent of damage to the brain in order prescribe treatment (Mutgi, Zha, & Behrouz, 2015; Shahi, et al., 2015).

Skin Diseases

Telemedicine is also used for treatment of skin diseases, including topical ones related to eczema, fungal and yeast infections, bacterial infections, viral infections, parasitic infections, auto-immune diseases and other miscellaneous skin diseases (van Hees & Naafs, 2001). The application is popular with store-and-forward technology, where a still

image or video of affected part of a patient's skin is captured and sent to a dermatologist for diagnosis and treatment prescriptions to be made (Du Moulin et al., 2003). Live interaction is another form of delivery which enables live dialogue between patient and specialist, and allows for real-time question-asking and clinical history education. This requires video-conferencing equipment and Internet connection (Lamel et al., 2012).

Cardiovascular diseases

Telemedicine for patients with cardiovascular disorders usually involve monitoring of their condition, so that clinicians can intervene within the shortest possible time when signs of deterioration are recorded or identified. Monitoring of patients with signs of heart failure for instance is usually home-based (Pandor et al., 2013). Telemedicine applications in treatment and management of cardiovascular diseases include: Management of acute coronary syndromes, Rehabilitation and Management of chronic heart failure, as well as for Arrhythmias and cardiac implantable electronic devices (Brunetti et al., 2015).

Diabetes

Telemedicine application for diabetes management has been identified in the area of education by Nyenwe et al. (2011). Through video conferencing technology, a Diabetes Self-management Education was delivered every 3 months addressing pathogenesis of diabetes, nutritional education, physical activity, self-blood glucose monitoring, effects of insulin and other diabetes medications, sick day management and complications of diabetes. The result of the research proved that diabetes management and care can be given through Telemedicine education to enhance management of diabetes and care for patients.

In another research, Rabia .A. Rehman, an endocrinology fellow at the University of Tennessee Health Science Center in Memphis, explained how patients were interviewed and examined using video conferencing in a Telemedicine studio with a nurse present at the remote site to take vital signs of diabetes patients, as well as helping physicians with some basic physical exam manoeuvres like swelling in the legs or thyroid exams. Results at 6 months of the research showed 85% of 20 diabetic patients significantly improved (Johnson K. , 2012).

2.8.3.3 Site of Care

A site of Telemedicine care represents the facilities within which healthcare takes place. These places vary based on the technology and application of Telemedicine. Telemedicine involves the delivery of healthcare services to patients at home through the use of telecommunications technologies, by enabling interaction of voice, video, and health-related data. (Bowles & Baugh, 2007). It is designed to meet the health needs of diverse array of patients, particular those with chronic diseases like diabetes and hypertension, and is not strictly patient monitoring, as it joins together health care delivery through health education, emotional and social support, information dissemination, and self-care help and suggestions (Wikipedia, 2015). Telemedicine services are based in client-server architecture where a server application usually sited in a hospital stores and makes available incoming vital signals such as heart rate, blood pressure, temperature and rate of respiration from the patient (Figueredo & Dias, 2004). Another form of Telemedicine is

an assisted care delivery with the help of community nurses. With this form, trained health care officers, with the aid of portable devices for checking patients' vitals and mobile phones with specially designed software applications, are able to move from one home to the other to monitor and report any situation which requires a specialist or physician's assistance. These health care officers are trained to be able to record and communicate health care data of patients to other officers with the ability to diagnose and prescribe treatment. They must also be able to execute prescribed treatments to ensure that patients receive the appropriate care that are needed. Whereas this form of healthcare delivery enhances convenience on the part of patients, it can be really stressful for health care officers, especially if patients' settlements are widely apart and there are no means of transport other than walking.

(Sharp, 2000)

Forensic homes

Forensic homes as sites for Telemedicine involves delivery of Telemedicine services to patients in the confines of a correctional or rehabilitation facility such as prisons and psychiatric homes, for legal reasons. Patients in such situations need to be monitored while in confined facilities. For correctional facilities like prisons, a patient with a chronic health condition may be put in special care facilities while in confinement, where monitoring of his or her condition is done using patient monitoring devices, and medical officers can be consulted for specialist treatment in cases of emergencies.

Schools and Child Educational Facilities

School-based health centres provide comprehensive medical care and a host of services to students at various levels of education. SBHCs usually serve as primary providers of health care for school-aged youth found in urban and rural settings (Gordon, 2010).

Privacy, Confidentiality, and Sense of well-being are three key elements of School Health Centres which require internal facilities like infirmary, private office space, secure storage areas, private examination and treatment rooms, utility areas, a laboratory, as well as waiting room, reception and restrooms (ibid).

2.10 Conclusion

Increasing access to health care is one way of ensuring that people everywhere have their health needs satisfied. In this chapter, this view has been expressly presented with evidence from the literature supporting the expectations of health care and I.C.T for sustainable health care through I.C.T Health Domains, particularly, Telemedicine .

CHAPTER THREE

3.0 STUDY AREA AND RESEARCH METHODOLOGY.

3.1 Introduction

This chapter describes the study area in terms of its geographical and economic features. The accessibility situation and some components of the health system have also been analysed to give a foresight of the health care accessibility situation of the project area. A background description of the Telemedicine Project, in terms of its objectives and structure, has also been presented to provide understanding of the nature of the Telemedicine intervention. The methodology of the research, including the design, sampling techniques, methods of data collection, and methods of data analysis, has been vividly explained.

3.2 Study Area

The Bonsaaso Millennium Village was formed in 2005 in the Amansie West District, which is one of the thirty (30) Districts of the Ashanti Region. The Millennium Village is the first of its kind to be formed in Ghana, with the sole aim of helping to reduce extreme poverty through an integrated approach, in order to achieve the MDGs. Since its inception, the cluster communities have experienced development in all forms, enhanced by a number of developmental projects which spans from Agriculture to Health, Education and other Infrastructural projects. One of the areas which has experienced significant transformation is Health Care. However, there still remains a lot to be done, if the health needs of residents would be achieved.

3.2.1 Site Profile and Accessibility Situation of the Millennium Village Clusters

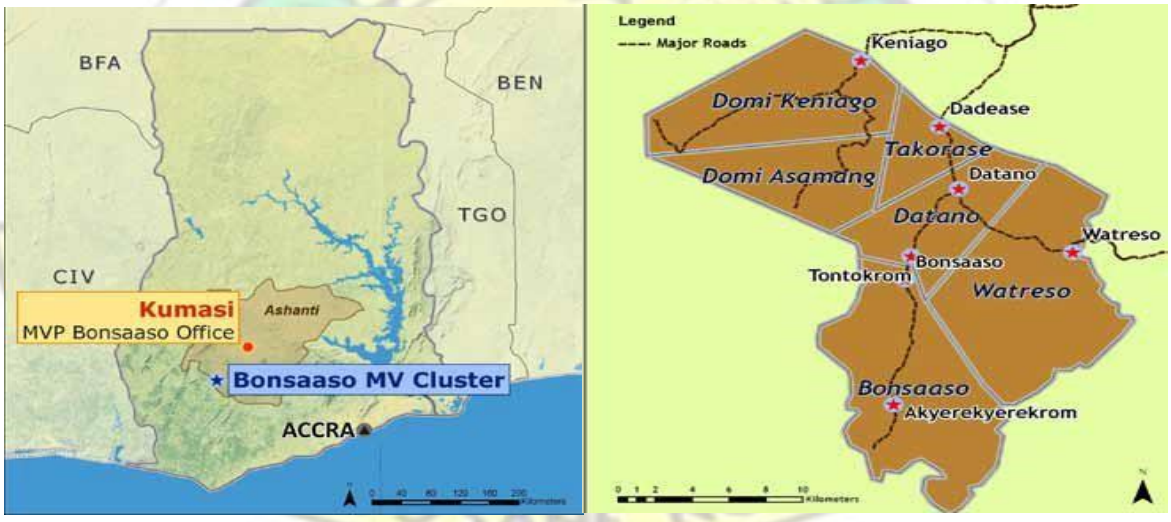

Figure 3.1: Map of Ghana showing the Bonsaaso MVP (Left), and Map of the MVP (Right)

(Source: The Earth Institute Infrastructure from Bottom Up, Chapter 6)

The Bonsaaso Millennium Village Clusters is located in the Amansie West District, which is to the South-West of the Ashanti Region (left of figure 3.1) above. It consist of six villages which are Domi-Keniago, Domi-Asamang, Takorase, Datano, Watreso and Bonsaaso, indicated by the partitions in the map to the right of figure 3.1. There is however thirty (30) communities with a population of about 32,000 people (Novartis Foundation, n.d).

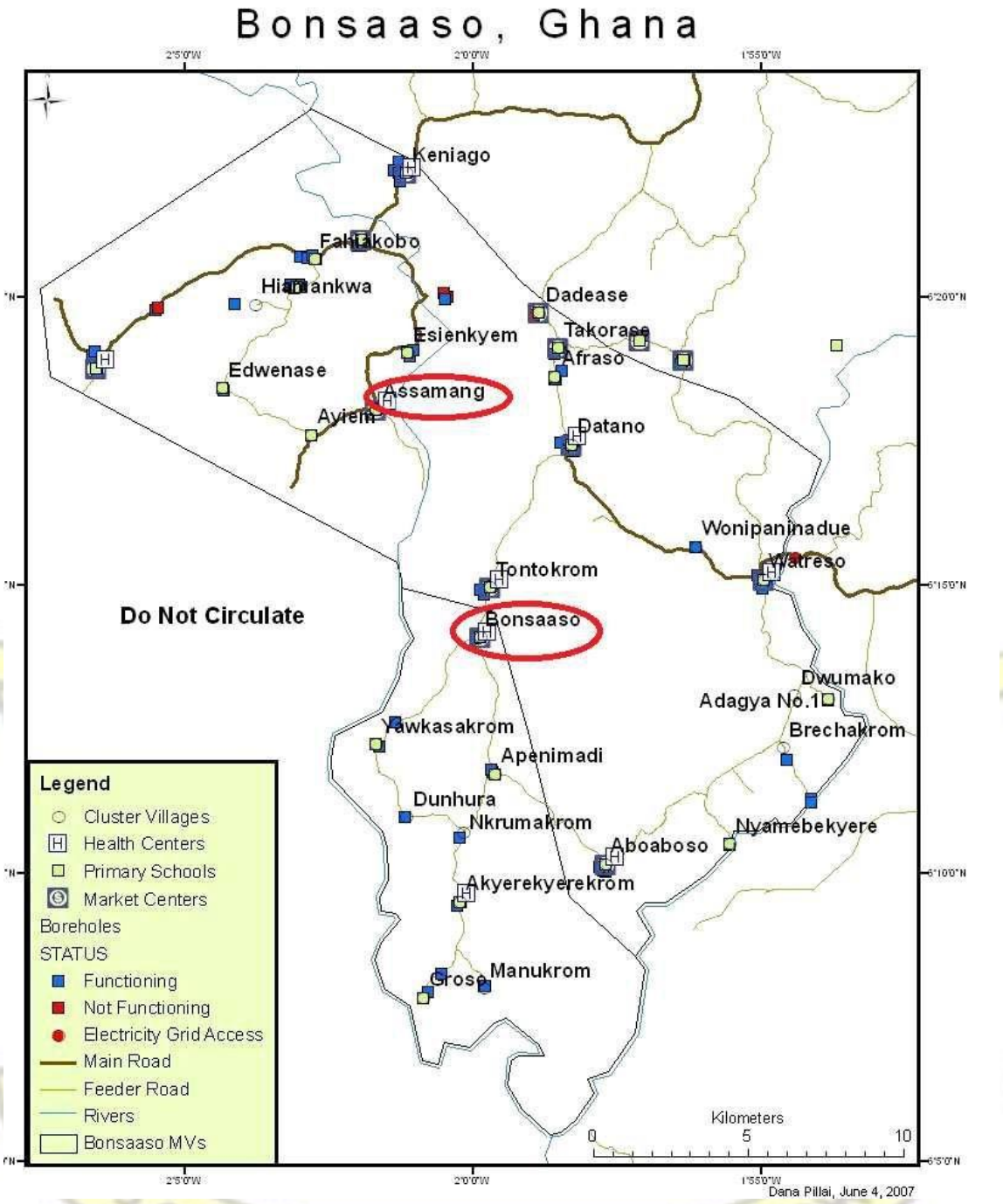

Figure 3.2 : Map of the MVP communities and infrastructure facilities including health care facilities

(Source: Millennium Village; Bonsaaso Village Project Baseline Report, 2008)

The communities are dispersed over a large geographical area separated by thick forests, and the roads are in poor condition. Access to vehicle, which is mainly 207 Benz buses, is very difficult, especially from the Agroyesum Junction on the main Kumasi – MansoNkwanta road. While making a journey to Datano, one of the communities in the Millennium Village Clusters, the researcher waited for close to thirty minutes with other people before getting a vehicle which was already full from where it was coming. About five passengers including the researcher had to stand in the already full 207 Benz bus. Since the dry season had started, the road was very dusty and this affected visibility and compounded the plight of the passengers, a situation which is hazardous to the health of motorists and passengers. A journey which should have taken less than 45 minutes took the passengers almost two hours. This situation poses a challenge to patients who try to access health care from health care facilities outside their communities, given that most of the communities are without health care facilities, or do not have health care facilities that are capable of providing the needed health care services.

3.2.2 The Millennium Village Health Care System

Table 3.1: Number of Health Facilities and Staff before and after the MVP

1.	Infrastructure/Equipment/Logistics/Health Staff	After MVP	Before MVP
2.	Number of Health Facilities (CHPS Compounds)	7	2
3.	Medical Laboratories	1	0
4.	Medical Stores	1	0
5.	Number of health Facilities with Electricity (grid/solar)	7	0
6.	Number of Health Facilities with water systems	7	0
7.	Number of Health Facilities with computers	7	0
8.	Number of Health Facilities with Basic (EMOC) equipment	7	0
9.	Number of Ambulance	2	0
10.	Number of Motorbikes (For CHOs)	10	0
11.	Number of Midwifes	7	0
12.	Number of Staff Nurses	1	0
13.	Number of Enrolled Nurses	12	0
14.	Number of Community Health Nurses (CHNs/CHOs)	11	1
15.	Number of Community Health Workers (CHWs) or CBSVs	60	12
16.	Number of Auxiliary Staff (Cleaners & Security at CHPS Com.)	14	2

(Source: Bonsaaso Millennium Village Handbook)

It should be noted that the data presented in Table 3.1 is with reference to thirty communities of a population of about 32, 000 people. Given the global target of 2 health care facilities per 10,000 people according the W.H.O health care facility density (W.H.O, 2013), it can be said that the number of health care facilities, that is 7 Health Care Facilities (CHPS Compounds) is adequate for the entire population. However, due to the

dispersed nature of the communities, people from some communities like Odaho and Mpatase which are without health care facilities have to access health care from other communities which are not easily accessible by road (Amankwah, 2013). Table 3.1 also shows that access to health care improved prior to the MVP, in terms of availability of Infrastructure, Equipment, Logistics and Staff. Although the situation has improved, there was still the need to bring health care closer to the people, considering the dispersed nature of the communities which are linked by roads with bad conditions. The Telemedicine project was therefore necessary to enhance access to health care, through improvement in infrastructure and the number of health care workers,

particularly CHWs.

3.3 Methodology

3.3.1 Research Design

An Exploratory Case Study design was used for this study (Yin, 2004). This study also fits the Instrumental case study design by Stake (1995), as the focus of the research is on providing an insight into the Telemedicine intervention, in terms of how it helps to enhance access to rural health care. The case is defined as a single case study of the Telemedicine project in the Bonsaaso Millennium Village Clusters, an intervention which represents a pilot for a nationwide Telemedicine programme (Yin, 2004). As a research design, an exploratory or instrumental case study design is used in many situations to contribute to knowledge of an individual, group, organizational, social, political, and related phenomena, in this case, Telemedicine (Yin, 2004; Stake, 1995). An exploratory case study according to Yin (2004) is therefore used when the focus of the study is on a contemporary phenomenon within some real-life context, and the investigator or researcher has little or

no control over the events or respondents. Since the researcher deliberately wanted to cover contextual conditions which are believed to be highly pertinent to Telemedicine, Yin (2004) also suggests that an exploratory case study design is appropriate and can be used to link program (Telemedicine) implementation with its effects in evaluation language, in this case; how Telemedicine helps to enhance access to health care, in order to explain the effectiveness of the

intervention.

3.3.2 Population and Sampling Procedure

CHWs Sampling

CHWs constitute a major component of the Telemedicine health workforce. As at the time of the research, there were sixty CHWs operating in the thirty Millennium Village communities across the Bonsaaso Millennium Village Clusters, a census of all the sixty CHWs was conducted. Five CHWs were purposively sampled for interviews based on their experience in terms of the number of years they had worked since the Telemedicine project was initiated, and on the recommendation of the CHWs Manager. **Healthcare Staff at the TCC and Other Officers of the Project**

There were two staffs at the TCC who were; a general nurse and a midwife. These two staffs and the CHWs Manager were sampled purposively for key informant interview based on their direct involvement with the Telemedicine health care delivery and project at large.

3.3.3 Sources of Data and Methods of Data Collection

The researcher employed the mixed methodology of quantitative and qualitative methods of data collection. Data was collected from primary sources through interviews, and questionnaire administration, to enhance triangulation (Yin, 2004).

Quantitative Data

Questionnaires were administered to all the sixty (60) CHWs working in the MVP Communities. The researcher employed Likert type questions with five response categories; 'Strongly Disagree', 'Disagree', 'Not Sure', 'Agree' and 'Strongly Agree' for the non-demographic component of the questionnaire. Four thematic areas relating to the four dimensions of access barriers which are; Geographic, Affordability, Acceptability and Availability, formed the main topics of the questionnaire. The factors included in the questionnaire were selected based on Telemedicine practice and processes outlined by the W.H.O in its report on the second global survey on e-Health

(W.H.O 2010), as well as the W.H.O's S.A.R.A tool.

Qualitative Data

Through face-to-face interviews, two (2) staff at the TCC, one (1) officer of the project, who is the CHWs Manager and five (5) CHWs, were engaged in semi-structured interviews using a semi-structured interview guide. The purpose of the interviews was to give an in-depth insight into the process of Telemedicine health care, and how the work of CHWs and staff at the TCC, who constituted providers of Telehomecare and Teleconsultation services, helped to increase access to rural health care. With the consent of interviewees, the researcher recorded all the interviews, with the exception of the interview with the staff at the TCC who rejected a recorded interview for personal reasons, although the confidentiality of the interview was assured.

3.3.4 Methods of Data Analysis

Quantitative Data

Quantitative data from the administered questionnaires were analysed using SPSS to present results in frequency tables and histograms. Relative Importance Index (RII) analysis was also done, after each factor's RII had been calculated to determine the degree of relevance attached to each factor according to respondents, and a ranking order of importance.

$$RII = \frac{\sum w}{AN}$$

Where;

'W' is the weight given to each factor by respondents ranging from 1 to 5

'A' is the highest weighing (i.e. 5)

'N' is the total number of respondents

Qualitative Data

Inductive Thematic Analysis method was used to analyse transcribed interviews by identifying, analysing and reporting patterns within the transcribed data, constituted into codes and finally, themes. The various themes derived from the analysis were therefore used to explain how Telemedicine helps to enhance access to rural health care, and also to identify contextual factors that determined the ability of the intervention to enhance access to health care, as well as problems with Telemedicine. The analysis was done with the help of the QDA Miner Lite software.

'Descriptive Coding' and 'In Vivo Coding' methods were mainly used to develop the codes (Saldana, 2008).

3.4 Analytical Framework of the Study

The assessment of Telemedicine ability to address multiple access barriers is based on Jacobs et al. (2011)'s analytical framework, adopted from Peters et al. (2008) and Ensor and Cooper (2004). The framework presents a comprehensive overview of identified access barriers along supply and demand sides and four dimensions of access. These barriers are categorized under the four dimensions of access which are; Geographic accessibility, Availability, Affordability and Acceptability. The framework enables policy makers and health planners, including researchers, to identify the different dimensions and aspects of barriers to access health services, and to devise the specific intervention or combination of interventions that can best address those barriers. Apart from this, the framework can assists in assessing the appropriateness of existing interventions as a means to address the identified access barriers. It can also be used both to identify interventions that effectively address particular access barriers and to analyse why certain interventions fail to tackle specific barriers (Jacobs et al., 2011).

3.5 Conclusion

This section has drawn relevant information from secondary data obtained from the District's Data Repository and the Telemedicine Project's Hand Book to provide a vivid description of the District and the Telemedicine intervention. The research design and methodological congruence has also laid the foundation for the research, to enhance generation of results in line with the objectives.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This analyzes and discusses the results of both quantitative and qualitative data obtained from the study, with the view of; Identifying the dimensions of access barriers that are tackled by Telemedicine, Assessing how the work of Community Health Workers (CHWs) in Telemedicine helps to address the health care needs of patients, as well as How health care specialists at the Teleconsultation Centre help to enhance teleconsultation. The contextual factors enhance Telemedicine, and the problems with Telemedicine mode of health care delivery are also identified and discussed. Frequency tables and Histograms are used to present results of the survey data, followed by an analysis and discussion. Themes derived from interviews are also used to explain how Telemedicine helps to increase access to health care.

4.2 Demographic characteristics of Respondents

Gender Distribution

Table 4.1: Gender of Respondents

GENDER	TOTAL	%
MALE	34	56.7
FEMALE	26	43.3
TOTAL	60	100

(Source: Field Data 2016)

Out of the sixty (60) respondents from the Bonsaaso Millennium Village Cluster communities, 56.7% are males while 43.3% are females. This reveals that there are more males than female CHWs in the study area, and the difference is significant. The CHWs for the Telemedicine programme are dominated by males, and involvement of more males in a profession otherwise dominated by females is good for gender equality (W.H.O, 2008).

Age Distribution

Table 4.2: Age of Respondents

Age Range	**Number**	**%**
18-25	19	31.7
26-30	16	26.7
31-39	5	8.3
40 and Above	20	33.3
Total	**60**	**100.00**

NOTE: Modal Age = 40 and Above, Median Age = 26-30

(Source: Field Data 2016)

Table 4.2 shows that majority of respondents (33.3%) were aged 40 years and above, while the minority group of respondents (8.3%) is 31-39 years. The age distribution can be said to be balanced, with a blend of youth and young adults.

Education of CHWs

Table 4.3: Educational Background by Gender of Respondents

GENDER	EDUCATION		TOTAL
	BASIC	S.H.S	
MALE	14	20	34
FEMALE	9	20	26
TOTAL	20	40	60

(Source: Field Data 2016)

The results from Table 4.3 reveal that all the respondents, irrespective of their gender, had some level of formal education. This presupposes that one is expected to attain a certain level of education to be able to work as a CHW. The result also shows that S.H.S constitutes the highest level of Educational attainment by majority of the respondent. It can therefore be deduced that education is an important requirement for becoming a CHW in a Telemedicine programme. This is because the work demands some basic knowledge and skills in reading and writing, as well as good communication skills in English and the local language.

4.3 Dimensions of Access Barriers Addressed by Telemedicine

Although the geographical dimension of health care barrier is the major access barrier that has been identified by most of the literature to be tackled by Telemedicine, the results from

the research reveal that other dimensions of access barriers are also addressed by Telemedicine.

4.3.1 Geographical access barrier

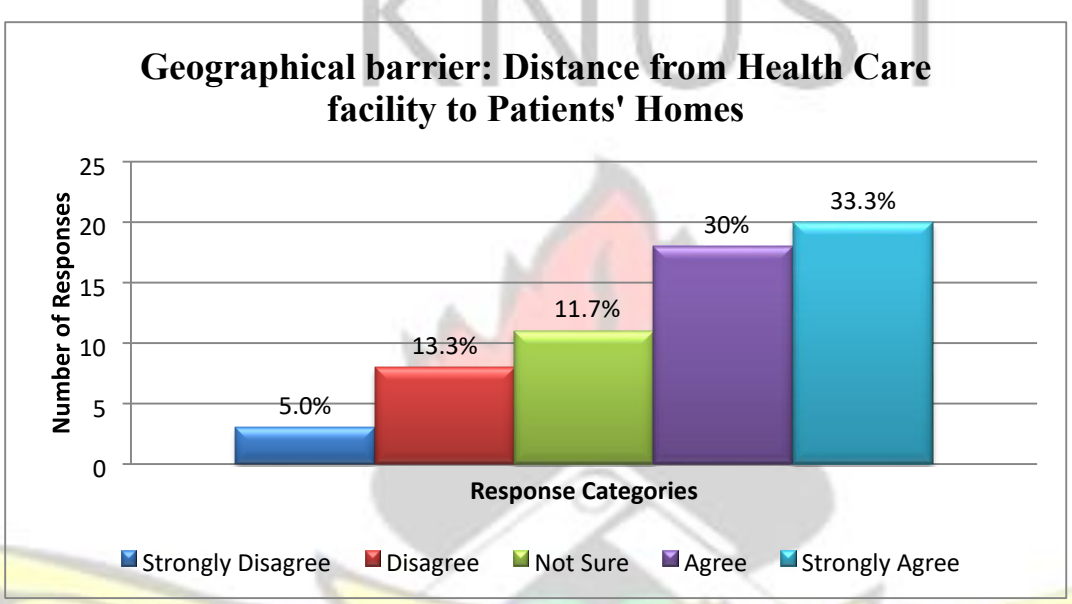

Figure 4.1: Perception about distance.

With respect to geographical accessibility, 63.3% of the respondents said they 'Strongly Agree' or 'Agree' that most of the patients they visit live far away from the nearest Health Care Facility. The remaining 36.7% of respondents said they 'Disagreed' or 'Strongly Disagreed'. Although CHPS compounds have been established in some of the communities to enhance access to health care, most of the households are far in terms of walking distance from the Health Centres, hence Telehomecare by CHWs provide a major relief for patients. Comparatively, with traditional health care accessibility, patients travel to health care facilities for health care, while Telemedicine takes health care to patients in the comfort of their homes. Due to the difficulties patients go through regarding travelling

costs and inconveniences, Telemedicine mode of health care delivery offers a better alternative to increasing health care access in rural areas.

4.3.2 Affordability barrier

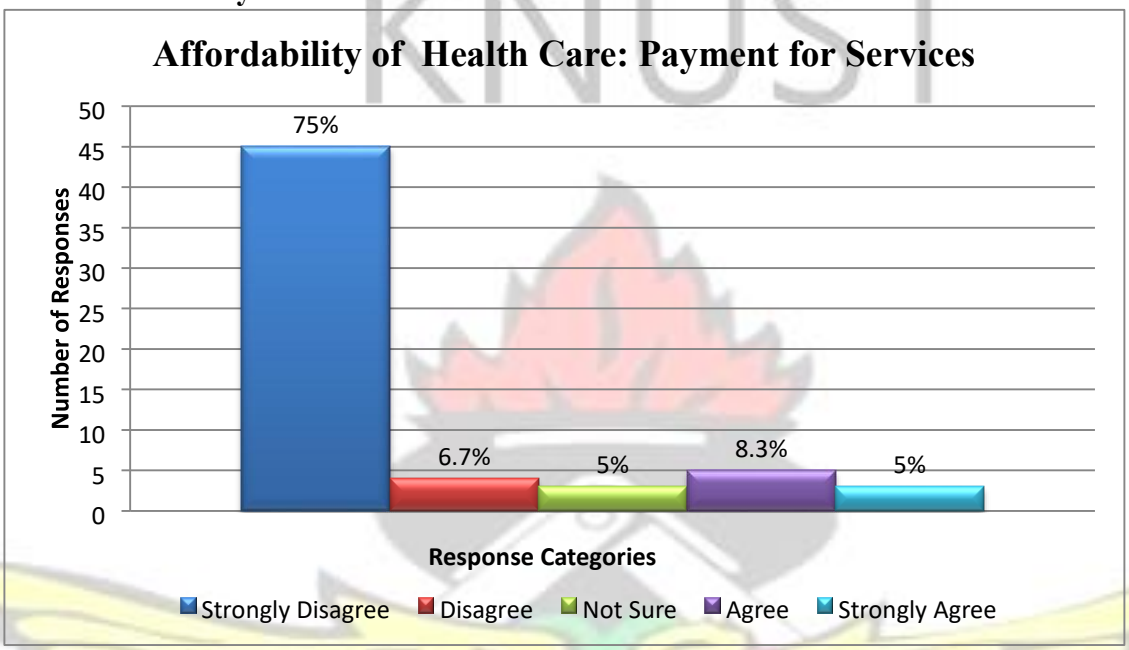

Figure 4.2: Payment for Telemedicine services

About 81.7% of the respondents said they 'Strongly Disagree' and 'Disagree' that patients pay for the Telemedicine services that are rendered. Only eight of the respondents, constituting 18.3%, said that they 'Agreed' and 'Strongly Agreed' respectively. Although the intervention aims at providing free health care for patients, the results reveal that some patients do pay for other services. Affordability barriers of health care relate to the indirect cost of lost labour hours, the direct costs of consultation, user fees, diagnosis and treatment, as well as the intangible cost of pain from travelling to the health care centre. With respect to travelling expenses, Telemedicine (Telehomecare and Teleconsultation) totally eliminates any travel expenses for patients, unless referral to a health care facility

becomes necessary. However, evidence from responses by the respondents reveals that there are no charges for the services, including drugs for treatment, especially for pregnant and lactating mothers and their children less than five years who constitute the target group of the intervention. This therefore means that Telemedicine can help to eliminate or reduce direct cost of health care, as has been revealed in a systematic review by Rojas & Gagnon (2008), and Lesley et al (2012). Moreover other costs related to transportation and admission is also avoided with

Telehomecare, unless a patient's condition requires emergency referral. The finding on affordability of health care is supported by other research works, but in different contexts and forms of applications. Johnston et al. (2000) for instance suggests that technology has the ability to reduce cost of healthcare if used as a substitute to some inperson visits, while a study by Finkelstein, Speedie and Potthoff (2006), revealed that additional visits by skilled home health care nurses like CHWs can be provided at a lower financial cost to patients.

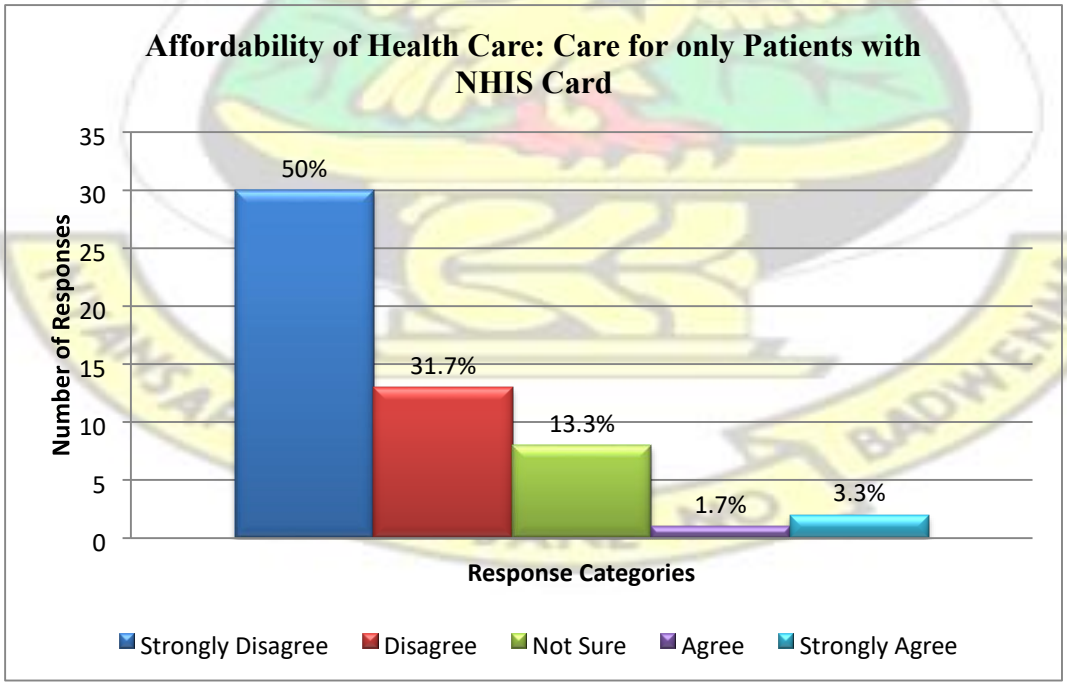

Figure 4.3: Health Insurance Card holders and access to Healthcare

Another revelation from the study is that, patients with health insurance have equal access to treatment as those without health insurance, hence there is no discrimination. This revelation is based on results from Figure 4.3, where cumulatively, forty-nine (49) respondents constituting 81.7% said they 'Disagree' and 'Strongly disagree' that only patients with health insurance are offered health care services. Patients are therefore encouraged to seek services without any financial constraint.

4.3.3 Availability and Readiness

Table 4.4: Modal Response for Each Category of Healthcare Availability

	AVL1	AVL2	AVL3	AVL4	AVL5	AVL6	AVL7
Modal Response (code)	5	4	4	4	5	2	4

(Source: Field Data 2016

Key: Strongly Agree= 5,Agree = 4, Disagree = 2,

AVL1 = Availability of Healthcare at all times

AVL2 =Availability of Most of Required Medical Equipment for

AVL3 =Availability of Essential Drugs for Treatment

AVL4 =Minimum length of Time for

AVL5 =Availability and Readiness of Health care Professionals at the

Teleconsultation Centre

AVL6 = Easy Access to Healthcare Specialists by Phone Call

AVL7 =Availability of Emergency Transport

The W.H.O in its "Service Availability and Readiness Assessment methodology" (W.H.O, 2013), recognises 'Health Workforce Availability' as an indicator of health care availability. General and specific service indicators of readiness include Trained Staff and Guidelines, Availability of Equipment, Medicines and Commodities, Diagnostics and Infection control. The modal response for the 'Availability' dimension of accessibility reveals that most of the respondents 'Strongly Agreed' or 'Agreed' to the statements relating to Availability of health care, with only one sub-category, AVL 6 (Easy access to healthcare specialists by phone call), remaining different (Table 4.4).

Each sub-category is analysed separately below for discussion.

AVL1 – Availability of Healthcare at all times

Availability of health care at all times of the day is very necessary to enhance access to health care. However, some constraints like inadequate health care personnel and accommodation problems make it difficult for the few health care officers in rural areas to provide care at all times of the day, especially at night.

Table 4.5: Availability of Healthcare at all times of the day

RESPONSE	FREQUENCY	%
Strongly Agree	37	61.6
Agree	21	35.0
Disagree	2	3.4
Strongly Disagree	0	0.0

TOTAL	**60**	**100**

(Source: Field Data 2016)

With respect to health care availability, a cumulative 96.6% of respondents strongly agreed or agreed that they are able to visit patients at any time of the day for Telehomecare. The ability of CHWs to visit patients at any time of the day shows that patients have access to health care at all times. Before the intervention, health workforce shortage was a major problem for the health system of the district, especially in the communities of the Millennium Village, as there were only 12 CHWs (Table 3.1). With 60 CHWs throughout the communities, health care is now closer to the people and patients are therefore able to access health care at any time of the day.This was confirmed in an interview with one of the CHWs –"*Yes, even at 1 a.m. some patients call us about problems" –CHW2*

–

AVL2 Availability of Required Medical Equipment

Availability and Usage of needed medical equipment helps to enhance health care delivery. Lack of the needed medical equipment can negatively affect health outcomes and quality of health care delivery. For, equipment like thermometer, light source, sphygmomanometer, Mid Upper Arm Circumference tape (MUAC), wellington boots among others is needed to enhance quality health care delivery.

Table 4.6: Availability of Equipment Needed for Telemedicine

RESPONSE	FREQUENCY	%
Strongly Agree	25	41.7
Agree	27	45.0
Disagree	6	10.0
Strongly Disagree	2	3.3
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

From Table 4.6, it can be observed that a cumulative 86.7 % of the respondents strongly agreed and agreed respectively that they have most of the equipment needed to facilitate Telehomecare heath care delivery. Only 8 respondents (13.3%) responded 'Disagree' and 'Strongly disagree' to the statement.

Table 4.7: Availability of Basic Equipment

	EQUIPMENT	AVAILABLE		NOT AVAILABLE	
		Freq.	%	Freq.	%
1	Thermometer	60	100	0	0
2	Child Scale	56	93.3	4	6.7
3	Adult Scale	58	96.7	2	3.3
4	Sphygmomanometer	51	85.0	9	15.0
5	MUAC Tape	60	100	0	0
6	Malaria Test kit	60	100	0	0
7	Pregnancy Test kit	60	100	0	0

(Source: Field Data)

Table 4.7 gives details of the percentage of respondents who have vital clinical equipment needed for delivery. Some of these equipment like the Mid Upper Arm Circumference tape (MUAC), Malaria Test kit, Pregnancy Test kit and Thermometer are basic equipment which are used by CHWs during household visits, hence all the respondents had them. In an interview with one of the CHWs, it was confirmed that most of the non-clinical equipment needed for Telehomecare have also been provided to the CHWs -"*…., we have been given wellington boots, rain coats and our phones also have torch light which is very bright. We have everything.*"-Theresa. From these results, it can be deduced that most of the CHWs have most of the equipment needed for health care delivery. Hence the intervention makes available most of the equipment necessary to enhance healthcare delivery and access. Without these equipment, diagnosis and treatment of illnesses would be difficult. It is therefore encouraging that most of the CHWs are equipped with most of the equipment needed for quality health care delivery, especially the light source which is needed to respond to calls in the night.

–

AVL3 Availability of Essential Drugs for Treatment

Lack of access to essential medicines for treatment of common diseases like malaria serves as a barrier to quality healthcare delivery in rural areas. It is therefore necessary that any health care intervention like that seeks to increase access to rural healthcare enhance easy access to essential drugs.

Table 4.8: Availability of Essential Drugs for Treatment

RESPONSE	FREQUENCY	%
Strongly Agree	26	43.3
Agree	30	50.0
Not Sure	1	1.7
Disagree	1	1.7
Strongly Disagree	2	3.3
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

Cumulatively, 93.3 % of the respondents said they 'Strongly Agree' or 'Agree' that essential drugs and commodities are always available for treatment after teleconsultation. Only three respondents (5%) said they 'Strongly Disagree' and 'Disagree' with the statement. In an interview with one of the CHWs, it was revealed that some of the drugs available for treatment include; COATEM (Anti-malaria drug), Zinc Tablets and Paracetamol. It was also revealed that, since the primary targets of the intervention are pregnant mothers and children under five years, excluding children between zero and six months, medication for any illness is given for only the target groups by the CHWs. Other cases are referred to the health care facility for treatment, and the major illness that the intervention seeks to treat is malaria; hence COATEM is

often used and treatment is free for the target group.

AVL4 Availability and Readiness of Health Care Professionals

Real-time teleconsultation requires availability of consultants who are easy to reach and always ready to assist CHWs in their duties.

Table 4.9: Availability and readiness of health care professionals at the TCC

RESPONSE	FREQUENCY	%
Strongly Agree	28	46.7
Agree	23	38.3
Not Sure	3	5.0
Disagree	3	5.0
Strongly Disagree	3	5.0
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

Fifty-one respondents (51), constituting a cumulative percentage of 85%, said they 'Strongly Agree' or 'Agree' that specialists at the TCC are always available and ready to assist them when they call for teleconsultation. Only six (6) respondents, representing a cumulative percentage of 10% said they 'Disagree' or 'Strongly Disagree' with the statement.

Based on the results, it can be deduced that CHWs are able to deliver health care to patients with the help of health care professionals who are always available and ready to assist in health care delivery through teleconsultation. This therefore ensures that the needed care is provided to minimize transfers and referrals.

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AVL5 Easy Access to Healthcare Specialists by Phone Call

Real-time teleconsultation relies on mobile communication technology to enhance transfer of data between patients and specialists, or among different healthcare providers. However, access to specialists via phone call can be difficult if the communication network is bad, and this can affect effective healthcare delivery.

Table 4.10: Access to Healthcare Specialists by Phone

RESPONSE	FREQUENCY	%
Strongly Agree	10	16.7
Agree	22	36.7
Disagree	23	38.3
Strongly Disagree	5	8.3
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

From Table 4.10, it can be observed that while 53.4% of respondents were positive about the ease of access to healthcare specialists by phone, the remaining 46.6% differed in their response. It was disclosed by one of the CHWs in an interview that, while they have been restricted in consulting specialists at the Teleconsultation Centre, they now refer cases first to their Community Health Nurses and Midwifes who in turn consult the Teleconsultation Centre if the need be. This is a form of structured conversations which limits direct consultation with specialists on the phone by CHWs, hence the reason for some CHWs disagreeing and strongly disagreeing to the statement.

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AVL6 Availability of Emergency Transport

In emergency cases when patients need to be rushed to the District Hospital for treatment, the need for emergency transport becomes necessary. 'EmergencyAmbulance' is therefore listed as one of the referral priorities on the Teleconsultation Encounter Forms used at the Teleconsultation Centre (Appendix D). Availability of emergency transport is hence necessary for an effective program.

Table 4.11: Availability of Emergency Transport

RESPONSE	FREQUENCY	%
Strongly Agree	11	18.3
Agree	17	28.3
Not Sure	9	15.0
Disagree	16	26.7
Strongly Disagree	7	11.7
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

While 46.6% of respondents strongly agreed or agreed that emergency transport is always available, 53.4% differed in their response.

This implies that the issue of availability of transport, in the form of ambulance or any other vehicle, still remains a major challenge to enhancing. Although seeks to take health care to the door-step of patients, without adequate emergency transport services to send patients to hospitals for treatment during emergency situations, the intervention may not be able to address patients' health care needs in critical conditions.

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4.3.4 Acceptability Barrier

Acceptability of a health care intervention is a necessary condition for successful outcomes. This section presents the results of the responses of CHWs to statements relating to the way they themselves feel about the intervention as providers of care, and how CHWs think patients also feel about the services they receive through Telehomecare and Teleconsultation.

Patients' Satisfaction

Acceptability of healthcare delivery is very necessary to ensure sustainability of any healthcare intervention. Patient-centred interventions must therefore seek to satisfy patients' healthcare needs and as a result enhance their satisfaction with healthcare delivery.

Table 4.12 Perception of CHWs about patients' level of satisfaction

RESPONSE	FREQUENCY	%
Highly Satisfied	34	57
Satisfied	22	36
Dissatisfied	4	7.0
Highly Dissatisfied	0	0.0
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

The responses on patients' satisfaction with services and treatment revealed that fifty-six respondents, constituting 93% of the respondents, strongly agreed or agreed that patients always expressed satisfaction with the care and treatment they receive. Based on this result, it can be deduced that patients are generally satisfied with the Telehomecare and

Teleconsultation mode of health care delivery and this helps to increase patients' utilization of health care services, a discovery also made by Whitten and Love (2005).

Another important discovery from an interview with one of the CHWs was that , particularly , helps to eliminate barrier of stigmatization to health care access, especially pregnant teenagers, "*Also, some pregnant women don't go to the clinic, some are even shy for it to be known by others, especially teenagers who get pregnant. So when we do household visits and find out that a teenager is pregnant in a household, we counsel and advise them so that they will go to the clinic for prenatal care."(Theresa, CHW)*

Motivation for Healthcare Delivery

Care providers' motivation to deliver health care helps to enhance quality health care delivery. For to enhance access to healthcare delivery, care givers must feel motivated by the process of healthcare delivery, and must be encouraged to consult other healthcare specialists through teleconsultation services.

Table 4.13: Motivation for Healthcare Delivery

RESPONSE	FREQUENCY	%
Strongly Agree	45	75.0
Agree	13	21.7
Disagree	2	3.3
Strongly Disagree	0	0.0
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

Regarding how CHWs feel about their work as providers, 96.7% of the respondents said they felt motivated by the work they do, while 3.3% were not motivated. Although the

work seems tedious, it was observed that CHWs are generally happy with the work they do and generally feel motivated. It can therefore be deduced that system of healthcare delivery enhances healthcare providers' motivation.

Timeliness of Services Delivery

Enhancing access to health care also implies minimizing the length of time patients spend in accessing health care, since time represents an intangible direct cost of health care to patients against their productive labour hours. A health care intervention like Telemedicine must therefore seek to reduce the length of time spent at health care facilities, especially with regards to waiting time.

Table 4.14: Timeliness of Telehomecare delivery

RESPONSE	FREQUENCY	%
Strongly Agree	13	21.7
Agree	24	40.0
Not Sure	6	10.0
Disagree	8	13.3
Strongly Disagree	9	15.0
TOTAL	**60**	**100.0**

(Source: Field Data 2016)

Majority of respondents agreed or strongly agreed that it usually takes them less than thirty minutes (30 minutes) to provide services to patients. This represents a cumulative percentage of 61.7% of the total responses. Only seventeen respondents representing 28.3% of respondents disagreed and strongly disagreed to the statement. The time taken for Telehomecare however depended on the case at hand, and this was revealed in an interview with one of the CHWs. Meanwhile, with the mode of health care delivery, the

waiting time for patients in the clinic or hospital is avoided. Through an interview with one of the CHWs, she revealed that they can refer or consult different people apart from the specialists at the TCC or the District hospital, a situation which reduced delays in health care delivery, "*.....so now we refer, we refer to the CHN, and my CHN will in turn refer to the midwife or if referral to my CHN is not possible, I can refer to the midwife, so the midwife too refer. Even we can refer to Papa Bright (CHWM) and the other team members. If there is a case during our visits and there is a problem, straight! We can call them (the team) to inform them so that they can give us another reference*" (CHW 3). With a wide range of expertise to refer to, CHWs and other health care workers are able to provide health care in a timely manner. Quoting the CHWs Manager of the project, "*Patients also had to spend long hours in hospitals because of the congestion but this has been solved*", it can be said that reduces or eliminates the time barrier for seeking health care. Also, with the traditional process of health care delivery, delay in processing of NHIS cards for health service delivery is considered as one of the reasons for delays at the health care centres and hence patients' unwillingness to visit the hospital for treatment (Ofosu-Kwarteng, 2012). However with, patients need not go through the cumbersome process of traditional care. This in effect enhances

acceptability of health care delivery by patients.

4.4 Factors That Enhance Telemedicine Health Care Delivery

Another key objective of the research was to identify contextual factors that enhance health care delivery in increasing access to rural health care. The study measured respondents' perception of factors they considered as necessary to enhance Telemedicine.

Table 4.15: 'RII' score and rank for each factor

Factors	Frequency					RII	Rank
	SA	A	NS	D	SD		
FAC1	36	22	1	1	0	0.91	6th
FAC2	29	28	3	0	0	0.887	7th
FAC3	41	16	3	0	0	0.927	3rd
FAC4	37	22	0	1	0	0.917	4th
FAC5	48	11	0	1	0	0.953	1st
FAC6	37	21	2	0	0	0.917	4th
FAC7	29	23	3	5	0	0.853	9th
FAC8	27	29	0	3	1	0.86	8th
FAC9	46	13	1	0	0	0.95	2nd
FAC10	4	2	1	30	23	0.38	10th

KEYS: SA=Strongly Agree, A=Agree, NS=Not Sure, D=Disagree, SD=Strongly Disagree

FAC1 = Collaboration among health workers

FAC2 = Adequate Health Care personnel

FAC3 = Health ICT Education and Training for health care personnel

FAC4 = Adequate Incentives for health care personnel

FAC5 = A good Health Information system for health records keeping

FAC6 = Technical Quality of Communication Network

FAC7 = A good software to enhance data collection

FAC8 = Community Support and Participation

FAC9 = Availability of adequate medical supplies and equipment

FAC10 =Ability of patients to pay for health care services

Table 4.16: Modal response for each factor.

	FAC1	FAC2	FAC3	FAC4	FAC5	FAC6	FAC7	FAC8	FAC9	FAC10
Modal Response	5	5	5	5	5	5	5	4	5	2

KEY: Strongly Agree=5, Agree=4, Disagree=2

4.4.1 FAC1-Collaboration among Health Workers

The modal response for this factor is '5', which represents 'Strongly Agree'. This supplements the RII score of 0.91, which is the 6th highest 'RII' score in ranking among the Factors in Table 4.15.

This means that most of the respondents strongly agreed that collaboration among health workers is very necessary for enhancing Teleconsultation and Telehomecare.

Collaboration includes consultation among health workers like CHWs, Midwifes, Doctors, Nurses, and Community Health Nurses. Teleconsultation is the main functionality of the Telemedicine project in the Bonsaaso Millennium Village, and this

functionality requires close collaboration among health workers in the communities and outside the communities.

In an interview with one of the CHWs, it was therefore revealed that close collaboration is very necessary at any point in the medical care process: - "*so now we refer, we refer to the CHN, and my CHN will in turn refer to the midwife or if referral to my CHN is not possible, I can refer to the midwife, so the midwife too refer. Even we can refer to Papa Bright (CHW Manager) and the other Telemedicine team members. If there is a case during our visits and there is a problem, straight! We can call them (the Telemedicine team) to inform them so that they can give us another reference*." (CHW 3)

4.4.2 FAC2- Adequate Health Care Personnel

This factor recorded a modal score of '5' which represents 'Strongly Agree', and a 'RII' score of 0.887 which is 7th in the 'RII' score ranking. From this result, it can be said that most of the respondents strongly agreed that, sufficient number of health care personnel in a Telemedicine project is a factor necessary to enhance Telemedicine, especially health care delivery. This is supported by evidence from research by (Subrahmanyam & Mariyam, 2011). The Telemedicine project in the Bonsaaso Millennium Village employs sixty (60) CHWs who are the facilitators of Telemedicine. These CHWs are involved in field work through constant household visits to educate and advice households about good hygienic practices, usage of insecticide treated bed nets, as well as performance of other medical processes. Their work is very necessary for communities with no health care facility or few professional health care workers like nurses, midwifes and doctors. A new project is therefore being implemented to increase the number of CHWs for a broader

coverage of health care and access to quality health care, and this was made know during an interview with the Manager of CHWs in the

Bonsaaso Millennium Village, "*Yes they do (with reference to CHWs playing a major role in the project), and currently we are trying to implement Project One Million CHWs campaign which means that more CHWs are going to be recruited to enhance the work, especially now that the intervention is going to be scaled out to cover the whole district.*" (CHWs Manager)

4.4.3 FAC3- Health ICT Education and Training for Healthcare Personnel. To this factor, most of the respondents strongly agreed that an effective Telemedicine intervention depends on adequate Health ICT Education and Training for health care personnel. This is based on the fact that this factor recorded a modal score of '5' which represents 'Strongly Agree', and a 'RII' score of 0.927 which represents the 3rd of 'RII' ranking. Since Telemedicine constitutes one of the ICT Health Domains identified by Bashshur et al. (2011), effectiveness requires education and training on its Functionalities, Applications and Technologies. CHWs and other health care workers therefore need education and training in the usage of the technology required for an effective Telemedicine health care delivery. This includes knowledge in the connectivity, application, and technological devices needed to transmit real-time and store-and-forward data in synchronous and asynchronous Telemedicine.

4.4.4 FAC4-Incentives for Telemedicine Healthcare Personnel Most of the respondents strongly agreed that adequate incentives for health care personnel, is another

major factor that enhances Telemedicine health care delivery in rural areas. This can be observed from the modal response, which is '5' for 'Strongly Agree', as well as a 0.917 'RII' score of 4th rank (Table 4.15).One of the factors responsible for rural health workforce deficit is unwillingness of health care personnel to work in rural areas due to lack of infrastructure facilities, social amenities, social opportunities and other benefits which their counterparts in the cities enjoy. To attract health care personnel to villages however, there is the need to motivate them with incentives. Incentives may be in the form of scholarships for further studies, appreciable income and appreciation in the form of extra rewards for hard work.

4.4.5 FACT5- Good Health Information System for Health records keeping

Health information systems that enable data to be collected and transferred to different users form a very vital component of Telemedicine health care delivery, particularly in telemonitoring. Majority of respondents, on this factor, strongly agreed that an effective Telemedicine health care delivery requires a good health information system for health records keeping. The modal response for this factor, as seen in Table 4.16 shows '5' for 'Strongly Agree', while the 'RII' score is 0.953 representing the highest score among the other factors.

4.4.6 FACT6 – Technical Quality of Communication Network Services

Most of the respondents agreed to technical quality of communication network services as a determinant of Telemedicine effectiveness. The modal response was therefore '4' representing 'Agree', as shown in Table 4.16. This factor scored a 'RII' of 0.917, and is joint 4th with another factor, 'FAC4-Adequate incentives for Health Care Personnel', in the ranking (Table 4.15). Telemedicine relies heavily on mediums of data transmission

from one end to the other, and transmission can be done with gadgets like mobilephones and computers. However network quality and connectivity determines the transmission quality of data, hence bad network connectivity can undermine transmission of data like voice-mails, videos and still images. Delays in transmission of information, as a result of poor connectivity, can affect health care delivery. Some CHWs in a meeting at the Telemedicine Centre which the researcher was present, blamed problems of bad network connectivity as the reason for delay in transmission of data on household visits to their Manager. This was further reiterated in an interview with one of the CHWs who said that, "For *the network problem, it depends on the area.*

Some CHWs don't have good network in their area, so they have to find an area where the signal is good before they can send anything about their household visits. Sometimes they would have to visit about fifty households before finding an area with good signal to send their information. This creates problems if there is a delay."- Theresa (CHW) **4.4.7 FAC7- Good Software and Devices to Enhance Data Collection** This was strongly agreed by majority of the respondents as a determining factor of effectiveness, as majority of respondents selected 'Strongly Agree', represented by the modal score, '5' in Table 4.16 and 0.853 'RII' score from Table 4.15. The COMCARE software used by CHWs was testified as a typical example to explain how good data collection software enhances Telemedicine health care delivery. The software also enhanced monitoring of CHWs' visits by their Manager. "*They (CHWs) also record symptoms of diseases and send the information of their visit using their mobile phones which has the COMCARE software for that purpose……and it (the software) links to my computer in the office which uses wireless internet connection. So I am able to know which households they*

visited and the reports from their visits."- CHWs' Manager. Each CHW is also given an android phone which has special features to enhance data collection, as was told by the CHWs Manager: "*...you know, we have provided the CHWs with android phones which uses a software to capture the reports on the households they visit",* and observed on the field. Although a systematic review of Telemedicine, with a focus on technology was not found by the researcher, some research on interventions by some researchers revealed that good software for data collection and storage is a principal component of Telemedicine interventions which determine effectiveness (Subrahmanyam & Mariyam 2011; LeadingAge 2013;

Bernocchi et al. 2014).

4.4.8 FAC8- Community Support and Participation

Community support and participation is necessary for sustainability of projects. Results from survey response on community support as a factor which enhance Telemedicine, produced a modal response of '4', signifying 'Agree' (Table 4.16). The 'RII' score for this factor of 0.86 was 8th on the rank. This means that in the opinion of majority of the respondents, community support and participation helped to enhance Telemedicine programme in the communities. One area where community support and participation is necessary in a Telemedicine project is the recruitment of CHWs and volunteers. CHWs and volunteers for the Telemedicine intervention are all members of their various communities, who were selected by their community leaders and other stakeholders to undergo training for the role of health workers. It is therefore based on this that most of the CHWs agreed that Community support and participation is necessary for a rural Telemedicine program.

4.4.9 FAC9-Availability of Medical Supplies and Equipment

Medical supplies and equipment are necessary components of every health care programme that involves curative and rehabilitative strategies. To this end, most of the respondents strongly agreed that 'Availability of Medical Supplies and Equipment' helped to enhance Telemedicine. The evidence is presented by the modal response for this factor, which is '5', representing 'Strongly Agree' and a rank of 7th with 'RII' score of 0.853. The W.H.O therefore recommends that the percentage of facilities (in this context CHWs) with fourteen (14) essential medicines available for health care delivery, and seven (7) items including; blood pressure apparatus, stethoscope, adult scale, infant scale, child scale, thermometer, and light source, should be used as some of the indicators of general service readiness (W.H.O, 2013).

4.4.10 FAC10- Ability of Patients to Pay for Healthcare Services

The cost of health care constitute one of the barriers to health care access for low income groups found mainly in villages. With respect to Telemedicine in the Bonsaaso Millennium Village, majority of CHWs were of the view that the effectiveness of the intervention did not depend on the ability of patients to pay for health care services. The evidence from the results of the responses regarding 'Ability of patients to pay for health care services' as a determining factor for effectiveness revealed a modal score of '2' which means 'Disagree'. This factor recorded the lowest 'RII' score of 0.38 and ranked 10th, a result which means that 'Ability of patients to pay for health care services' does not determine the effectiveness of the Telemedicine programme. This position by majority of the CHWs complement the results from Figure 4.2 on 'Affordability of Care' that, patients, especially pregnant women and children under five years who constitute the target group of the intervention, did not pay any money for treatment during household

visits by CHWs in .In the rural context, the ability of patients to pay for health care services would be a barrier to any health care intervention that seeks to increase access to rural health care, as majority of people in rural areas fall in the lower income group.

4.5 How the Work of CHWs and Health Care Staff at the Teleconsultation Centre Enhance Health Care Delivery

CHWs and Health Care workers at the TCC are major players in the Telemedicine intervention and engage in services relevant for the success of the project.

4.5.1 CHWs in Household Visits (Telehomecare)

As part of the Telemedicine program, CHWs are involved in household visits. Each CHW has a certain number of households within his or her community of residence under his or her care. CHWs are expected to visit at least five households a day.

'Household visits' is therefore one of the themes from the interview analysis with the highest count of eight (8). During household visits, CHWs perform different assignments which fall under three dimensions of care; Preventive, Curative and Promotional health care. In every household, CHWs register all children under five years, excluding those between zero and six months, as well as pregnant and lactating mothers. These categories of patients form the primary target of the intervention. Assignments regarding health promotion include advising and educating households on sanitation and bed net usage, as

well as new diseases which patients need to be educated on. Concerning preventive health care, CHWs support immunization programmes for children. Home visits for new-born babies and their mothers, has been recommended by the W.H.O for the first week of delivery as part of measures to reduce maternal and infant mortality (W.H.O, 2015). Telehomecare therefore offers the opportunity for CHWs to visit new-borns and their mothers in as part of a monitoring system which helps to check any postnatal complications for both mothers and their new-born babies.

4.5.2 Usage of 'COMCARE' Software for Data Collection The clinical process of curative health care, related to health care, involves CHWs diagnosing illnesses using available instruments like thermometer to check temperature, sphygmomanometer for blood pressure, Mid Upper Arm Circumference (MUAC) for growth and malnutrition, adult and child scales, as well as recording symptoms and performing rapid diagnosis test using malaria test kits to diagnose malaria, which is one of the common diseases treated by CHW. It also involves CHWs inquiring about the health condition of members of the household to know if anyone is ill or has any health condition that needs attention. Treatment of illnesses following diagnosis is given to only the target groups or category, meanwhile CHWs advice and counsel patients outside of the category to seek health care from the appropriate place if they identify any patient with a condition which needs treatment they (CHWs) don't have the mandate to treat. CHWs monitor the health condition of the patients that they treat by regularly visiting them to know if they are taking their drugs as prescribed. In the situation where

CHWs have no idea of what to do, they refer to their superiors which include CHNs, Midwifes, the Telemedicine team, or Teleconsultation from specialists at the TCC or other

specialists at the district hospital for consultation. This enhances collaboration among health workers to ensure that the right kind of treatment is received by patients. The Telehomecare and Teleconsultation practice relies heavily on ICT, and CHWs have been provided with android phones with software called 'COMCARE'. This software aids in recording of health care information of patients and also serves as a guide to CHWs as to what to do during household visits. Through internet connectivity and mobile network service, CHWs are able to transmit the data from their household visits to their Manager for analysis. CHWs also reach other health workers for consultation via mobile phone calls, a form of real-time teleconsultation. In this real-time or synchronous teleconsultation, CHWs are able to provide complete treatment or first-aid treatment for patients before they are referred to the clinic or hospital for further treatment. This is particularly helpful when there are no health care facilities in the community that can handle the patient in critical or emergency situations. It also helps to reduce referral of simple cases to the hospital, hence minimising congestion at the District Hospital.

Concerning usage of the COMCARE software in Telehomecare and Teleconsultation, CHWs are guided by statements which demand response from various options, as demonstrated by one of the CHWs in an interview: "*There are three options on the phone (shows me: Pregnant Woman, Child List, and Household). So if I visit a household and there is a pregnant woman, after tapping on the option 'Pregnant Woman', a page will open with the inscription, 'woman available?' (shows me). There are two options to this, ' Yes or No' so if I choose 'Yes', another pop up will emerge with the inscription ' Emergency danger signs shown?'. There are many danger signs which have been included in this (shows me: Vaginal bleeding, convulsion, severe headache, loss of consciousness, abdominal pain, labour contraction, fever, swelling of face, cough for three weeks, not*

responding to treatment etc). Any of these emergency danger signs requires that I call the TCC. Anyone at the TCC will tell me what to do in any of these situations. After consultation from the TCC, the next option is 'Emergency referrals'. The CHW will have to indicate the emergency referral he or she used. There are options like, 'Take to Clinic', 'Call Ambulance' etc." - Theresa, CHW. The procedure involving the COMCARE application provides the opportunity for CHWs to

identify and respond to cases quickly.

4.5.3 Collaboration Among Health Workers in Teleconsultation and Referrals

Another theme which was developed from the interviews was 'Collaboration among health workers'. During the analysis, 'Collaboration among health workers' and 'Teleconsultation and referrals' were merged into a single code. This represented the highest count of thirteen (13) in the coding frequency shown in Appendix C. Collaboration among health workers and the Telemedicine team was a very vital factor for Telemedicine effectiveness. This was also identified as one of the factors necessary for the effectiveness of Telemedicine in the survey analysis (Table 4.15), as majority of the CHWs strongly agreed to its relevance in enhancing Telemedicine health care. Collaboration among health workers is mostly needed during consultation. It was revealed through an interview with one of the CHWs that CHWs formerly had the opportunity to consult doctors and other specialist on phone, but at the time of the research, they had to first consult their Community Health Nurses (CHNs) and Midwifes, who would in turn consult other health workers should they need help. The CHWs also had the opportunity to consult a general nurse and midwife at the TCC, as the general nurse or midwife at the TCC also consulted doctors and specialists or made conference calls to connect doctors and other specialists for consultation. This chain of consultation enhances health care delivery and increases

access to quality health care from doctors and specialist who might not be physically available to handle cases. The case of consultation and referral however starts with CHWs and the health records they take of patients during household visits, as CHWs had to give information on patients' vitals and symptoms of illness for other health care workers to be informed in their diagnosis and prescription of the appropriate treatment. At the TCC where there is an emergency nurse and midwife, there are computers and telephones which are used to receive calls and information about patients' health condition. In an interview with the general nurse at the TCC, she outlined the process of teleconsultation as follows;1) the caller (usually health worker from a health facility), introduces himself or herself after the call has been picked, 2) an enquiry about the case, whether a general case or maternal, is made by the recipient of the call in order to know who to connect the caller to, 3) information about the patient's health condition, including a brief health history, is sought after the caller has been connected to the appropriate person at the TCC. 4) The caller is given directives as to what to do regarding treatment or first aid, to refer the case to a nearby clinic or hospital, or be connected by conference call to a doctor or specialist for further consultation. Calls are recorded electronically for future reference, and a form (Appendix D) is also filled manually for each call and case. Calls to the TCC are often made when a case cannot be managed by health workers in the health care facility as a result of lack of equipment and logistics, qualified health care specialist to handle a case or emergency transport (ambulance service) to transport a patient to the hospital. It was revealed by the general nurse at the TCC through an interview that, although the intervention is aimed at reducing the number of referral cases to the district hospital, the health care facilities in most of the communities lacked basic equipment and logistics to manage cases; hence they are mostly required to refer cases to the district hospital. Seven

referral centres were used by the TCC at the time of the research. This included the St. Martins Hospital, which is the Amansie West District hospital, and three other hospitals; Dominase Hospital, Nyinahini Hospital, and Nkawie hospital, all of which are outside but closer to the district by geography. Two ambulance services were also in use including; The Ghana Ambulance Service (A public ambulance service), and the MVP ambulance which is privately operate.

4.6 Problems With Telemedicine Health Care Delivery

Although health care delivery helps to enhance access to quality health care services in rural areas, as with all health care interventions, is associated with its own problems. The problems identified through interviews with respondents included; 1) Network and Connectivity Problems, 2) Alienation from Clinical Practice 3) Technical Problems 4) Insufficient and Unreliable Emergency Transport Services 5) Problems with Information Sharing 6) Inadequate Sensitization and Education about 7) Expensive equipment.

4.6.1 Network and Connectivity Problems

Network and Connectivity are two components of Telemedicine technology which to a large extent determines its effectiveness, based on the research outcome on factors that enhance Telemedicine effectiveness (Table 4.12). One of the major problems identified by interviewees was therefore related to mobile network and internet connectivity. It was revealed that failure of mobile network and internet connectivity affects their work in delivering the needed care, especially regarding data transfer and teleconsultation services. A poor mobile network creates delays and disruptions in calls to the TCC and other health care specialists for consultation. During emergency cases, a network disruption can be very fatal, as health care workers would not be able to administer the appropriate treatment to save lives.

4.6.2 Alienation from Clinical Practice

Teleconsultation involves medical staffs stationed in a room with necessary technological devices like phones and computers which enable receipt and transmission of data relevant for teleconsultation and monitoring over distance. This set-up is quite different from the traditional clinical environment like hospitals where practical health care delivery is done. Alienation of medical staff from the traditional clinical environment was revealed as one of the problems with Telemedicine health care delivery by one of the health workers at the TCC during an interview. Alienation, according to the staffs at the TCC, leads to knowledge gap which affects their ability to be updated on new clinical practices and issues relevant for evidence-based health care delivery. The two staff at the TCC admitted that they prefer being at the health care facilities where practical health care delivery is done, in order to be always abreast and experience the practical side of health care delivery.

4.6.3 Technical Problems

Telemedicine technologies are complex and can be disturbed by problems related to the technological devices and appliances used for transmission and storage of data. Some of the technical problems with the Telemedicine program of the MVP included faults with mobile phones and computers. CHWs whose phones had developed faults had to send them to a specialist at the MVP Office for repair or replacement. This, according to them sometimes takes a while, and without the phones, they could not make calls to the TCC or send data about their Telehomecare visits.

4.6.4 Insufficient and Unreliable Emergency Transport Although minimizes referrals, one of the emergency referral options which is recommended is ambulance

services to transport patients to the hospital if a case is beyond health workers in a community, or demands specialist attention. Unfortunately, only two ambulance services were available for the whole district, one of them was provided by the Ghana Ambulance Services and the other by a private operator. Apart from the insufficient number of ambulance services to provide emergency transport, lack of proper maintenance also rendered the ambulance unreliable, as it could be faulty at the time of need and may therefore not be able to move. Since the district faces challenges related to bad road networks and hence difficulty in accessing transport, this problem really posed a major problem to Telemedicine health care delivery. **4.6.5 Problem with Communication and Information sharing** Information sharing is very vital for teleconsultation. One of the problems with information sharing, identified through an interview with one of the staffs at the TCC, was lack of trust of information received from senders regarding patients' health conditions. Although the medical staffs at the TCC had to probe other health workers about the health condition and health history of patients, the information provided was admitted to be sometimes unreliable and insufficient to enhance teleconsultation. It was reported by the nurse at the TCC that sometimes, cases reported by health workers from health care facilities demanded detailed description, but since the health workers at the other end may not have the needed equipment to check patients' health conditions it becomes difficult for consultation to be effected. It was also revealed that in some cases, since health care workers would want cases to be transferred and not treated within the communities' health care facilities because of lack of the needed equipment, they often 'mislead' the staff at the TCC to call for referral of the case to the hospital by hyping the cases. This made it difficult for the intervention to achieve its objective of minimizing

referrals to the district hospital.

4.6.6 Expensive Equipment for Telemedicine Set-up

Although Telemedicine enhances access to health care over long distances, the technology is expensive. Most of the technological devices used to deliver health care are expensive and this therefore makes it difficult to have a set-up which provides general health care services. At the TCC, consultative health care delivery was limited to maternal healthcare and other common cases, and not other diseases which required expensive technological equipment to aid diagnosis, as such equipment were not available. The TCC was only equipped with devices like telephones and computers with internet connection which aided in voice and textual message communication, and not screens to aid in video conference which is relevant for effective consultation and diagnosis of certain disease conditions which requires visual images. Good mobile network coverage and internet connectivity is equally expensive, but required for Telemedicine to be successful in rural health care delivery. Staffs at the TCC therefore identified these as reasons why they are not able to deliver some kind of Telemedicine services, since some equipment needed for such services were not available.

4.6.7 Lack of Education and Sensitization about Telemedicine It was also revealed through an interview with the general nurse at the TCC that most health workers lacked knowledge about Telemedicine (Research about this assertion is needed), as she had little idea about Telemedicine before she was assigned her role. She complained that it therefore took her sometime after research and orientation to really understand what

Telemedicine entailed. With this gap in knowledge in educational institutions, it will become difficult for the intervention to be scaled out to other places with similar health care access barriers, given the demand for health care professionals needed for such program.

4.7 Conclusion

The results of the research offer an understanding of the various access barriers which are tackled by Telemedicine. The work of CHWs and other staff, in their various capacities as agents of the intervention, has also been revealed to contribute to the success of the intervention, while some factors deemed by respondents to enhance the intervention, chief among them being 'A good Health Information system for health records keeping' and 'Availability of adequate medical supplies and equipment' have also been identified. These factors are very necessary to enhance access to quality health care, considering the nature of the intervention which requires ICT tools and systems to facilitate patients' health records collection for consultation, and medical supplies and equipment constitute the primary component of curative health care. Some of the problems which were identified from interviewees include; network and connection problems, alienation from clinical practice, communication and information sharing gaps, as well as unreliable emergency transport, affect the ability of the intervention to achieve maximum efficacy and effectiveness.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This final chapter summarizes the entire study by briefly explaining the methodology used for the research, while presenting a summary of the results, the major conclusions drawn from the study and the recommendations by the researcher, based on some of the problems identified.

5.2 Summary

The research aimed at exploring how Telemedicine helps to enhance access to rural healthcare as a way of achieving the Global Sustainable Development Goal 3. Based on four sub objectives, the researcher identified Sixty (60) respondents who were all CHWs from the Bonsaaso Millennium Village Communities where the Telemedicine Project was being implemented. Two (2) other health care workers at the Teleconsultation Center and The Manager of CHWs were also engaged in interviews. After conducting a survey and engaging interviewees in series of semi-structured face-to-face interviews, results were analyzed using SPSS for quantitative data and QDA Miner Lite software for qualitative data. A summary of the results is presented below;

5.2.1 Access Barriers addressed by Telemedicine

Although Telemedicine has been identified to address geographical barriers associated with health care delivery and access, the research results show that other barriers related to Affordability, Availability and Acceptability of health care in rural areas are

addressed by Telemedicine as well.

5.2.2 How the Work of CHWs and Staff at the TCC helps to enhance access to health care

The Telemedicine workforce contributes greatly to the success of the intervention.

The research revealed that with regular household visits, CHWs are able to provide Telemedicine services for patients who would otherwise not have been able to visit the health care facilities in their communities or other communities for health care. By using android phones programmed with the COMCARE software, CHWs are able to collect patients' health information and send them to their manager at the office, as well as make free calls to other health workers in their communities' health care facilities and the TCC for consultation. This practice helps to provide health care from a distance and at the convenience of patients. Telemedicine also helps to monitor patients' health conditions after being discharged from the hospital. Through Telemedicine, some patients like pregnant teenagers who for fear of stigmatization would not have visited a health care facility for prenatal and antenatal care are advised and educated to follow the proper processes of maternal health care to avoid complications during pregnancy and child birth. Other dimensions of care rendered by CHWs during include counseling and advice on sanitation and bed net usage, constituting health promotion. Staff at the TCC on the other hand receive emergency calls for consultation, and also connect other health workers to physicians and other specialists, through conference calls, for teleconsultation. They also call ambulance when there is a need for referral to the district hospital.

5.2.3 Contextual Factors that Determine Telemedicine Effectiveness

According to Jacobs et al. (2012), health care interventions can be affected by contextual factors, hence the researcher sought to identify some contextual factors which respondents perceived to determine 's effectiveness in addressing health care barriers. Some of the factors identified in order of ranking were: A good Health Information System for Health Record Keeping, Availability of adequate Medical Supplies and Equipment, Health I.C.T Training and Education for Health Care Personnel, Technical Quality of Communication Network, Collaboration among Health Workers, Adequate Healthcare Personnel, Community Support and Participation, and A Good Software to enhance data collection.

5.2.4 Problems with Telemedicine Health Care Delivery Although the Telemedicine intervention has helped to enhance health care delivery in the Bonsaaso Millennium Village Communities, respondents identified some problems with the Telemedicine mode of health care delivery which needs to be addressed for maximum efficiency. These problems included: Network and Connectivity Problems, Alienation of Staff at the TCC from Clinical Practice, Technical problems related to the usage of the technological gadgets, Insufficient and unreliable emergency transport, Problems with Communication and Information Sharing, Expensive Equipment for Setup.

5.3 Conclusion

In conclusion, Telemedicine's ability to enhance access to rural health care is based on its ability to address multiple access barriers. Although the focus of most Telemedicine applications is to address distance barriers to health care access, it has been revealed that

other barriers related to Affordability, Availability and Acceptability of health care in rural areas can be addressed as well. Telemedicine health care eliminates cost of transportation when Telemedicine is practiced, and saves time and other opportunity costs associated with extended admission at a health care facility when care can be continued at home. With respect to availability of health care, Telemedicine, especially Telehomecare and Teleconsultation, helps to deal with shortage of health care specialists and specialist services. With Telehomecare, CHWs engage in mobile health care delivery through regular household visits, a situation which helps to solve the deficit of rural health care workers. Drugs and other equipment needed for health care delivery are also readily available for health care delivery. Integration of Telemedicine into the health care delivery system can therefore help to achieve Sustainable Development Goal

(SDG) 3, while creating jobs for many people through employment of more CHWs in Telemedicine delivery and other Telemedicine functionalities, applications and technologies. Inasmuch as healthcare is not a perfect substitute for the traditional mode of healthcare, its infusion into the healthcare delivery system can facilitate collaboration among healthcare workers, and between healthcare workers and patients, to solve access barrier and therefore increase access to rural health care for the attainment of SDG 3.

5.4 Recommendation

The researcher makes the following recommendations for effective Telemedicine healthcare delivery, especially in the rural context.

5.4.1 Integration of Teleconsultation into the NHIS and Capitation The Capitation system of NHIS allows patients to seek healthcare from one care provider at the district level, however, teleconsultation services span across different districts therefore making

it possible for access to specialists outside a particular district. For an effective teleconsultation service to be delivered to patients in rural areas there is a need for the Capitation system to be reviewed to make it possible for consultation across districts. Additionally, while a free teleconsultation service like the system practiced in the Bonsaaso Millennium Village helps to increase access to healthcare by eliminating the direct medical cost of consultation, a nationwide Telemedicine scheme would have to include fees for teleconsultation into the NHIS.

5.4.2 Inclusion of Telemedicine and Health ICT Education in the Curricular of Health Sciences Education.

Knowledge about Telemedicine must be enhanced to increase its acceptability and adoption into the health care system. While the researcher recommends further research to know the level of knowledge and perception of healthcare practitioners about as an evidence based practice, the curricular of Health sciences education should include courses in and other I.C.T Health domains, as a way of educating and equipping healthcare practitioners with knowledge about the Technology, Application and Functionalities of . This can help to produce more health care professionals with the knowledge and skills needed for Telemedicine practice.

5.4.3 Expansion and Improvement of Mobile Network and Internet Connectivity in Rural and Remote Areas

Telemedicine, especially Teleconsultation, relies extensively on mobile network and internet connectivity as primary media of communication. Expansion of mobile network and internet connectivity to rural and remote areas will therefore pave way for quick and easy adoption of Telemedicine and its related applications into the healthcare system of

rural and remote areas. Although Ghana has about 180 internet service providers, internet penetration estimates range from 4% to 6% and is largely concentrated in urban areas (Acheampong 2012). Conversely, telephone and mobile communication penetration by private mobile telephone companies keeps rising, yet quality service provision seem to be concentrated in the cities and urban areas with little concern for rural and remote areas. To enhance and teleconsultation services in rural areas, this trend must change with the help of partnership between state institutions in charge of communication, like the Ministry of Communication and the National Communications Authority, and private communication and internet service providers to focus on rural areas.

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APPENDICES

APPENDIX A: QUESTIONNAIRE FOR COMMUNITY HEALTH WORKERS

Introduction

I am Augustine Yaw Amankwaa, a final year student of Kwame Nkrumah University of Science and Technology. As part of my final year thesis for award of MPhil degree, I am doing this survey to collect data about how mode of healthcare delivery helps to increase access to rural healthcare, and the contextual factors that determine effectiveness of the .

Your answers to this questionnaire will only be used for this research and will be treated with utmost confidentiality. You are therefore not required to write your name on the form, except if you choose to do so.

DEMOGRAPHIC INFORMATION

1) Gender 1. MALE [ ] 2. FEMALE [ ]

2) Age 1.**18-25 [ ]** 2.**26-30 [ ]** 3.**31-39 [ ]** 4. **Above 40 [ ]**

3) Level of Education before becoming a CHW
Basic Level [ ]
SHS/SSS [ ] No Education [ ]

PERCEPTION OF HEALTH PERSONNEL ABOUT EFFECTIVENESS

Please tick the options which you deem appropriate, whether you Agree, Strongly Agree, Not Sure, Disagree or Strongly Disagree with any of the Statements. You are to tick only one option for each statement.

		AGREE	STRONGLY AGREE	NOT SURE	DISAGREE	STRONGLY DISAGREE
	GEOGRAPHICAL ACCESSIBILITY					
2.	Most patients I visit live far away from the health center (CHPS compound)	[ ]	[ ]	[ ]	[ ]	[ ]
	AFFORDABILITY OF CARE					
1.	Patients don't pay money for the services	[ ]	[ ]	[ ]	[ ]	[ ]
2.	Only patients with Health Insurance are taken care of	[ ]	[ ]	[ ]	[ ]	[ ]
	AVAILABILITY					
1.	I am able to visit patients at any time of the day	[ ]	[ ]	[ ]	[ ]	[ ]
2.	I have most of the equipment needed to check patients' vitals	[ ]	[ ]	[ ]	[ ]	[ ]

3.	Essential drugs and commodities are always available for treatment	[ ]	[ ]	[ ]	[ ]	[ ]
3.	It usually takes me less than thirty minutes to provide health care to patients	[ ]	[ ]	[ ]	[ ]	[ ]
4	Specialists at the TCC are always available and ready to assist me if I call them	[ ]	[ ]	[ ]	[ ]	[ ]
5.	Sometimes I can't reach specialists by phone and this delays treatment	[ ]	[ ]	[ ]	[ ]	[ ]
6.	Emergency transport is always available to send patients to the hospital in case of emergency.	[ ]	[ ]	[ ]	[ ]	[ ]
	ACCEPTABILITY					
1.	Patients always express satisfaction with the care I give.	[ ]	[ ]	[ ]	[ ]	[ ]
3.	I feel motivated by the work I do	[ ]	[ ]	[ ]	[ ]	[ ]

Please tick the factors which you think determine effectiveness of Telemedicine for health care delivery

		STRONGLY DISAGREE	**DISAGREE**	**NOT SURE**	**AGREE**	**STONGLY AGREE**
1.	Collaboration among health workers	[ ]	[ ]	[ ]	[ ]	[ ]
2.	Adequate health care personnel	[ ]	[ ]	[ ]	[ ]	[ ]
3.	Health ICT Education and Training for health care personnel	[ ]	[ ]	[ ]	[ ]	[ ]
4.	Adequate incentives for health care personnel	[ ]	[ ]	[ ]	[ ]	[ ]
5.	A good Health Information System for health record keeping	[ ]	[ ]	[ ]	[ ]	[ ]

6.	Technical Quality of Communication Network Service.	[ ]	[ ]	[ ]	[ ]	[ ]
7.	A good software to enhance data collection	[ ]	[ ]	[ ]	[ ]	[ ]
8.	Community Support	[ ]	[ ]	[ ]	[ ]	[ ]
9.	Ability of patients to pay for health care services	[ ]	[ ]	[ ]	[ ]	[ ]
10.	Availability of Medical Supplies and Equipment	[ ]	[ ]	[ ]	[ ]	[ ]
Do you have other factors not mentioned? Please state them below.						
	1)..... . 2)..... . 3).....					

APPENDIX B: INTERVIEW SCHEDULE

Objective of the research: To explain how telemedicine helps to address healthcare access barriers in the cluster communities of the Bonsaaso Millennium Village and the contextual factors which determine Telemedicine effectiveness.

Community Health Workers

1. **HOW DOES YOUR WORK AS A CHW HELP TO ADDRESS PATIENTS' HEALTH CARE NEEDS?**

Lead Questions

a) How does your work as a CHW help to increase access to health care in the Telemedicine project?
b) How often do you make calls to the TCC?
c) What is expected of you when you call the Teleconsultation center?

2. PROBLEMS ASSOCIATED WITH TELEMEDICINE MODE OF HEALTH CARE DELIVERY

Lead Questions

d) Do you have any problem with the phone you use?
e) Do you have any problem with the COMCARE software?
f) Do you encounter network connection problems?
g) Do you encounter problems communicating with a specialist on phone?

Health Care Specialists at the TCC

1. HOW DOES YOUR WORK HELP TO ENHANCE TELECONSULTATION AND TREATMENT OF ILLNESSES?

Lead Questions

a) How often do you receive calls from CHWs?
b) Are you able to receive proper diagnosis from CHWs for response?
c) How do you perceive the collaboration between and other Health Workers in delivering services

2. WHAT DO YOU CONSIDER AS SOME OF THE PROBLEMS WITH TELEMEDICINE MODE OF HEALTH CARE DELIVERY?

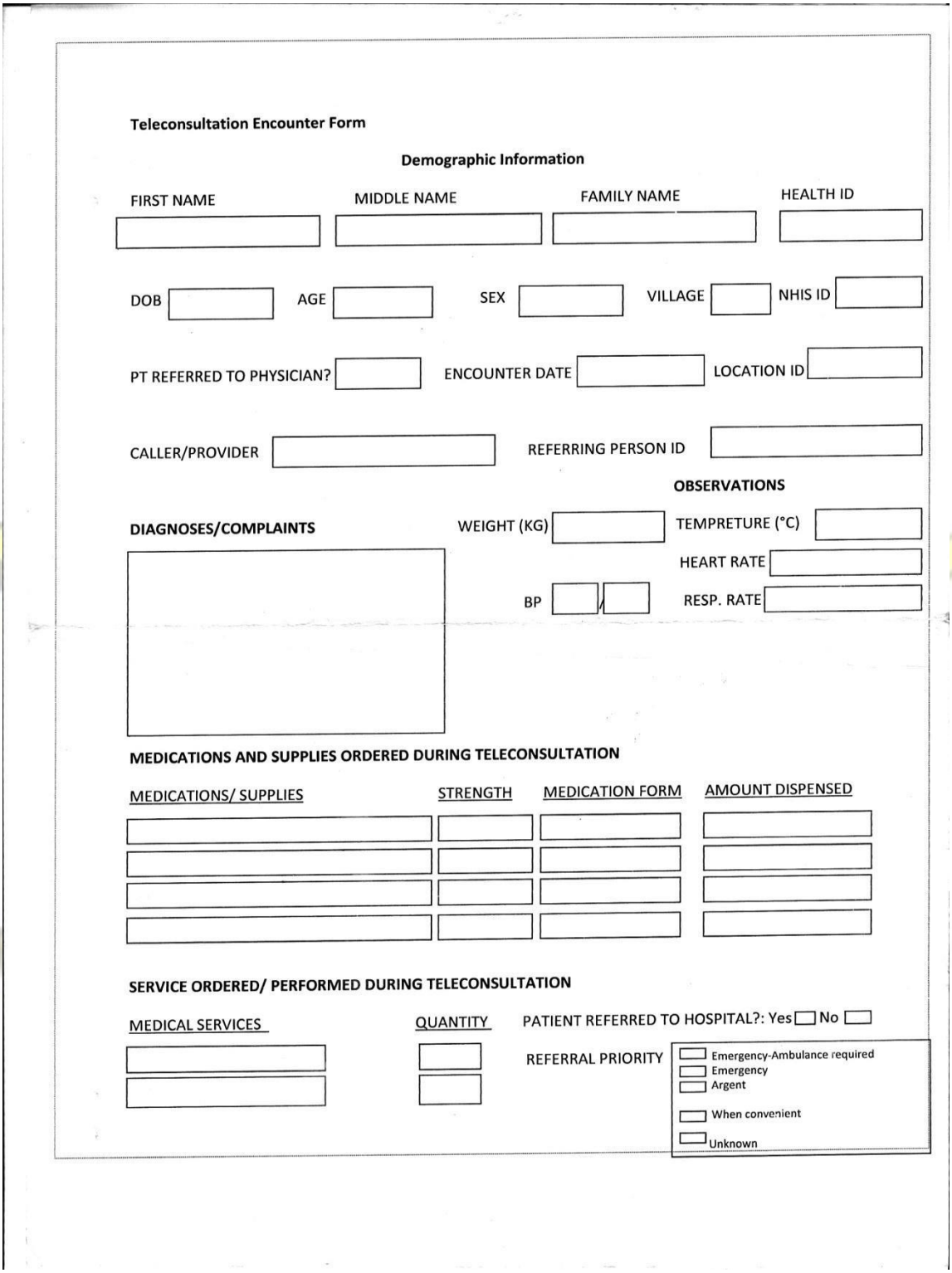
Lead Questions

a) Do you have any problem with the technology?
b) Is there any problem regarding communication with other health care workers?
c) Is there any problem with diagnosis and reporting during consultation?

APPENDIX C: Codes and Themes derived from Transcribed Interview

Category	Code	Count	% Codes	Cases	% Cases	Nb Words	% Words
Work of CHWs	Household Visits	12	16.20%	1	100.00%	1176	26.80%
Work of CHWs	Collaboration among Health Workers	13	17.60%	1	100.00%	646	14.70%
Work of CHWs	Clinical process	10	13.50%	1	100.00%	1035	23.60%
Problems of	Network problems	1	1.40%	1	100.00%	61	1.40%
Problems of	Stressful	2	2.70%	1	100.00%	64	1.50%
Problems of	Technical problems and lost phones	1	1.40%	1	100.00%	48	1.10%
About the Project	Target group	6	8.10%	1	100.00%	157	3.60%
About the Project	CHWs	2	2.70%	1	100.00%	73	1.70%
About the Project	Software	2	2.70%	1	100.00%	227	5.20%
About the Project	Dimensions of Care	5	6.80%	1	100.00%	238	5.40%
About the Project	Diseases for treatment	2	2.70%	1	100.00%	50	1.10%
About the Project	Availability of drugs and medical equipment	4	5.40%	1	100.00%	584	13.30%
About the Project	Verbal Autopsy	1	1.40%	1	100.00%	334	7.60%
About the Project	Android Phone Usage	1	1.40%	1	100.00%	58	1.30%
About the Project	Intersectoral Collaboration	1	1.40%	1	100.00%	70	1.60%
Benefits of	Ethical	2	2.70%	1	100.00%	218	5.00%
Benefits of	Emotional						
Benefits of	Financial	5	6.80%	1	100.00%	274	6.20%
Benefits of	Reduced congestion in health care facilities	1	1.40%	1	100.00%	31	0.70%
Benefits of	Data Sharing	1	1.40%	1	100.00%	25	0.60%
Accessibility situation of the Millennium Village	Geographical and Roads	1	1.40%	1	100.00%	46	1.00%
Accessibility situation of the Millennium Village	Lack of bigger health care facilities	1	1.40%	1	100.00%	26	0.60%

APPENDIX D: Teleconsultation Encounter Form



Teleconsultation Encounter Form

Demographic Information

FIRST NAME | MIDDLE NAME | FAMILY NAME | HEALTH ID

DOB | AGE | SEX | VILLAGE | NHIS ID

PT REFERRED TO PHYSICIAN? | ENCOUNTER DATE | LOCATION ID

CALLER/PROVIDER | REFERRING PERSON ID

OBSERVATIONS

DIAGNOSES/COMPLAINTS

WEIGHT (KG) | TEMPRETURE (°C)

HEART RATE

BP | RESP. RATE

MEDICATIONS AND SUPPLIES ORDERED DURING TELECONSULTATION

MEDICATIONS/ SUPPLIES	STRENGTH	MEDICATION FORM	AMOUNT DISPENSED

SERVICE ORDERED/ PERFORMED DURING TELECONSULTATION

MEDICAL SERVICES	QUANTITY

PATIENT REFERRED TO HOSPITAL?: Yes ☐ No ☐

REFERRAL PRIORITY

- ☐ Emergency-Ambulance required
- ☐ Emergency
- ☐ Argent
- ☐ When convenient
- ☐ Unknown