

**Review Article**

# Telemedicine Diffusion in a Developing Country: A Case of Ghana

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**To cite this article:**

Femi Ekanoye, Temitope Olokunde, Foluso Ayeni, Carole Mireille Mende, Vekima Nina, Victor Mbarika. Telemedicine Diffusion in a Developing Country: A Case of Ghana. *Science Journal of Public Health*. Vol. 5, No. 5, 2017, pp. 383-387. doi: 10.11648/j.sjph.20170505.14

**Received:** October 20, 2016; **Accepted:** November 19, 2016; **Published:** August 8, 2017

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**Abstract:** Telemedicine allows healthcare professionals to evaluate, diagnose, and treat patients. International telemedicine is detrimental and necessary in order to exchange information through electronic communications to improve and assist in patient healthcare. In this study we examine and assess the telemedicine practice in the developing country of Ghana. Healthcare coverage is an expensive worldwide epidemic and population growth in developing nations continues to remain high. This requires support from national leaders and the citizens who comprise the societies. The slums of Accra, the capital of Ghana are inhabited by low-income earners and migrants. Citizens are unlikely to insure as they move closer to poverty regardless of the risk-aversions they may face regarding illness. Limited benefits of being insured and failure to uphold promised benefits will also negatively affect the Ghana citizens to remain insured as they move to a fight or flight mindset for survival. With support from government leaders, Telemedicine can influence Ghana in a very positive way. With financial support as well as technological support the Health epidemic in Africa can be reduced and better manageable.

**Keywords:** Telemedicine, Ghana, Healthcare Coverage, Health Epidemic, Africa

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## 1. Introduction

Ghana, Africa is a developing country in West Africa. In 1957 Ghana became the first African nation to achieve independence from its colonial ruler. Although Ghana has suffered mixed political and economic fortunes, some see Ghana as a model for North – South cooperation [1]. With a wide area of 238,500 square kilometers and an estimated population of 20 million people it is important to realize the significance of healthcare. The life expectancy in Ghana is 57 years old [1].

Telemedicine is a developing system to better help medical institutions to better use information and technology to treat patients. It is the use of video and informational systems to help doctors and other medical staffs better diagnose and treat patients [2]. Through these information systems doctors can locate articles and information that may have been previously used before to treat patients and use that to quickly and more efficiently treat patients in the future.

Healthcare is a growing issue in Africa, and with the spread of HIV and AIDS on the rise it is necessary to have the tools required to be able to handle the issue of infecting others. Not only is telemedicine useful in treating patients from a distance in can help patients who are in rural areas receive the healthcare or information necessary to be treated accordingly [2]. By using telemedicine and the information provided via telemedicine it can cut down on the amount of hospital space and beds significantly by remotely treating patients.

Komofo Anokye Teaching Hospital is the second largest hospital in Ghana [1]. Built in 1954 it was known as the Kumasi Central Hospital and help only 500 beds. In 1975 it was converted to a teaching hospital and accredited for postgraduate training by the West African College of Surgeries and now holds 1000 beds. Telemedicine will be a huge step in the right direction regarding healthcare in developing third world countries, yet having proper medical supplies and medicines remain a major issue.

## 2. Need for Telemedicine

The need for telemedicine is as necessary as the healthcare itself. Telemedicine can revolutionize healthcare in Ghana by producing a system that can drastically reduce the amount of time needed for patient care. With doctor-patient relationships improved through telemedicine, patients can receive the medical attention they need without having to travel to a major institutions for care. Also, with information systems improved with databases and research, medical staff can easily research and develop more efficient treatments for more dire patients.

The spread of HIV/AIDS can be better assessed with faster diagnoses of patients who contract the disease to help prevent the disease from spreading more with patients being more aware of their status. With an estimated 250,000 people with HIV/AIDS (CIA. gov), it is necessary to be able to access and implement the use of telemedicine. The risk of infection from major infectious diseases like malaria or yellow fever are very high specifically in Ghana Africa.

Telemedicine can influence the way people use the internet as well. According to the CIA World Fact book, only 19.6% of the population in Ghana use the internet. With resources being so limited the use of telemedicine can be a difficult goal to achieve without the financial assistance of the government and other third parties [3].

The need for more efficient healthcare systems is limited and chronically underfunded [3]. Most of the healthcare in Ghana is provided by the government and administered by The Ministry of Health and Ghana Health Services [3]. Although there is shortage of funds to operate these health facilities effectively, Ghana has about 200 hospitals. Some of these hospitals and clinics are for profit but the overall number of these is below 2% [3]. Urban areas have the most amount of health facilities while rural areas are deprived of the healthcare that is necessary for some individuals to survive. Patients in rural areas have to travel long distances to get the patient care that they need and even with the journey being successful, most families and communities lack the funds to receive proper care in these rural communities. To remedy this, telemedicine services are being put in place to reduce the amount of time and money to receive proper healthcare.

## 3. Overview of Telemedicine Infrastructure in Ghana

Ghana's telemedicine adoption rate highly depends on the support of third-party funding and the economic balance of Ghana. There are only seven health centers in Ghana [4]. One of the main obstacles hindering the use of conventional healthcare is the distance between each health center. The journey to these health centers often require 4-wheel drive vehicles in order to safely navigate to each center.

E- health or electronic Health is one of the most rapidly growing areas of technology in Health today, especially in developing countries like Ghana [5]. The use of E-health along with advances in telemedicine will dramatically improve the way patients receive care who may not have

transportation to these health centers.

Ghana shows promise in their efforts to develop Telemedicine and other E-health applications [5]. The Novartis Telemedicine Project is stationed in the Bonasso cluster; this cluster holsters 6 villages and has an estimated population of about 35,000 people. Communities in the cluster are very diverse and separated, most of the villages are separated by miles of unpaved road and challenging terrain making it especially difficult to receive efficient healthcare without having to endure a hazardous journey to one of the seven health centers. This difficulty is furthered by the limited number of health centers, and weather conditions that may make it impossible for some cases to even receive healthcare. Taking into account the several diseases prominent in Ghana such as Malaria, Anemia, Tb, HIV/AIDS, it affects the every health of the patients in the communities. To reduce the danger in traveling and minimize traveling the health centers placed throughout the communities have taken steps to eliminate the risks almost completely.

One of the many steps that have been implemented is the use of teleconsultation. The practice of teleconsultation reduces the time needed and the overall cost of receiving healthcare dramatically [5]. Healthcare can be addressed and delegated to those who need it through protocols developed by Med Gate in Switzerland (NTP); the teleconsultation program is being pioneered to adapt and better utilize the techniques implemented by Med Gate.

The first step in maximizing efficiency in telemedicine was to evaluate and assess the current need for technology. The next step was to identify and enroll medical staff and important health personnel and enroll them into a workshop to develop their skill in telemedicine applications; during this phase of the Novartis Telemedicine Project, healthcare personnel and even doctors attended extensive workshops and were presented with mobile technology and more ways to interact with telecommunication applications as well. The benefit of this was to create a skilled group of doctors and medical staff to successfully practice telemedicine and teleconsultation services to reach patients who do not have transportation to health centers. With the help of the Ghana Ministry of Communications, several telecommunication stations and antenna were installed across the Bonasso Cluster, this in turn created a better range for telecommunication systems and telemedicine applications. The extended range and signal provided increased network accessibility to over 21 communities and all seven health facilities, which is necessary for the successful implementation of telemedicine throughout Ghana.

Through the support of the Novartis Foundation, medical staff were able to procure mobile phones and other telecommunication devices that could be used in the advancement of telemedicine in Ghana. It is clear that telemedicine is successfully being a break through in the advancement of medicine in developing countries. Future endeavors of the Project include providing 24-hour support to teleconsultation centers, development in logistics, human resources and technical advancements, as well as a greater

number of workshops that will be available to staff in order to ensure the proper use of telemedicine applications [6].

The growth of telemedicine has improved dramatically since 2011. According to an online article written by Yomi Kazeem, Ghana could soon surpass South Africa, Ethiopia, and Mali in the construction of Telemedicine [7]. A telemedicine consultation center set up in Amansie West provides around the clock support with experienced medical staff who could provide extensive medical advice over mobile phones and networks. Ghana Health Services reports that 60% of call were maternity-related and 54% of call in 2013 were resolved entirely by phone. During the 3-year phase starting in 2012 the Telecommunication Center in Amansie West only served 30 communities but currently they service the entire district.

#### 4. Cases: Telemedicine and E-Health in Ghana

##### *Case 1 – Telemedicine E-Health*

Prof T C Ankra, a professor of medicine at Komoko Anokye Teaching Hospital in Kumasi, Ghana leads his team to a 16-year-old male patient who could barely speak, due to massive swelling on the left side of his face. The boy had been out of school for 4 months and upon his examination they found a mix of large and small lymphocytes. The treatment for his illness calls for Cyclophosphamide, however the hospital pharmacy where the boy lays has none. Due to the use of electronic health, which is the use of information and communication technology, Physicians were able to use satellite communication and computers to find this diagnosis and treatment. The doctor started a treatment of dexamethasone to help reduce some of the swelling.

The pharmacist sadly told the family that the Cyclophosphamide would not be arriving due to its high cost and irregular demand. He further instructed them to seek private pharmacies in the city to find treatment. Of the two private pharmacies nearby, one does not carry the drug, however the other one does. The family had already spent 100,000 cedi to provide the health care services and secure a hospital bed at the Komoko Anokye Teaching Hospital. The drug costs 35,000 cedi, however due to the multiple treatments the boy needs the total cost will come to a minimum price of 250,000 cedi.

##### *Case 2 – Teleradiology*

With an estimated 250000 citizens whom are Human Immune Deficiency Virus (HIV) positive in the country of Ghana, Africa the need for healthcare and telemedicine is detrimental. Tuberculosis, a potentially serious infectious disease that affects the lungs, is very common among HIV/Aids patients. To ensure proper diagnosis and treatment, radiologic evaluations must be performed. With few radiologists available Ghana has collaborated with UNAIDS Program Coordinating Board to improve this division of healthcare in the country. The World Health Organization (WHO) recommends a ratio of 228 health professionals per

100,000 population. The director of Health Service for Greater Accra region stated the doctor patient ratio was approximately one doctor to 15,259 patients in a year [8]. Lack of radiologic interpretation results in higher patient morbidity and mortality.

Upon the implementation of teleradiology for the Komoko Anokye Teaching hospital from 2012-2013 they were able to use X-Ray images from 158 patients. Eighty-six percent of X-Rays performed were chest radiographs, 7.8% were spine radiographs, and the other 5.8% undocumented. Results of this implementation has changed patient management by reducing the time it takes to diagnose and also helped prevent misdiagnosis. Teleradiology has enhanced patient care by collaborating radiologists. Ghana reduced new HIV infections by 53% from 2001-2014. Ghana and the West African Region has addressed the need for better healthcare for particular populations at higher risk. These gains will help move toward an AIDS-free generation.

##### *Case 3 – Teledermatology*

With low doctor to patient ratios, dermatologists are few to none in Ghana's community. As access to mobile communication increases dermatologists are now able to use the mobile telecommunications infrastructure to provide "mobile teledermatology", which uses mobile devices to provide dermatologic services at a distance rather than face to face consultations [9]. This study evaluated diagnoses made by 3 Ghanaian dermatologist examining patients face to face compared to a Ghanaian teledermatologists using Samsung mobile platform and a U.S. teledermatologist using a computer. 34 patients with skin symptoms were randomly selected from the cities of Accra and Kumasi in Ghana.

As the face to face visits were made images and data were collected with the use of a Samsung mobile telephone and sent to the U.S. and Ghanaian teleconsultants. Through on the phone access to the world-Wide Web-based interface the Ghanaian and U.S. teledermatologists diagnoses were in accordance with the face to face Ghanaian dermatologists. The degree of accuracy comparing face to face visits with the Ghanaian and U.S. teleconsultants were 80%, with eczematous eruptions most common, followed by acne, drug rash, pigmentary alterations, tinea versicolor, and others [9]. Mobile teledermatology is a positive step in the healthcare in Ghana and has helped eliminate costly equipment, providing a cost effective solution.

##### *Case 4 -Teleconsultation*

In Ghana it is extremely difficult to receive healthcare without traveling long distances. Most patients can never make it to a healthcare facility due to the lack of transportation and safe means of delivery to each location. Due to the extreme road conditions and lengthy distances between health centers and communities, patients rarely, if at all, receive healthcare and most likely end up dying or suffering severe illness or disability. Although health centers are placed in highly populated areas, it is the rural areas and communities that need the most help. There are new applications and new means of getting healthcare to these patients as well. The method that is becoming a standard in healthcare in rural areas is teleconsultation.

Teleconsultation is the consultation between doctors and other doctors or doctors and patients on a video link or channel. With teleconsultation the amount of risk involved in receiving healthcare in rural areas can be reduced for the patient. A Teleconsultation service was introduced in the Amansie-West district in 2010 [10] it linked communication between the district hospital and the local teleconsultation clinic. The service was placed there to assess the healthcare professionals' perceptions of the benefits and challenges of servicing this area, and to identify possible areas of improvement [10]. The trial received positive feedback from medical staff and was described as a dramatic improvement to the quality of care, which in turn reduced the need to refer patients to the district hospital. Some problems occurred such as phone service delays, stressful workloads on the telecommunication staff, and inadequate information received from phone calls, but steps have been taken to rectify problems that arose. In conclusion, the teleconsultation service had the potential to greatly improve the quality of care to those who needed it the most. However, problems due to technical difficulties threaten the potential effectiveness of the teleconsultation. Through proper training and maintenance, teleconsultation should be the future of medicine in developing countries.

#### *Case 5 – Telecommunication*

In Ahanta West, Ghana a study was conducted using a SMS tool called Measure SMS. This tool was developed in congruence with Tripod Software LTD to use SMS data transfer using basic mobile phones as opposed to an application to its low cost [11]. It was safe to say that health workers were more likely to own a basic mobile phone as opposed to a smartphone. The SMS tool was used in 34 of the 114 communities in Ahanta West.

Dix Cove District Hospital as well as seven clinics and ten community-based health services are the community's healthcare providers. In May of 2014 a study team visited the communities for three weeks, while community healthcare workers (CHW) reported information on lymphedema and hydrocele cases from their communities. Researchers in collaboration with the study came from the Kumasi Center for collaborative Research, Kwame Nkrumah University of Science and Technology, and Kumasi, Ghana and the National LF Program. The CHWs in Ghana are volunteers with no education requirement, assigned one to each community. The health workers were then trained in six training sessions where they learned how to identify lymphedema and hydrocele, how to classify lymphedema severity by stages of mild, moderate, and severe, as well as basic lymphedema management. Each healthcare worker was required to record details of each case and send as a SMS to a device which Measure SMS app was installed. This method was able to help diagnose and treat patients. There is ongoing investments in mobile network coverage which increase suitability of the tools necessary such as Measure SMS to ensure they reach full potential.

#### *Case 6 – Teleradiology*

At the Korle Bu Teaching Hospital in Accra, Ghana a study was conducted to analyze nephrectomies performed in adults over a twelve-year span. Nephrectomy is the removal of a

kidney and is used for malignant as well as benign lesions. In evaluations of renal pathologies they have used abdominal ultrasound, urography, abdominopelvic computerized tomography (CT) scans and radioisotope renal scans. Over the twelve year study sixty-two nephrectomies were carried out. The average age of the patients were forty-nine plus or minus sixteen years, and the male to female ratio was 1:1. The data was taken and analyzed using a Statistical Package for Social Sciences for Windows operating system version 19. Studies showed that 85% were proven to be malignant, while 14.5% were found to be benign [12].

#### *Case 7 – Telemedicine*

Lassa Fever is an acute viral hemorrhagic illness and is named after the town Lassa in Nigeria where the first case was discovered. Carried by rodents humans become infected through aerosols, direct contact with droppings or urine of infected rodents, or blood or secretions from an infected person. In a particular case a nineteen years old male farmer in the Ashanti Region was overcome with chills and joint pain for three days. The initial laboratory results showed malaria parasites and a diagnosis of severe malaria was made and he was admitted the same day in the general ward with other patients. After two hours upon arrival the patient developed muscle cramps, palpitations, delirium, and bleeding from the nose, ears, mouth and anus [6]. The diagnosis of Viral Hemorrhagic Fever was then given and upon considering referring the patient to either Agroyesum Hospital or Komofu Teaching Hospital the patient died that day. If the availability to doctors and medicine by way for telemedicine were an option a life could have been saved.

Dr. Einterz of the Kolofata district Hospital states that he is the only doctor over the district's 75,000 mostly poor people. He expresses the importance and need of telemedicine but with technology failures it is very difficult. There is ignorance and illiteracy, and unreliable sources of electricity. Several larger villages have electricity however there are prolonged blackouts. When blackouts occur the pump that brings water from the underground source fails and the community must fill buckets from open wells or boreholes. Telemedicine needs to be implemented in these distressed areas to find curative and preventative care. Telephone line connections are scarce along with paved roads and post office access, but the implementation of telemedicine is necessary for the growth of this area.

#### *Case 8 – Prenatal Care*

The practice of genital mutilation continues to go unnoticed and unchallenged in several villages in West African countries. Young women are even forbidden access to prenatal and maternity care. Because of traditional customs women are to remain in the home during the first twelve months of marriage. In this case a young pregnant woman by the name of Deborah Asamoah, who resides in the Ashanti Region of Ghana. Two months into her pregnancy she became ill and nauseas and started vomiting. She visited a clinic where they were able to give her medicine and was able to regain her appetite. Months later upon going into labor Deborah went to the clinic to find the midwife was not

there, only Louisa the community health official. She told Deborah not to worry and she would then deliver the baby. The Novartis Foundation, a telemedicine project in Ghana was provider of this healthcare service and they adopted implemented the use of telemedicine practice. Deborah was in labor for a long time and after the delivery of the baby the bleeding did not stop. Before referring her to a hospital, Louisa was able to call the doctor who diagnosed which drugs needed to be given. The implementation of telemedicine through telecommunications was necessary as there were no ambulances available and the process of finding a vehicle and being able to afford a vehicle were slim to none.

## 5. Conclusion

Telemedicine is the future of healthcare in rural areas as well as urban areas in developing countries. With the support of Government-based programs and third-party funding, telemedicine can successfully make its way to patients in secluded and diverse areas. The Novartis Telemedicine project continues to provide telemedicine applications and workshops to educate and inform medical staff and medical institutions so that telemedicine can be effective and affordable. The extended range provided satellites will service rural areas thoroughly to reduce the need and cost of transportation to medical institutions dramatically.

Through proper training and methods of distributing technology to doctors, Telemedicine will lead the way in cost-efficient, safe, and reliable healthcare for those who cannot afford or have no transportation. Ghana is still developing, with a structured healthcare system being set in motion, telemedicine will influence the way medicine is delivered, especially to rural areas. More patients won't have to attend a district hospital or any other main medical institution because of teleconsultation, and with teleradiology and other applications being set in place, patients may not even have to leave their homes to receive updates on medical records and conditions.

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