

TELEMEDICINE ENDEAVORS IN ETHIOPIA: BENEFITS, CHALLENGES, AND FACTORS

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ABSTRACT

Delivery of healthcare services is a major challenge for governments in most developing countries. Some of these challenges are financial, human resources, as well as the ability to manage and transform scarce resources to meet healthcare needs. Telemedicine is increasingly helping to address these needs in developing nations such as Ethiopia. This study analyzes the potential benefits of telemedicine diffusion in addressing the country's healthcare needs and discusses the obstacles and challenges that exist. Current and past telemedicine projects are explored to understand the state of telemedicine in Ethiopia. Three factors observed through case studies appear instrumental in influencing the diffusion of telemedicine in the region: active participation of higher education institutions, foreign alliances, and government involvement.

INTRODUCTION

In developing countries, health problems like HIV/AIDS and malaria, combined with high population growth rates, have increased the demand for additional health services and for more expensive treatments. Slow economic growth and rising health costs have not adequately kept up with the funding of the health sectors in most developing countries (Editorial, 1995). Information and communication technologies (ICTs) could address some of these healthcare challenges in Ethiopia, one of the world's poorest countries. With the falling costs and increasing capabilities of computers and imaging systems, many developing countries could benefit extensively from the diffusion of telemedicine as a possible step to address the acute medical dilemma of Ethiopia.

Telemedicine refers to health care delivery where physicians examine distant patients using telecommunication technologies. Telemedicine enables medical personnel working in hospitals and clinics to transmit medical laboratory results and patient data, independent of location (Bekele, 1999; Field, 1996). Telemedicine therefore represents "medicine at a distance". In this paper, we examine the current status of telemedicine in Ethiopia by drawing together the disparate threads from various cases in order to identify the important commonalities that reveal salient factors that could impact the diffusion of telemedicine in the country. These commonalities observed from the cases offer insights to information systems researchers on factors that could warrant further research.

Located in Eastern Africa, Ethiopia has an area of 1.11 million square kilometers. The population of Ethiopia is approximately 67 million, consisting of 85% rural inhabitants. According to the Ministry of Health and the U.S. Agency for International Development (USAID), Ethiopia has an estimated HIV adult prevalence rate of 6.7 percent. Currently, the average life expectancy is 41 years old (USAID Ethiopia, 2003). Diseases such as malaria, respiratory infections, diarrhea, and eye problems are becoming increasingly common killers in the region. Compared to other Sub Saharan African countries and the world average, Ethiopia's health indicators are among the lowest. The Infant Mortality Rate (IMR), population growth rate, and Crude Death Rate (CDR) are twice the world average (CIA, 2003). The population pattern is typical of developing countries, with the young age group below the age of 15 years old accounting for nearly half of the population (Bekele, 1999).

Telemedicine seems to offer a potentially viable solution to Ethiopia's serious health problems. Both healthcare providers and patients want rapid, cost effective service. The information systems used in health care must be flexible enough to support constant development. Telemedicine offers important quality-of-life, health, and socio-economic benefits to developing countries to reduce costs and optimize utilization of the healthcare system.

TELEMEDICINE PROJECTS IN ETHIOPIA

Teleradiology: Teleradiology is a means of electronically transmitting radiographic patient images and consultative text from one location to another. Basically, teleradiology attempts to transfer CT scans, MRIs, and X-rays from one location to another (ITU, 1998; UIHC, 2001). In May 2000, a teleradiology project was implemented in the Tigray

region. The region has six hospitals with 640 beds and 18 other health centers with 220 beds, which are all owned and operated by the Ministry of Health (MOH). There are also 142 other small health stations in the region (132 MOH and 8 others) (Ethiopian Ministry of Health, 2003; ITU, 1998). The medical and communications equipment were installed in two regional hospitals in Mekele, the regional capital. The communication is done in two steps: The first connects a doctor traveling from village to village with the regional hospitals, and the second connects the regional hospitals to Black Lion hospital in Addis Ababa. This project was not only successful, but it was the first step in the right direction to effectively implement telemedicine in the country.

Teleophthalmology: Blindness is one of the major health issues in Ethiopia, often associated with poverty, illiteracy, and deprivation. Medical facilities are extremely poor in the villages where 85% of the population lives. Teleophthalmology allows patients to screen for eye diseases at sites other than ophthalmologists' offices, helping to reduce medical costs and improve access to the majority of the rural population in Ethiopia (Spaeth, 2002). The teleophthalmology health care centers are equipped with a complete but low cost ophthalmology system with an ordinary digital camera. Central ophthalmology centers maintain the software and provide technical support and provide a database server for teleophthalmology software. The network of teleophthalmology in Ethiopia, utilizes the existing network of connector colleges and universities, namely Addis Ababa, Gonder, Gimma, Dilla, Alemaya; and the ophthalmology nursing schools of Tigray and Alert, as well as Direedewa, Adama and Menilik II regional hospitals. Furthermore, the network of teleophthalmology centers has been introduced to each regional hospital, nursing training center, and medical university with basic telephone connections (POTS), and is connected to the telemedicine coordinating center (Minilik II hospital) where the data is stored (Tehome, 2002).

Telecardiology: In Ethiopia, over 100,000 children are born with congestive heart disease. 200,000 new cases of various types of heart diseases occur each year, and the country has an estimated 500,000 to 700,000 heart disease patients (Schneider and Bezabih, 2001; WHO, 2003). In Ethiopia, telecardiology is being used with the transfer of a still image or store-and-forward network, and suitable software and communication lines for transmission of still images from the local sites to the central telemedicine-studio at the international health center (Schneider and Bezabih, 2001; Rendina, 2000; Darkins and Cary, 2000). The transmitted images are X-rays, electrocardiography printouts, or images of skin lesions. Specialists at the international health center make diagnoses based on still images and additional written information, work out treatment plans and, if necessary, recommend more diagnostic tests. A physician at the domestic hospital is then able to provide qualified medical care with assistance from a senior specialist in a distance consultation center (Darkins and Cary, 2000; HRSA, 2003; TeleVital, 2003).

HealthNet: HealthNet is a global communication network that links healthcare workers around the world via e-mail (SATELLIFE, 2001). HealthNet Ethiopia was established in 1994 in collaboration with Addis Ababa University Medical School, which hosts the network. Today, there are more than 60 points that are connected all over the country and make use of HealthNet's services (ASIST, 2001; SATELLIFE, 2001). These points cover a wide geographical area and many institutions including hospitals, medical schools, non-profit organizations, clinics, health research centers and individual care health practitioners. The medical school of Addis Ababa University, the Gondar College of Medical Sciences and the Jimma Institute of Health Sciences, which are located in Addis Ababa, the Amhara and Oromo regions, respectively, have a total of more than 4,000 staff workers and students who use HealthNet for research and information needs (ASIST, 2001).

Russian Red Cross Society (RRCS): The RRCS project has two main divisions: One uses a system of mobile ambulance stations to fight tuberculosis, AIDS and malaria by employing specially-equipped trucks with satellite-based communications (TANA, 2001b). The second division deals with consultations on X-ray diagnostics. This project connects medical centers in Russia, Ethiopia, and a number of other medical centers around the world through a telemedicine network. The Red Cross hospital in Addis Ababa is equipped with an X-ray computer tomography along a complete set of telemedical equipment. This system is used to carry out telemedical consultations in order to provide patients with a variety of services particularly in the areas of cardiology, histology, and functional diagnostics. Additionally, this system is used to conduct remote consultations through videoconferencing sessions (TANA, 2001a; TANA, 2001b).

CHALLENGES FOR TELEMEDICINE DIFFUSION

Despite the success of ongoing projects, there are still a number of challenges that have yet to be overcome. The most significant is probably the lack of modern ICT infrastructure, mainly telecommunications. ICT infrastructure development is imperative for telemedicine diffusion. Ethiopia has a relatively reliable telephone network, but with

175,000 telephone lines for a population of over 67 million, Ethiopia's teledensity of 6 lines per 1,000 persons is one of the lowest in the world (Mbarika, 2001). Addis Ababa, the capital city, accounts for about 57.2% of the total installed lines, and other large towns account for the other 32.5%. Ethiopia had Internet access by 1997, when Ethiopian Telecommunication Corporation (ETC) started providing Internet services using a 256 kbps international satellite link. Currently, Ethiopia's Internet services use a 2-Mbps symmetric international link, which does not allow for the efficient transfer of large data or images. A basic private subscription with 8 hours of access costs \$US 19, and \$US 4 for each extra hour (Bekele, 1999; ITU, 1998). These rates are economically prohibitive for the country's health practitioners.

In addition to the current ICT infrastructure, the government's health and ICT policy also has a major impact on telemedicine endeavors in the country. Despite recent improvements the government still needs to do much in addressing the healthcare crisis in the country. The government needs, among others things, to significantly increase its healthcare expenditure, which currently accounts for only 7.5% of the whole GDP. The government has to actively work on international relations to get support and financial assistance from donor countries and international organizations. The recent war with Eritrea had a major impact on the country's healthcare. Funds had to be diverted to war support, which led to the discontinuation of projects that were underway and the cancellation of proposed projects. The war also had an impact on the country's foreign relations.

Other major barriers to the expansion of telemedicine in Ethiopia include the lack of basic infrastructure such as electricity and health centers. Financial constraints to furnishing health stations in remote areas with terminal equipment are a significant obstacle. Lack of knowledge and practical experiences among professionals in the field of telemedicine coupled with lack of awareness among the public about the benefit of telemedicine services hinders its diffusion and growth in the country. In the following section, we will consider the three prominent factors common to all the reviewed case studies that seem to offer potential solutions to some of these barriers.

POTENTIAL FACTORS FOR TELEMEDICINE DIFFUSION

The diffusion of telemedicine can have a strong impact on healthcare services, especially in underdeveloped countries (Edworthy, 2001), as they suffer from inadequate technical infrastructure, knowledge and financial resources. Hence, the potentially salient factors for telemedicine diffusion in developing countries are necessarily fundamental as opposed to those in developed countries (Bekele, 1999). In the Ethiopia's history of telemedicine diffusion, three factors stand out as being potentially instrumental for the diffusion of telemedicine projects in the region: active involvement of higher education institutions, the government's full cooperation, and foreign alliances.

Higher Education Institutions

Educational institutions are a backbone of telemedicine projects worldwide because of their capacities, involvement in teaching and research, and dedication to new technology (Bloch, 2003). The diffusion of telemedicine projects should start on a small scale. This will encourage government and donor investment, enabling the building of local capacity (ITU, 1996). In the USA and Europe, most telemedicine projects began with the collaboration of a higher education institution, usually as a pilot project (Bloch, 2003). They continued with the ongoing evaluation of the project through data collection, and observation and comparison of achievements with objectives (Bloch, 2003; Liska and Haile, 1998). Eventually, after gaining some experience, they escalated to full-scale diffusion. From such experiences, we see that higher education institutions should be encouraged to undertake telemedicine initiatives.

In Ethiopia, higher education institutions such as Addis Ababa University play an important part in capacity building and human resource development for telemedicine endeavors. The potential factors for telemedicine diffusion depends not so much on the performance of different tools, as on the acceptance of the medical science community. The majority of the medical community of Addis Ababa University understands the need of ICT to enhance and optimize existing human resources. There is also a broad recognition of telemedicine in university communities across the country. This understanding has been achieved, through among others the experiences of HealthNet network and several other workshops on ICT.

Government's Cooperation

Most telemedicine projects involve institutions from various sectors at the national and international level. Telecommunication services, electricity and other major infrastructures of most developing countries are owned and

operated by government monopolies. Therefore, the governments of these countries play a major role in facilitating necessary conditions for telemedicine diffusion. The governments are working to integrate telemedicine services into the overall health infrastructure to ensure that a certain degree of balance is achieved between urban and rural access (Bloch, 2003). In addition, they are responsible for developing clear policies regarding licensing, liability, confidentiality and practitioner responsibility. For example, such policies will regulate the activities and increase the cooperation of all the stakeholders in the public and private sectors. Lastly, they must provide funds—or acquire them from other sources—for the diffusion of telemedicine (Gurbaxani et al., 1990; ITU, 2000; ITU, 2001).

The Ethiopian government has recognized the need to strengthen national capacities to address ICT for the health sector. The government has worked on policy and strategy, capacity building, and education in the health sector (IPD, 2001). All concerned stakeholders—universities, the telecommunication authority, the Ministry of Health, and other institutions and policy makers—have committed themselves to supporting telemedicine diffusion. The use of government-owned and -controlled healthcare institutions and ICT infrastructure requires the permission and cooperation of concerned authorities. Such cooperation then facilitates the diffusion of telemedicine projects as part of the overall healthcare infrastructure, rather than merely an auxiliary service added to existing components.

Foreign Alliances with Ethiopia

Telemedicine is globally popular with practices reported from many countries over the past 10 years. Lessons from the USA, Europe, and Australia show that there are indeed standard practices for telemedicine diffusion. Developing countries should seek advice from more experienced institutions in other countries at all stages of telemedicine projects. Telemedicine is experiencing growth in becoming a significant domain of international cooperation, with several institutions contributing funds and expertise. Through foreign alliances, projects in developing countries can receive help in formulating policies and implementing strategies, creating government awareness, obtaining financial and technical assistance, and facilitating links and relationships between national and research institutions abroad (Mous, 1996; Heeks, 1999; UNECA, 2002).

Most telemedicine projects require qualified human resources, funds and reliable infrastructure that are often too expensive for governments or local agencies of countries like Ethiopia to implement without outside assistance. This has been evidenced in past and current telemedicine endeavors in Ethiopia. Almost all telemedicine projects were conducted with a significant contribution from foreign institutions. In addition to providing financial and technical help, international institutions such as the United Nation (UN), the International Monetary Fund (IMF), and the World Bank have close links to top government officials and could be very influential in advocating the need for telemedicine and encouraging them in drafting policies (UNECA, 2002; NICI, 2003).

CONCLUSION

This study has a number of implications for research and practice of telemedicine in developing countries, and particularly in Ethiopia. Concerning research, more focused case studies would be helpful for insight on important factors that could influence the diffusion adoption and diffusion of telemedicine within the Ethiopian context. These could be longitudinal multi-method analyses of single projects or cross-comparisons of multiple projects within the country. Findings from such research could eventually be carried over to other developing countries, with similar socio economic statuses. This study could also help the Ethiopian government as it develops national ICT policies that are specific to telemedicine diffusion. Besides implications for the government, potential multinational companies, involved in telemedicine and other ICT projects could gain a better understanding of the current status of telemedicine in Ethiopia. This is important as they make major decisions about investing in the region.

Of course, telemedicine alone is not sufficient to solve Ethiopia's health crisis. However, as information systems researchers use more robust research approaches to examine telemedicine diffusion in Ethiopia or other developing countries, policy makers and other telemedicine stakeholders within these regions will be provided prescriptive directions that would benefit the health sector as a step towards sustainable socio-economic development of human life of this oft-neglected region of the world.

Please contact the authors for the list of references.