

# Chapter 3

## Envisioning a National e–Medicine Network Architecture in a Developing Country: A Case Study

**Fikreyohannes Lemma**

*Addis Ababa University, Ethiopia*

**Mieso K. Denko**

*University of Guelph, Canada*

**Joseph K. Tan**

*Wayne State University, USA*

**Samuel Kinde Kassegne**

*San Diego State University, USA*

### **ABSTRACT**

*Poor infrastructures in developing countries such as Ethiopia and much of Sub-Saharan Africa have caused these nations to suffer from lack of efficient and effective delivery of basic and extended medical and healthcare services. Often, such limitation is further accompanied by low patient-doctor ratios, resulting in unwarranted rationing of services. Apparently, e-medicine awareness among both governmental policy makers and private health professionals is motivating the gradual adoption of technological innovations in these countries. It is argued, however, that there still is a gap between current e-medicine efforts in developing countries and the existing connectivity infrastructure leading to faulty, inefficient and expensive designs. The particular case of Ethiopia, one such developing country where e-medicine continues to carry significant promises, is investigated and reported in this article.*

## **INTRODUCTION**

Healthcare consumers in general tend to seek access to affordable health services that will meet their needs. From an ethical standpoint, healthcare has to be available when and where consumers need it; physical separation between consumers and healthcare facilities must not pose severe limitations on the delivery of efficient healthcare, even if patients are located in remote areas. In this sense, information and communications technology (ICT) has been demonstrated to offer a competitive choice for accessing affordable and effective health services, especially when access is difficult and limited (Horsch & Balbach, 1999; Kirigia, Seddoh, Gatwiri, Muthuri, & Seddoh, 2005; Tan, Kifle, Mbarika, & Okoli, 2005). More recently, with the continued maturity of network such as Integrated Services Digital Network (ISDN) and Asynchronous Transfer Mode (ATM) networks and related technologies (Perednia & Allen, 1995; Tan, 2001), e-medicine implementation has entered a stage where both the health providers and consumers can now benefit significantly.

IT-based horizontal and vertical communications among the healthcare facilities within the organizational structure of the healthcare system are essential. Such communications facilitate efficient information exchange and help the delivery of essential health services to underserved rural areas. These communications can be supported through a nationwide e-medicine network that is based on affordable telecommunications infrastructure. The network should connect all regional clinics to urban area hospitals. The benefits of such a network include: (a) establishing reliable horizontal-vertical communications and information sharing among facilities, thereby driving up quality, improving efficiency, and enhancing cost-effectiveness of services; (b) achieving e-health commitments and bringing healthcare closer to underserved and un-served rural areas; (c) strengthening collaboration among hospitals

within a multi-provider care management context; (d) minimizing long distance travels among rural people in need of proper medical care to urban areas or the capital city; and (e) providing medical information to clinical practitioners that will help them keep abreast of clinical breakthroughs as well as new technological advances.

For Ethiopia, a lesser developing country with significant challenges in meeting basic healthcare needs, it is argued that e-medicine development is emerging and can be fruitfully cultivated over the coming years if a vision and long-term strategy for this technology can be used to help increase the number of citizens receiving care and decrease the subsequent healthcare costs. This article lays out such a vision and strategy for a nationwide e-medicine infrastructure to be designed. It is organized as follows. First, the background and various design considerations for a nationwide e-medicine network is presented. Next is an overview of the requirements for the network design followed by a more in-depth description of the local and wide area network (LAN/WAN) architecture envisioned. The focus of the discussion will then shift to the existing Broadband Multimedia Network (BMN) and Very Small Aperture Terminal (VSAT) infrastructures and how these networks may be integrated into the nationwide e-medicine infrastructure. Finally, the article concludes with insights into potential future work in e-medicine for developing countries.

## **E-MEDICINE NETWORK DESIGN CONSIDERATIONS**

E-medicine refers to the electronic delivery of healthcare and sharing of medical knowledge over a distance employing ICT. A national e-medicine network allows sharing and exchanging of clinical data among physicians, administrators, even patients or other participating health professionals regardless of physical distance separation or geographical terrain of the whereabouts of these

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