Chapter 23
Mobile Application for Ebola Virus Disease Diagnosis (EbolaDiag)

Kwetishe Joro Danjuma
Modibbo Adama University of Technology Yola, Nigeria

Solomon Sunday Oyelere
University of Eastern Finland, Finland

Elisha Sunday Oyelere
Obafemi Awolowo University, Nigeria

Teemu H. Laine
Luleå University of Technology, Sweden

ABSTRACT

This chapter describes how the Ebola virus is considered extremely infectious with a series of physical and psychological traumas on the victims. Common clinical signs associated with the disease include a sudden fever, severe headaches, muscle pain, fatigue, diarrhea, vomiting, and unexplained hemorrhages. In Africa, with strained medical facilities and remote localities, prompt identification and diagnosis of the symptoms of Ebola in a suspected patient are important to the control of the epidemic and in curtailing further spread. This chapter presents the development of an Android mobile application called EbolaDiag (Ebola Diagnosis), which is capable of supporting the diagnosis, screening, and healthcare experts working on the frontline in contact tracing and monitoring of the spread of Ebola. Furthermore, EbolaDiag is suitable for aiding the strained medical facilities in endemic areas. In addressing this gap, the application provided a model for implementing such solutions in pandemic environments. Such a solution becomes more relevant and useful to combat Ebola and several other diseases in similar environments.

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INTRODUCTION

Ebola virus disease (EVD) outbreak in West Africa in 2014, was the largest and most complex Ebola outbreak (Wong & Kobinger, 2015) since it was first discovered in 1976, in terms of geographical spread, number of cases and deaths recorded as well as the proportion of healthcare workers infected (Dahiya & Kakkar, 2016). The epidemic started in Guinea and spread to Sierra Leone, Liberia, Nigeria, Senegal, and Mali (Cenciarelli, et al., 2015; Dhama, Malik, Malik, & Singh, 2015), and was imported into North America, and Europe (Baden, et al., 2014; Roca, Afolabi, Saidu, & Kampmann, 2015).

EVD is a thread-like non-segmented, negative-sense, and single-stranded ribonucleic acid (RNA) virus that belongs to the Filoviridae family (Roca, Afolabi, Saidu, & Kampmann, 2015). Filoviridae is the deadliest pathogens known to both humans and nonhuman primates (NPHs) (Wong & Kobinger, 2015). It is made of the Ebola virus (Zaire ebolavirus), Sudan ebolavirus, Tai-forest ebolavirus (Cote d'Ivoire ebolavirus), Bundibugyo virus and Reston ebolavirus (Beeching, Fenech, & Houlihan, 2014; Kuhn, et al., 2010; MacNeil, et al., 2011).

It causes haemorrhage, uncontrolled virus replication, multiple organs dysfunctions, intravascular coagulation, and shock-like syndrome (Bird, et al., 2016; Feldmann & Geisbert, 2011; Paessler & Walker, 2012). However, prevention and core containment have been established as the most effective response to EVD infection (Krause, et al., 2015). Core containment measure involves effective case management, active surveillance and contact tracing, communication and social mobilization, early detection and timely response (Tom-Aba, et al., 2015).

In order to address these needs, mHealth have demonstrated efficacy in addressing access, coverage, and equity gaps in healthcare management in developing and resource-poor country (Beratarrechea, et al., 2014). The application of mobile phones and the use of innovative health applications in tackling health challenges gave prominence to what is known as mobile health (mHealth) (Bholah & Beharee, 2016). The term was first coined and defined to mean, "emerging mobile communications and network technologies for healthcare" (Istepanian, Laxminarayan, & Pattichis, 2006). During the 2009 mHealth Summit, mHealth was redefined by the Foundation for the National Institutes of Health (FNIH) to mean "the delivery of healthcare services via mobile communicational devices" (Torgan, 2009). It has further been defined by the Global Observatory for e-health of the World Health Organization (WHO) as the "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices" (Kay, Santos, & Takane, 2011).

mHealth holds potentials to transform and alleviate disease management burden on healthcare systems especially in a resource-poor and overstretched healthcare systems. The Mobile health has the capacity to improve and enhance access to healthcare, engagement and delivery and improves the expected outcome of the healthcare system (Heerden, Tomlinson, & Swartz, 2012). It utilizes short messaging service (SMS), wireless data transmission, voice calling, and smartphone applications to transmit healthcare informatics (Betjeman, Soghoian, & Foran, 2013). Mobile phone enables the rapid collection, transmission, storage and transformation of data with a specific focus on monitoring and evaluation of healthcare systems, and support two-way communication between individuals and large groups, for instance using instant messaging (Leon, Schneider, & Daviaud, 2012).

The mobile phone can benefit the patient and the healthcare providers through the frequent delivery of reminders on disease monitoring and management, education and training using both mobile voice and short message service (SMS) intervention (Krishna, Boren, & Balas, 2009). It further empowers the physician to; (a) respond more promptly to reading test results, (b) reduce errors in medication prescrip-