Chapter 3
Towards Building Internet-of-Things-Inclusive Healthcare for Neglected Tropical Diseases

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ABSTRACT

This work presents a comprehensive review of e-health and d-health systems and the individual components used in each. It presents information and communication technologies to detect, control, and manage NTDs, highlighting their features and functionalities. The chapter highlights some biosensors explicitly developed to diagnose NTDs, paving the way for an internet of things-inclusive e-health system for NTDs. This chapter proposes an internet of things-inclusive e-health model for NTDs offering special services to NTD-affected people besides other fundamental e-health services for a smarter medical environment for patients. The model shall be useful to implement an internet of things-inclusive e-health system including applications and mobile Apps. The e-health system, including app and the application, shall be useful to NTD-affected people, volunteers, attendants, doctors, and researchers. It shall also benefit governments, policymakers, social activists, and other stakeholders to build an e-health vision, action plan, and monitoring framework.

INTRODUCTION

Neglected Tropical Diseases (NTD) (WHO-NTD, n.d.) are a diverse group of infectious diseases that prevail in tropical and subtropical conditions in 149 countries, including India. Populations living in poverty, without adequate sanitation and in close contact with contagious vectors, domestic animals, and livestock are those worst affected. As per World Health Organization (WHO, n.d.), these diseases include

Leprosy, Dengue, Rabies, Trachoma, Buruli ulcer, Yaws, Chagas disease, African human trypanosomiasis (sleeping sickness), Leishmaniases, Taeniasis and neurocysticercosis, Dracunculiasis (guinea-worm disease), Echinococcosis, Foodborne trematodes, Lymphatic filariasis, Onchocerciasis (river blindness), Schistosomiasis. Soil-transmitted helminthiases, and Mycetoma. Out of 7.44 billion cases of these diseases reported globally, 18% of cases have been found in India (Hotez and Damania, 2018). Although India has been committed to multidrug therapy for leprosy for years, the highest percentage of new and prevalent cases (WHO-NTD, n.d.) and (IHME, n.d.) have been reported in India. WHO estimates that out of 214,783 new leprosy cases and 171,948 prevalent cases, 63% and 51%, respectively, are from India. IHME estimates that out of 523,245 reported cases of leprosy, 32% are from India.

Innovations in Information and Communication Technology (ICT) promise to increase productivity, reduce poverty, improve living standards, boost economic growth, and provide social, environmental and civic benefits. The increasing applications of ICT in all spheres of human activities with promises for human, social and economic development has urged Information and Communication Technology for Development (ICT4D) researchers and policy-makers to understand the role of ICT in development by examining a diverse range of topics, ICT solutions and technological implementation, their settings, changes made in different forms of capitals, roles of stakeholders, their adaptions in communities, etc. Human development has been characterized by various factors, including living a long and healthy life, a better standard of living, and per capita income (Yakunina and Bychleov, 2015). A recent study (Biggeri and Mavro, 2018) suggests that ICT influences economic growth and human development in developed and developing countries. Research works (Mishra and Nathan, 2014) and (Asongu, 2018) have argued that human development and technological advances are essential components of economic growth instead of income. A high relevance in the neoclassical growth model (Solow, 1965) suggesting long-run economic growth depends on external factors, including technological development and population growth, when applied to ICT4D, has also been reported (Hong et al., 2016; Donou-Adonson, 2018).

While most of the eHealth Applications and Apps offer all benefits of electronic governance and some take advantage of the recent innovation in ICT, the Internet of Things to provide real-time monitoring via connected devices, end-to-end connectivity through various means, data assortment and analysis, tracking and alerts, remote medical assistance, rehabilitation, etc. The Internet of Things holds significant promise for delivering social and economic benefits in healthcare, sustainable agriculture, water quality, industrialization, and environmental management.

This paper, after a thorough review and examination of the use of ICT in healthcare, a study of technologies involved in eHealth systems, transformation to the d-Health system, biosensors and use of the Internet of Things in healthcare, suggests that recent and innovative developments in Information and Communication Technology particularly Internet of things, sensors and wearables, artificial intelligence and cloud computing can further extend the service and quality of healthcare while reducing the cost and contribute towards economic, social, civil, environmental and human development. It also suggests an Internet of Things inclusive eHealth model for NDTs, inviting ICT4D researchers, policy-makers, and practitioners to adopt this model as a guiding framework.

E-Health system can offer diverse advantages and can be more effective in reducing the burden of NTD as it can be used for early detection of new cases, reduce the prevalence of the disease, improve social inclusion and participation of NTD-affected people, improve the management of acute and chronic complications, promote self-care activities and rehabilitation, reduce the psychological and social sufferings, and allow people to fight stigma and discrimination. Besides, e-Health shall permit to sustain expertise after integration of some NDT services such as leprosy services at the primary level, which is

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