

mHealth: A Sustainable Healthcare Model for Developing World

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Abstract Health is a basic requirement to improve the quality of life. Providing effective health care is an essential component towards the social and economic development of a country. A large number of people in the developing countries, particularly in rural and remote areas, remained with no or little access to health care facilities. However, recent emergence of mobile communication technologies could play in improving healthcare services. There is a great potential in using mHealth as one of the supportive systems within the healthcare sector to solve the inequalities in healthcare delivery between rural and urban hospitals. This research aims to evaluate the potentialities, issues and challenges of developing mobile healthcare system in the developing world. We have proposed a potential mHealth model based on mobile telecommunication networks. This research offers a set of guidelines to aid the implementation of a successful mobile healthcare system.

Keywords: healthcare, mHealth, e-Health, mobile telecommunication

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1. Introduction

Health care is one of the most important dependencies for economic sustainability and growth of a country. The national economic and social development depends on the state of health. Bangladesh as well as other developing countries are facing the challenges of quality healthcare. The emergence of smart mobile phones have created an unprecedented opportunity to provide healthcare services to unprivileged people in an instantaneous, interactive and customized way. Mobile health, popularly known as mHealth is transforming healthcare delivery by making it more accessible, affordable and available [1]. The use of mobile devices has significantly improved information access, enhanced workflow, and promoted evidence-based practice to make informed and effective decisions directly at the point of care [2]. mHealth has already been deployed for remote collection of various health data, remote monitoring, and improved living standards of patients using mobile devices [3].

The term mHealth, a subset of eHealth or electronic health was coined by Robert Istepanian as use of "emerging mobile communications and network technologies for healthcare" [4]. A definition used at the 2010 mHealth Summit of the Foundation for the National Institutes of Health (FNIH) was "the delivery of healthcare services via mobile communication devices such as mobile phones, smart phones, PDAs, laptops and tablet PCs" [5].

According to a World Health Organization (WHO) report [6], higher-income countries show more mHealth activity than do lower-income countries. Countries in the European Region are currently the most active and those in the African Region the least active. The WHO notes an extreme deficit within the global healthcare workforce. According to WHO, 57 countries have critical shortages in health care workers, with a total deficit of 2.4 million health professionals worldwide. The study finds an average density of physicians, nurses and midwives per 1000 population of 0.64 in twelve countries of Africa. The density of the same metric is four times as high in the United States, at 2.6.

mHealth has emerged in recent years as largely an application for developing countries, stemming from the rapid rise of mobile phone penetration. Because of the size, portability, low power consumption and ability to operate with limited infrastructure, mobile phones are better platforms to provide health services in the developing countries. In this context, mHealth largely emerges as a means of providing greater access to larger segments of a population in developing countries, as well as improving the capacity of health systems in such countries to provide quality healthcare [7,8,9].

2. mHealth Classifications

mHealth systems can be classified according to the characteristics of the source and destination of the medical information flow [10]:

- Patient to medical supervisor
- Patient to physician
- Physician to physician
- Physician to expert system
- Patient to medical system (management of patients).

Depending on the target group, mHealth systems can be classified as follows:

- mHealth for hospital patients
- mHealth for healthy people (preventive mHealth)
- mHealth for the chronically ill or vulnerable individuals.

3. Emerging Areas of mHealth

The emerging areas of mHealth applications include [11]:

- Emergency response systems (e.g., road traffic accidents, emergency obstetric care)
- Human resources coordination, management, and supervision
- Telemedicine diagnostic and decision support to remote clinicians
- Pharmaceutical Supply Chain Integrity & Patient Safety Systems
- Clinical care and remote patient monitoring
- Health extension services
- Health services monitoring and reporting
- Health-related m-Learning for the general public
- Training and continuing professional development for health care workers
- Health promotion and community mobilization
- Support of long-term conditions, for example in diabetes self-management

A report of the UN Foundation and Vodafone Foundation presents seven application categories within the mHealth field [12]:

- Education and awareness
- Helpline
- Diagnostic and treatment support
- Communication and training for healthcare workers
- Disease and epidemic outbreak tracking
- Remote monitoring
- Remote data collection

4. Potentiality of mHealth in Developing Countries

Health services are often inadequate in developing countries because they are neither accessible nor affordable and when they are accessible, they are often dysfunctional, low in quality, and unresponsive to the

needs of clients [13]. Many developing countries like Bangladesh can't provide minimal health service to their people due to insufficient number of doctors, health care professionals and medical services. Although there are many clinics and hospitals are found in the rural and suburban areas but they are often ill-equipped. The inadequate infrastructure makes it more difficult to provide health care in rural and remote areas at the right time. If traveling cost of a patient to visit a medical specialist is higher than the cost of providing mobile consultation (m-consultation), then mHealth might be an economically viable solution. Table 1 outlines the dire situation of primary health care in developing countries in comparison with developed countries [14].

Within this context, mHealth has emerged as a viable solution to serve the pressing healthcare needs through its high reach and low cost mechanism by making health care more accessible, affordable and effective across the developing world. For many years, the mobile phone was not considered powerful tool to reduce the digital divide in health, but the dramatic penetration rate of mobile phones in the low and middle income countries over the last decade has increased the potential of mHealth services [15]. Cellular Phone has revolutionized the telecommunication infrastructure all over the world. Figure 1 shows the mobile telecommunication status in the world. Mobile phone penetration rates stand at 96% globally; 128% in developed countries; and 89% in developing countries [16].

Developing countries need to drive the development of mHealth to improve healthcare delivery systems in their countries. Bangladesh and other developing countries has the opportunity to use mobile telecommunication in a more integrated way in the healthcare sector to improve the quality, safety and efficiency in delivering healthcare services to the people.

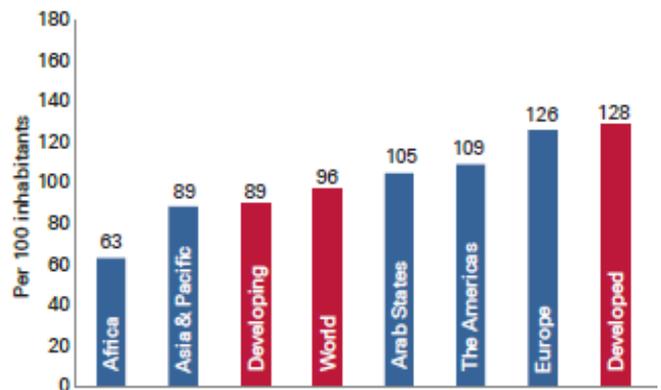


Figure 1. Mobile telecommunication status in the world

Table 1. Healthcare indicators in developed and developing countries

Countries	Infant Mortality rate (per 1000)	Maternal Mortality (per100000)	Years of life lost due to communicable disease (%)	Births attended by skilled health personnel (%)	Hospital beds (per 10000)	Total Health workers (per 10000)
USA	5	8	10	100	32	125
UK	7	11	9	99	39	75
India	57	450	58	47	9	14
Mexico	22	63	27	83	11	28
Pakistan	78	320	70	54	12	12
Bangladesh	52	570	60	20	3	5

5. A Patient-centric mHealth Model

Figure 2 shows a patient-centric mHealth model sustainable for both urban and rural people of the developing countries since mobile phones have got the tremendous popularity and become the most usable communication tool in the developing world. The model has incorporated different stack holders of health care services.

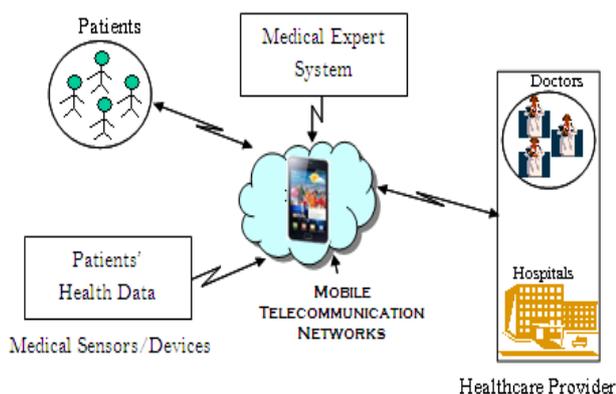


Figure 2. A patient-centric mHealth Model

6. Challenges of Developing mHealth in the Developing Countries

Bangladesh as well as other developing countries are facing various obstacles to the promotion and implementation of mHealth. This study has identified some major threats and challenges for developing mHealth in the developing world which include:

- Poor ICT infrastructure
- Lack of appropriate IT policy
- Lack of awareness of both government and citizens
- Inadequate human resource capacity
- Non-acceptability of IT systems
- Lack of coordination
- Low level of IT literacy
- Lack of IT training
- High-cost, lower liability of Internet access
- Lack of education
- Hassle in getting required service
- Lack of information

7. Recommendations

Quality health service is critical for the poor people to access in developing countries. To cope with the issues and challenges, the rural poor in the developing world draw on indigenous knowledge and innovate through local experimentation and adaptation. The use of mobile communication technologies in health services can reduce the primary gap in health related needs that exist in daily life. In this context, functional quality of health information, affordable cost, availability of services, communication infrastructure, and easy to use information

can play a predominant role in developing user perceived health care system. Technical awareness, network dynamism, service effectiveness and data delivery mechanism should be emphasized for raising user satisfaction. This study intends to recommend that the following policy initiatives are important conditions and facilitators for successful implementation of mHealth in the developing countries:

- Facilities should be built to mHealth services both in urban and rural areas. In this regard, steps can be taken for enhancing the country's technical setup with modern technology. Government as well as donor agencies, non-government organizations and other development partners of the country should participate in building up the necessary capacity in this area.
- Doctors, nurses, health professionals and health service providers are the most vital resources in promoting mHealth services to the door steps of the people. Since there is an acute shortage of qualified doctors and health professionals, short-term intensive training may be arranged.
- Modern and effective mobile telecommunication networks need to be built to support mHealth services.
- Everyone should have access to mobile communication, not just those who are literate and economically privileged. Special attention should be given to the needs of the disadvantaged and remote village people.
- Everyone should be encouraged and enabled to cope with mHealth services.
- Mobile telecommunication operators should be encouraged through providing governmental support and financial packages so that they could reduce the communication access cost for the user especially for the rural people.
- An integrated flexible and reliable nation-wide mobile communication system capable of voice, audio, video, data and graphics transmission should be ensured. National Information Infrastructure should be developed and it should be connected to Global Information Infrastructure through an information superhighway to create, collect and provide mHealth services to the world market.

8. Conclusion

The developing countries are facing the challenges of quality healthcare. mHealth can be considered as one of the potential and supportive systems within healthcare sectors in the developing countries to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by healthcare organizations, practitioners, patients, and consumers in an effort to cheer up the health status of patients and to face the emergency situations in some cases. This research evaluates the potentialities, issues and challenges for implementation of mobile healthcare system in the developing countries. This research proposes a patient centric mHealth framework for healthcare management in the developing world. This study has suggested some recommendations useful for developing a successful mHealth system. The proposed

mHealth model could assist to deliver quality healthcare services, management of serious diseases and face the emergency situations of critical patients.

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