

by Francis Pereira, Ph.D. and Elizabeth Fife, Ph.D.

The Promise of m-Health

Untangling the issues in US, Africa and Asia



Globally, the health care industry has been facing substantial and ever-increasing cost pressures. Annual health care expenditures in the United States alone totalled some USD2.6 trillion dollars at the end of 2010, a figure that is expected to double in the next five years. Given that early detection and preventive care are seen as solutions to escalating costs of medical care, mobile health (mHealth) specifically, and its larger context, tele-health, may be the way forward.

While mHealth is relatively recent, telemedicine has existed since the 1920s. Tele-medicine is generally defined as "the use of telecommunications and computer technologies with medical expertise to facilitate health care delivery". Through remote sensing, collaborative patient care and access to electronic libraries and medical databases telemedicine, now often referred to as "tele-health" has held the potential to bring better and more extensive health care, lower medical costs, and increase medical productivity. mHealth is a subset of tele-health and usually refers to the use of mobile and remote sensor technologies in delivery of health care.

More importantly, in developing countries, mHealth and tele-health are viewed as a means to overcome the substantial obstacles to the delivery of health services to the poor that include the shortage of health workers and overall inadequate public health infrastructures.

At present, 57 countries face critical shortages of health workers, with estimates ranging from a global deficit of 2.4 million to over 4 million doctors, nurses, and midwives.

While the value proposition of mHealth and tele-health is high, as we show in this paper, the low adoption rate argues for the existence of significant obstacles, across multiple dimensions.

The patient value-proposition

North America

Experience over the past 40 years suggests that tele-health is most useful when physical barriers, such as geography, distance terrain, and climate make transportation and/or direct contact between patient and clinician difficult.¹ Savings could be generated from reduced costs for serving patients, through the management of chronic diseases and savings in time and travel for doctors and patients. Cost reductions from early diagnosis and increased monitoring are also possible.

mHealth and tele-homecare applications can provide management for chronic diseases, such as Diabetes Mellitus, Hypertension, Chronic Obstructive Pulmonary Disease (COPD) and heart disease. For example, COPD is an important cause of hospitalization for the aged population in the US. Approxi-

mately 65% of the 638,000 hospital discharges annually were in the 65 years and older population.²

It is estimated that one in five Americans will develop Congestive Heart Failure (CHF), and outcomes related to heart failure still remain relatively poor.³ For CHF patients, appropriate disease management is critical. CHF is the leading cause of hospital admission for people over 65 years in the US, with a re-admission rate of 44% within a six-month period. Treating high risk heart failure patients is estimated to account for some 1% to 2% of the total heart care budget in the US and Europe. Studies show that tele-monitoring has led to a 26% reduction in the number of days patients stayed in hospitals. Survival rates also improved.⁴ Table 1 further illustrates the potential costs-savings from adopting various home-care e-health applications for monitoring.⁵ Epidemiologic transitions are accelerating in such a way that developing countries are now beginning to bear the burden of chronic diseases like COPD along endemic infectious diseases.⁶

Yet, specific utilization of the mobile phone in tele-health remains very much in the early adopter stage.^{7,8} One key area is follow-up care.^{9,10} Rural healthcare development is also an area of interest. While the doctor-patient ratio is typically low, many rural communities are within range of a cell phone tower.¹¹ Doctor-patient communication is one of the earliest areas of application

Table 1

COST OF INPATIENT CARE (PER PATIENT PER MONTH) COMPARED TO HOME CARE FOR SELECT CONDITIONS			
Conditions	Hospital costs (USD)	Home care costs (USD)	USD savings
Low birth weight	26190	330	25860
Ventilator-dependent adults	21570	7050	14520
Oxygen-dependent children	12090	5250	6840
Chemotherapy for children with cancer	68870	55950	13920
Congestive heart failure in the elderly	1758	1605	153
Intravenous antibiotic therapy for cellulitis, Osteomyelitis, others	12510	4650	7860

and midwife personnel per 10,000 people in high income regions of the world, there are only 5 doctors and 11 nurses and midwifery personnel per 10,000 people in low income regions. These resource shortages are compounded by the burden of global diseases, which disproportionately falls on the developing world. As globalization brings the challenges of obesity, diabetes, and hypertension into emerging market economies, health challenges only continue to grow.¹⁶

More than 100 countries are now exploring the use of mobile phones for health. In Ghana nurse-midwives use mobile phones to discuss complex cases with colleagues and supervisors. Similarly, Rwanda uses a system of rapid SMS alerts, through which community health workers inform health centers about emergency obstetric cases.⁶ Figure 2 illustrates other initiatives in developing countries.

Poor women and children often have very low access to quality health services due lack of physical access to health facilities, poorly trained health providers, and cultural factors that limit health care accessibility.¹⁷

Challenges to adoption

Patient interface issues

Patient use of a service is heavily predicated on the user interface experience, namely simplicity and convenience. The small-scale clinical trials that have been carried out have found that “extreme” simplicity is needed in the home environment given that users may have recently been released from the hospital, may have vision problems or other impairments among other issues.¹⁸ Figure 3, below, reiterates that ease of use is a key requirement.¹⁶ Tele-health’s value appears high; even non-technically-oriented individuals are interested in learning how to use services if they preserve independence.¹⁹

of the mobile phone in tele-health, and concrete statistical results have been obtained. SMS text messaging has been utilized as an appointment reminder system which has seen success in countries such as New Zealand and the Philippines.^{11,12}

From a patient’s perspective, several studies also suggest general satisfaction with tele-health and tele-home health services, even among older adults, particularly for CHF, COPD and chronic wound care, with satisfaction levels increasing with increased levels of tele-health care intervention.¹³

A recent random survey of over 5,000 respondents in North America illustrates consumer interest in using wireless technologies as well as the terrestrial Internet to better manage their health care needs. This is shown in Figure 1a and 1b.¹⁴

Respondents' views

Developing Countries

The potential of mHealth and tele-health in developing countries to alleviate some of their medical requirements is significant given that:

- » 70% of all mobile phone users are in emerging markets; currently the fastest growing markets
- » Almost 90% of the world’s population lives in areas with mobile phone coverage
- » By 2012, half of all individuals in remote areas of the world will have mobile phones.¹⁵

Health care in many developing countries remains constrained by high financial and human resource costs, coupled with lengthy implementation and training times. While there are 28 doctors and 87 nurses

Figure 1a

Respondents' views on usefulness of various digital home health services (Source: F. Pereira, Digital Home Survey, 2008-2011, Institute for Communications Technology Management, University of Southern California, Los Angeles, 2011)

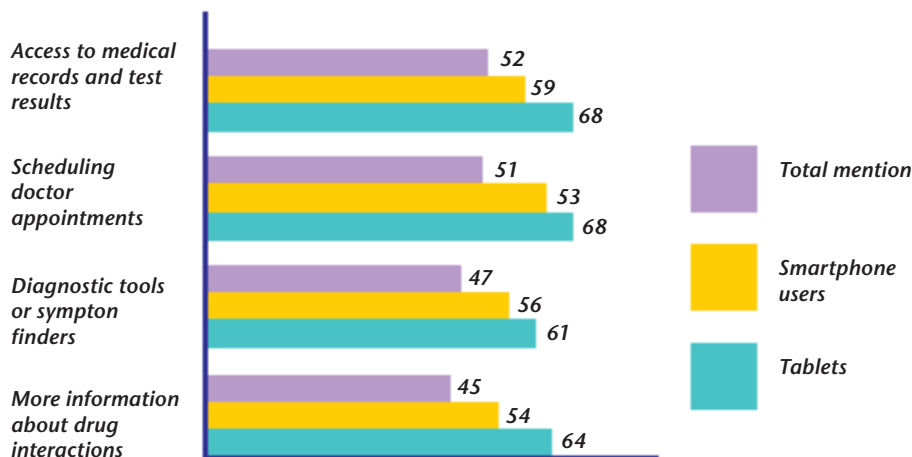
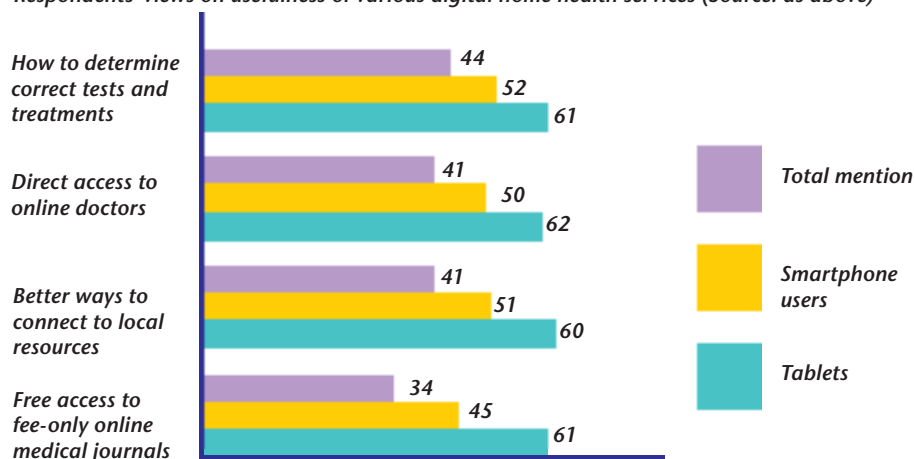


Figure 1b

Respondents' views on usefulness of various digital home health services (Source: as above)



Technical interoperability among tele-health devices has been a limiting factor. Although mobile phones are considered to be relatively ubiquitous, the adoption rate of mobile tele-health is influenced by its ability to be integrated with other medical devices and hospital IT systems.²²

Health eco-system issues

In the United States, the medical health social system is very structured and complex, with some 12 State and Federal Agencies regulating the industry.²⁰ In addition, under the present individual state licensure system, tele-health is limited to state borders. Physicians are required to have medical licenses in each state in which they practice. This clearly limits the potential geographic benefits that mobile tele-health solutions can provide. Also, there is significant uncertainty regarding whether malpractice insurance policies cover tele-health services.²³ The legal problems associated with tele-health malpractice liability are especially intricate when services cross state borders.²⁴

Finally, network security, particularly in the case of wireless is an issue given the need to ensure the confidentiality of patient information.²⁵ This is a challenge for both developed and developing countries. To date, there are few national policies that facilitate mHealth solutions. Practitioners feel that the pace and demand of mHealth on the ground is not being met by enabling policy, funding, and regulations at national and institutional levels.

Enormous investment barriers to the deployment of tele-health exist, barriers that are unnecessary given the widespread and rapid deployment of commercial wireless networks almost invariably using solely private funds built on market penetration.⁶ Governments have a broad range of policies that could be

Service Platform and Technical Issues

Several structural, technical and social constraints affect mHealth including low compatibility with existing medical practices, complexity of telemedicine equipment and interfaces, multiple technical standards, physicians' unfamiliarity with the technology, and ineffective change management and training.²⁰ Additionally, with mobile tele-health and the existence of different wireless technologies, such as GSM, GPRS, 3G, WiFi, Bluetooth

and Zigbee, interoperability issues create challenges.²¹ Network security is a primary concern, particularly in North America, thus a requirement for mobile tele-health is high security to protect health data.¹⁹

The plethora of mHealth applications systems and platforms in development and use, both open source and proprietary, is a global challenge due to the lack of common architecture. Rarely is there a single "owner" of all of the elements within a health system who can require an overall, interoperable approach.⁶

Figure 2
Initiatives in developing countries

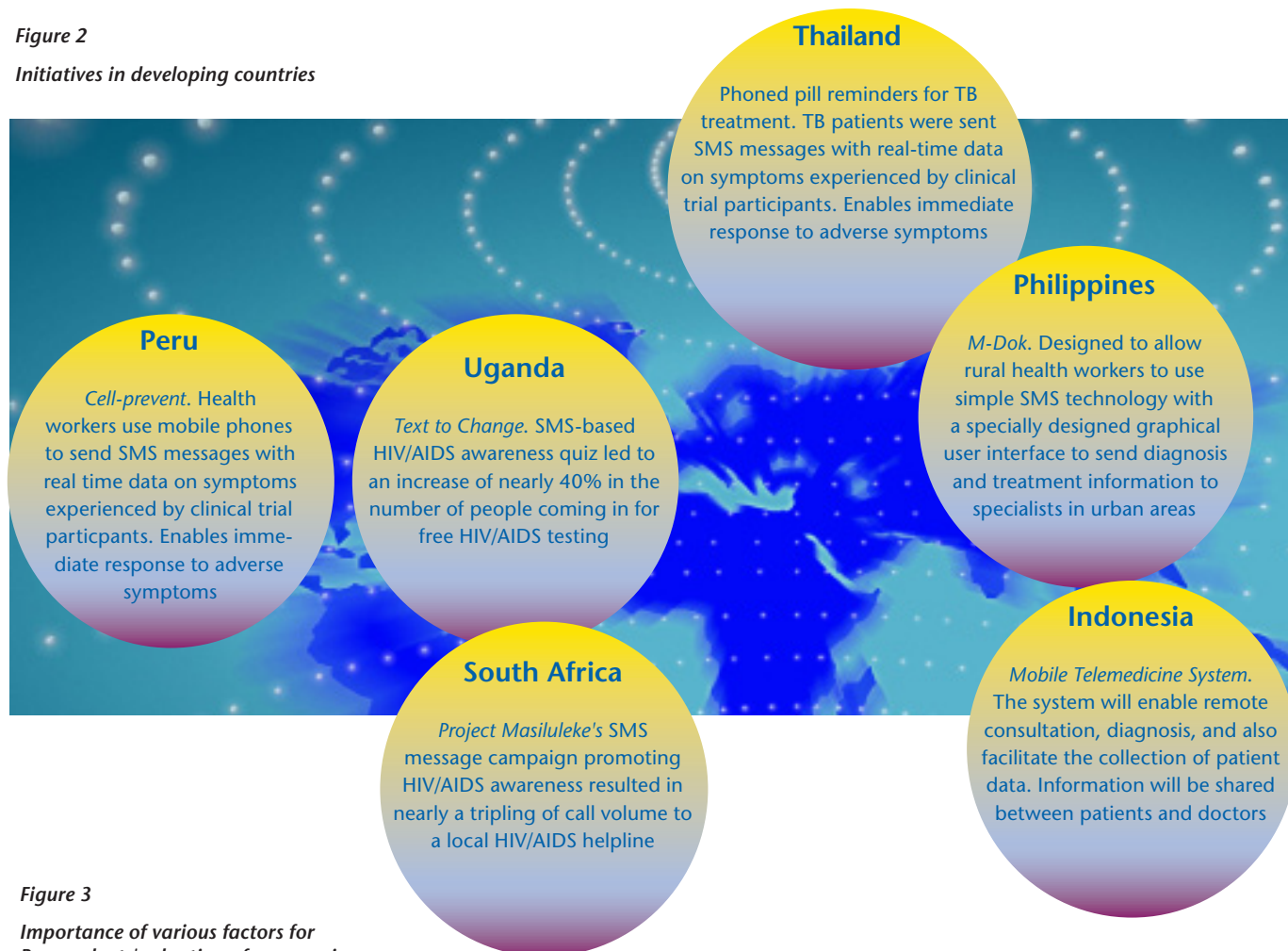
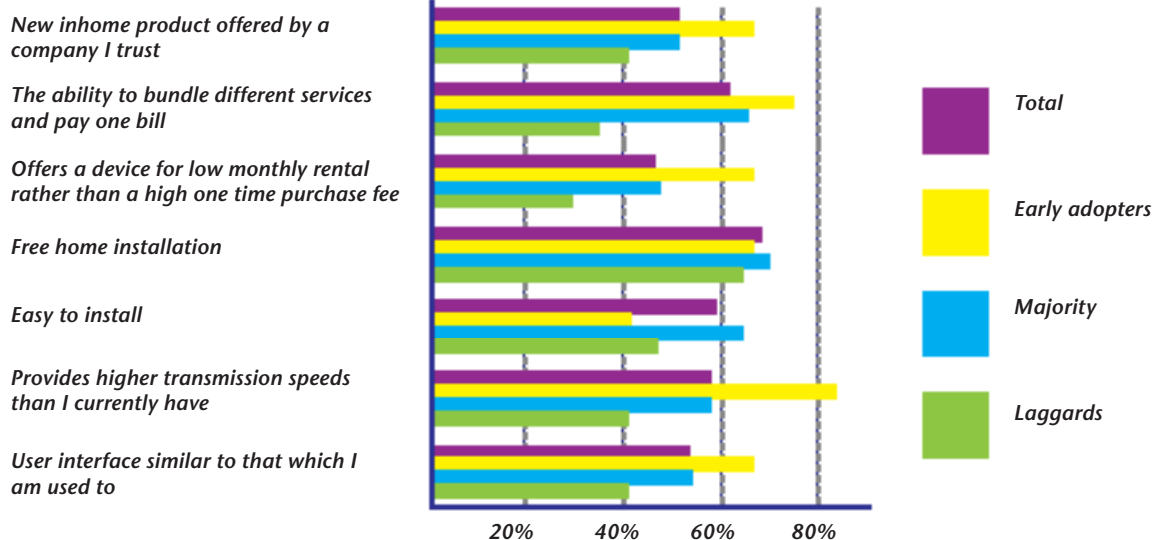


Figure 3
Importance of various factors for Respondents' adoption of new services



leveraged to drive mHealth implementations which ideally would define broad parameters including identification, security, and network reach and highlight social priorities for the use of ICTs including education and health.

While pure market forces have driven, and continue to drive, the global wireless explosion almost entirely, it is likely that incentives to extend network coverage may be required for remote populations

where such services stand to have the greatest impact.⁶

Continued on Page 44

Continued from Page 38

The Revenue Model

The cost of implementing the infrastructure, and reimbursement of tele-health services remain two major obstacles both in the US and in Europe. Although many studies show the potential cost savings of tele-health and remote monitoring, most of these studies involve small sample sizes with diverse types of tele-homecare intervention for few select chronic illnesses. Nevertheless, few studies examine the potential economic return to employers, such as increased productivity.

There are no current comprehensive studies of the economic benefits of tele-health to society in general and specifically, the extent to which tele-health can reduce the total health care bill as recent reports suggest.¹⁵

With regards to developing countries, however, the literature on the cost of ICTs in health is largely limited to OECD countries, with a focus on the role of ICTs in improving health sector efficiency, deriving value from tele-health systems, and assessment of the economic impact of tele-health investments. mHealth is not the explicit research focus.⁵ Overall, the cost of tele-health is not yet well established. The greatest costs expected to be incurred are training and human resource implementation costs, since hardware such as mobile phone devices are not expensive, and mobile networks are already established. There are expected cost savings based on several pilot tests.

Conclusions

Our discussion above shows that there is a large and growing consumer interest in tele-health and mHealth which provides a solution to growing health costs for many people. However, besides the presence of technology issues, such as security, the non-technological

challenges are particularly salient. These include regulatory, organizational and revenue-based issues. In summary some key requirements in both developed and developing countries need to be met to accelerate adoption:

- » mHealth devices and applications must be able to accommodate patients' differing physical capabilities
- » Open, non-proprietary, platforms provide potential for greater innovation from end-users, though regulation is still important. Non proprietary or open systems would help ensure rapid innovation of new services. These platforms must provide for ubiquitous access
- » Interoperability of access devices is crucial for rapid adoption and to ensure medical applications will not fail on different devices
- » The technical complexity in the delivery of e-health services requires the active participation of network service providers. In the US market, network service providers are now just beginning to explore eHealth. Network service providers also offer the advantage of being able to set and/or establish standards and protocols
- » Effective delivery of tele-health applications requires pooling of resources across different stakeholders in the eco-system. Coordination of effort across the different partners will be crucial for success. Because total benefits accrue to all stake-holders in society, "subsidized pricing" by corporations, government and other private stakeholders are both appropriate and necessary for ubiquitous adoption.

Francis Pereira and Elizabeth Fife are with the Center for Telecommunications Management at the University of Southern California

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