

# Future of the Smartphone for Patients and Healthcare Providers

Jae-Ho Lee, MD, PhD

Secretary General of the Korean Society of Medical Informatics; Department of Biomedical Informatics, Asan Medical Center, Seoul;  
Department of Emergency Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Mobile health (m-health) uses mobile phones, patient monitoring devices, PDAs, and other wireless devices [1]. However, the smartphone is the most popular and attractive device in m-health. Actually, the m-health market has grown rapidly since the emergence of the smartphone. A hospital in Korea reported that an iPhone-based mobile Electronic Medical Record (EMR) system developed in 2010 was accessed over 200 times more frequently than a PDA-based mobile EMR system developed in 2004, although the PDA-based one had more invaluable clinical functions [2]. Other hospitals may have had a similar experience. A smartphone is a mobile device, but it is different from other cellular phones or PDAs in terms of computing power (smartness), sensors, and connectivity [3,4]. Connectivity encompasses not only network connectivity, but also social media and wearable devices. These features enable the smartphone to work as an essential tool for m-health. Last year, Eric Topol wrote a column for *The Wall Street Journal* entitled, “The Future of Medicine Is in Your Smartphone” [4]. Such perspectives can be found in several medical journals. The ‘medicalized’ smartphone is becoming more familiar to biomedical informaticians in Korea. Is the future of medicine really in the smartphone? Which practices can be carried out with a smartphone? What is needed for the smartphone to be the future of medicine?

As of 2014, 64% of American adults owned a smartphone, and 62% of smartphone owners had used their phones to look up information about a health condition [5]. The number of iOS apps including health and fitness groups increased from about 43,000 in 2013 to 98,000 in 2015 [6]. Such growth is not confined to m-health apps. The Internet of Things in the healthcare market is expected to be 117 billion US dollars in 2020 [7]. Regardless of the accuracy of the report, the m-health market seems to be experiencing explosive growth, but the m-health market for healthcare is lagging far behind or is still in an early stage. Apps for disease-specific information (9%), medication reminders & information (6%), and healthcare providers/insurance (2%) were only 17% of the health and fitness group apps in Apple App store [6]. Only 27% of community health centers in the United States use cellular phones for communication with patients. Cellular phones are rarely used for healthcare purposes—medication adherence, personal health information access, and chronic disease management support—in such centers [8], and wearable devices are rarely used for clinical purposes.

Although m-healthcare services are still in an early stage, expectations are high. Why? The nature of smartphones, that is, their ease of use, smartness, accessibility, mobility, connectivity, etc., could explain these high expectations. Another explanation could be the nature of healthcare. Healthcare providers (HCPs) and patients are mobile in themselves. There are many reports that HCPs are not comfortable with health information technology (HIT), and HIT is not well integrated with their workflow. No physicians stay at an outpatient clinic all the time. They always move to and from

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

© 2016 The Korean Society of Medical Informatics

wards, operating rooms, examination rooms, emergency rooms, or laboratories. The gap between physicians' needs and HIT functionalities cannot be filled by PC-based HIT. Tools for the bedside or point-of-care are also needed for HCPs. The most convenient place for an HCP and a patient to communicate is the patient's bedside. HIT armed with mobility can satisfy an HCP's essential requests. From the patient's perspective, the situation is the same. Healthcare is shifting to patient-centered care. Patient satisfaction, empowerment, and engagement are becoming more important. The new healthcare paradigm encourages patients to access their medical data wherever they are, to discuss such data with their physicians, to decide their treatment plans with their physicians, and to learn about their discharge plans. HIT can support these requirements, but accessibility and mobility issues must be solved. Today hospitalized patients look for health information regarding their conditions with smartphones and tablets, and some HCPs even provide them. Smartphones or tablets can be used effectively for all of the above purposes.

There are worries about the present and future of ubiquitous health or HIT in Korea. However, m-health for healthcare services seems not to be lagging behind. Many hospitals in Korea provide various innovative m-health services to improve their workflow and quality of care. Mobile EMR services are implemented and used well in many hospitals. One Korean hospital developed more than 20 apps and reviewed the apps with respect to six quality-of-care aims. The report concluded that m-health apps have great potential to improve care and patient outcomes [9]. A hospital in Bundang, Korea started to use a unique and innovated display device for in-patients to provide their medical information and communicate with them [10]. Smartphones have been used as barcode readers or tools for patient identification, medication, and transfusion in some hospitals [9]. Hospitals in Korea seem to be working with the belief that the smartphone is the future of medicine.

However, if m-health is to be the center of healthcare service in Korea, many challenges, including national health policies, industry, and research must be solved. Biomedical informaticians should provide evidence that m-health can improve quality of care and reduce the cost of care, although they must cope with all other challenges. M-health research in Korea is just emerging; themes are limited to development, usage patterns, user's characteristics, etc. M-health's impact on clinical workflow, patient satisfaction, patient outcome, patient safety, and cost reduction should be investigated. The effectiveness of mobile EMR to HCPs and of mobile

PHR to patients should be determined. Methods to evaluate how helpful wearable devices are in clinical practice and how to make these devices more helpful for patient and clinicians should be researched. 'Medicalized' smartphones in Korea are waiting to be evaluated by biomedical informaticians.

## References

1. World Health Organization. mHealth: new horizons for health through mobile technologies. Geneva, Switzerland: World Health Organization; 2011.
2. Park JY, Lee G, Shin SY, Kim JH, Han HW, Kwon TW, et al. Lessons learned from the development of health applications in a tertiary hospital. *Telemed J E Health* 2014;20(3):215-22.
3. Lee JH. Smart health: concepts and status of ubiquitous health with smartphone. Seoul, Korea: IEEE; 2011.
4. Topol EJ. The future of medicine is in your smartphone [Internet]. New York (NY): The Wall Street Journal; 2015 [cited at 2016 Jan 28]. Available from: <http://www.wsj.com/articles/the-future-of-medicine-is-in-your-smartphone-1420828632>.
5. Smith A. U.S. smartphone use in 2015 [Internet]. Washington (DC): Pew Research Center; 2015 [cited at 2016 Jan 28]. Available from: <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>.
6. IMS Institute for Healthcare Informatics. Patient adoption of mHealth: use, evidence and remaining barriers to mainstream acceptance. Parsippany (NJ): IMS Institute for Healthcare Informatics; 2015.
7. McCue TJ. 107.5€ Billion market for Internet of Things in healthcare by 2020 [Internet]. Jersey City (NJ): Forbes; 2015 [cited at 2016 Jan 28]. Available from: <http://www.forbes.com/sites/tjmccue/2015/04/22/117-billion-market-for-internet-of-things-in-healthcare-by-2020/#1f42b1d02471>.
8. Broderick A, Haque F. Mobile health and patient engagement in the safety net: a survey of community health centers and clinics. New York (NY): The Commonwealth Fund; 2015.
9. Lee Y, Shin SY, Kim JY, Kim JH, Seo DW, Joo S, et al. Evaluation of mobile health applications developed by a tertiary hospital as a tool for quality improvement breakthrough. *Healthc Inform Res* 2015;21(4):299-306.
10. Yoo S, Lee KH, Baek H, Ryu B, Chung E, Kim K, et al. Development and user research of a smart bedside station system toward patient-centered healthcare system. *J Med Syst* 2015;39(9):86.