Editorial

m-Health

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Several years ago, a man many of us know was reporting yet again on his arduous efforts in telemedicine to teach the arcane intricacies of computing and the proper use of static computer stations to medical personnel in the far-flung outposts of his island nation. His work had not been met with great success. He would teach and teach and only rarely found the adapter who might lead an isolated medical community to the advantages of integration with the continuum of healthcare through computing. He was used to having his small audience pulled away by emergencies in settings where there was really no redundancy in the staff. However, he was steadily struck by the siren call of the cell phone (*dadada-dadada-dadada daaaaaaa*) in his audience, which would cause one of his few students to excuse herself to take a call outside. The cell phone he thought was a terrible interruption to his diligent efforts. Soon the cell phone went to short message service (SMS), and his small audience would be thumbing away at text messaging even while he spoke. One day, the importance of what he thought as a distraction hit him. He returned to the capital and became a powerful advocate of cellular telephony as the tool of telemedicine that seemed to require no teaching, no advocacy. In fact, his efforts at telemedicine had been overwhelmed by the reality of what we now call m-health. The cell phone was far more nearly ubiquitous than personal computers and certainly far more personal. A useful definition for m-health was offered by the Foundation for the National Institutes of Health as “the delivery of healthcare services via mobile communications devices.”¹

When did all this happen? What is this timeline for what must be seen as the logical restructuring of personal telemedicine to reach the masses of the world? When did the population make the technology adoption necessary to empower the planet and its medical community to simply take off while the telemedicine disciples struggled to catch up? That actually is hard to say because the adaptation of cellular mobile technology to medicine was not preceded by a slow series of demonstrations and slow incorporation into practice. The recent statistic is astounding in that there are 6,835,000,000 cell phone subscribers in the world with a population of only 7.1 billion. It is widely believed that there are more cell phones in the world than toilets, and in the developed world the penetration of the cell phone is over 126% of the population. How you use more than one is not immediately obvious, but the number stands. The cellular saturation is not limited to simple 2G devices, but the broadband cell users exceed 2 billion.² Furthermore, there have been more cell phones

manufactured and sold worldwide in the past 18 months than televisions in all of human history.

Mobile telemedicine, or m-health, has just happened and has exploded with the introduction of the smartphone, including Google's Android[®] platform and Apple's iPhone[®]. Cellular telephony has grown with increasing capability. The 1973 introduction by Cooper and Motorola was an analog device, or 1G. Subsequent improvement to 2G brought texting (SMS) and encryption in 1991. The cameras keep getting better with gyroscopic stabilization and 8-megapixel detail. WiFi allows Internet connection and all the advantages of Internet protocol (IP) interaction. The current smartphone is far more capable than the static computer station of 10 years ago. These advantages have a 3G or 4G platform.³ Today, such communication technology was just what is needed for a financially viable market with games, Grandma's videos, social media, and streamed movies. What about medicine?

Frankly, social media was used for medical gossip from the outset. However, the targeted effort for medical applications can best be marked by the number of medical applications (8,000 at the iPhone app store). Once a platform was robust in a business model and medical applications could simply be added on, the astronomical cost of freestanding medical telecommunications has evaporated. An application download may only cost a few dollars, and you have an instant telemedicine station in the hand with the device you already own and would not give up without a fight! In fact, m-health is a multibillion dollar contributor to the global telecommunications market. However, what has the telemedicine community done to catch up with the phenomenon, and what is the success?

Your journal, *Telemedicine and e-Health*, was very early in reporting the importance of screen size for credibility, image requirements for professional interpretation, and quality control for education, management of diseases, and data gathering. The science of m-health is amply presented here in this journal in scores of articles going back at least 10 years. However, to be candid, m-health was not a key word index term in our journal until quite recently. The same may be said for the National Library of Medicine, where a search for mobile medicine will bring up mobile health units and many other things before the obvious definitions took over about 5 years ago. The extensive work of the American Telemedicine Association for standards and guidelines has not yet addressed m-health. On the other hand, Google will bring you 1,600,000 sites for an m-health search. So where are we, and where are we going?

M-health may be divided into eight areas that are held in common by m-health devices but separated as disciplines: Personal, Social, Home Health Monitoring, Public Education, Medical Records and Communication, Professional Education, Professional Information,

and Professional Consultation. The first is empowerment of the individual patient who seeks medical advice through the Internet with a mobile device. Given the saturation of the populace with these devices, the abundance of Internet information, and the heavy use of Internet medical sources by the population, this area is a leader in overall Internet use, representing perhaps 20% of all Internet traffic on cell phones.⁴ Certainly not all the information is pure, and we have raised in our journal significant concerns about commercial medical information that may not represent the best in advice. However, with the caveat to seek out reputable professional organizations, this use of Internet should be encouraged and become part of the medical dialog with patients and providers. For example, if a search is made on Google for back pain and blood in the urine, you can find out pretty quickly that you may be passing a kidney stone. However, the Web sites do not then teach you how to buy your own computed tomography device, make the diagnosis, and assemble your own scopes to pull out the stone. No, you are informed, empowered, and directed to a proper medical site for whatever intervention might be needed. You initiate the dialogue and remain a highly informed participant throughout. Social m-health with regard to personal empowerment is similar and is best considered as sharing medical concerns with nonprofessional acquaintances. It is not clear how to make this better. People have telephoned Mom and other relatives about highly personal health concerns since the days of Alexander Graham Bell. A good friend or relative will try to provide support and share some other experiences but then try to get the medical issue to an appropriate medical setting. Perhaps increasing medical sophistication with personal and social m-health will actually help in this area. However, older relatives will still be asking, "What did the doctor say?," and the answer will be inconsistent with life as we know it on this planet. In fact, the comfort zone for sharing medical information in social media is astounding. Facebook is replete with reports on anorectal conditions that in another time would have been appropriate only in guarded whispers with intimates rather than blasted onto the Web.

Involvement of patients and caregivers in the home with m-health and monitoring is growing and continues to be more medically relevant and pertinent. Capture of data in the home with worn medical devices and the logging of longitudinal data in chronic disease management have not yet seen their full potential. The home and personal environment of patients can be embraced with the full force of medical alerts, tracking and meeting objectives to minimize complications of many conditions. Diabetes, congestive heart failure, asthma, dementia, wound care, rehabilitation, and certainly routine temporary surgical and medical follow-up after a crisis, are all proven interventions. In home health monitoring, the cell phone is not the only tool, of course. Advances in sensors, wireless communications over short distances, power issues, advances in alerts and responses, and, most important, the experience to incorporate the advances into sound medical practice with experience have changed the practice of medicine forever, and the rubric for all the elements is m-health.

Public medical education as a push rather than a pull event is at its beginning in m-health. Pushing out messages for behavioral modi-

fication through the cell phone has shown merit in smoking cessation, weight management, and mental health.⁵ Personalized and generalized programs for reinforcement of positive behaviors have now been extensively studied, and the prompts and nudges toward better health carry great promise for improved disease management. In general, the push message is text messaging. Directions this endeavor might take are concisely outlined in a report from the U.S. Department of Health and Human Services (HHS). The HHS Text4Health Task Force put forward seven recommendations in 2010 with regard to such topics as research, coordination, privacy, and regulation. One of the guiding principles put forward was the establishment of a program for implementation and evaluation.⁶

Medical records could certainly be held or accessed by m-health tools, and the notion of personal health records has certainly been advanced in recent years. The success of such programs in the private sector has not been overwhelming, and perhaps this is just a step too far for a public that likes social networking but does not like to keep up with electronic bills. However, entry of data into a medical record that could be accessed by a cell phone with password protection cannot be ignored, and certainly a large part of home health monitoring must integrate at some level into a complete medical electronic medical record. Considerable work needs to be done here, and perhaps this is a fertile area for study of adaptation and barriers. Certainly the use of m-health is not consistent across all ages, and there are distinct gender issues as well. Studying technology adaptation is a fertile area to make this inclusion universal. The use of m-health to communicate with patients with regard to reminders, appointments, and information concerning lab values continues to grow and is in itself remarkably well accepted.

On the professional side of m-health, we find growing reliance on the cell phone to access medical information on a just-in-time basis in hospitals and offices everywhere. One example is Epocrates, started in 1998 by two Stanford University students. Epocrates offers 40 services in medical information about anatomy, physiology, pharmacy, decision support, and current practices. It claims to be the number 1 tool for m-health in this regard, and it is certainly seen on every medical service one visits.⁷ In professional education limiting the need for videoconference centers, podcasts, Webinars, and group interactions can be distributed to medical consumers at very low cost to assure uniform information in large groups of practitioners as though they served on the same virtual medical staff with the same expectations for quality and currency. Professional education and information can be delivered without the need for travel and can be documented for compliance. Information from the Web in the form of electronic libraries is accessible at anytime and anywhere. IP m-health allows the use of huge databases and medical literature from any point. Professionals can also enter their experience and that of their patients into databases for consistent tracking of quality, epidemiology, and application of best practices. Professional consultation has always had an informal aspect among medical staff members. The curbstone consult has been a bit of a joke but a mainstay to seek out the experience of others. M-health

allows this process to extend around the world, creating the global virtual medical staff to share experiences. On a more formal basis, images can be shared for interpretation, including pathology images and radiology studies. The power of the current smartphone can meet all reasonable expectations for image interpretation and be used by the consultant anywhere. The operating room can be made accessible to any consultant, and collaboration can be spread to any limit to achieve the proper expertise for patient care. Encryption and password protection are adequate for current applications.

M-health has come of age and may be the leading tool in whisking critical and life-saving information around the planet and beyond for the improvement of healthcare access, practice, and quality. Medicine cannot be considered any longer a lonely pursuit, and the applications of m-health can be expected to proliferate. A measure of the importance of m-health can be seen in the program of the mHealth Summit held for only the fifth time this past December by the Health Information and Management Systems Society. At this session, over 5,000 participants from industry, academia, and government gathered for an intense 4-day program of all areas of m-health.⁸ The topic has impetus, financing, acceptance, and a great future. The subject moves so rapidly that it is hard to rely on standing publications to fully grasp the topic. Please note the use of URL references (Web citations) in this editorial. They are necessary to communicate current information! However, we invite you to follow the increasing validation of applications in our journal, and we offer a brief reading list from recent issues of *Telemedicine and e-Health* to give some insight into the role your journal has played.^{9–14}

REFERENCES

1. Available at www.caroltorgan/mhealthsummit.com (last accessed December 26, 2013).
2. Global Mobile Statistics 2012. MobiThinking. December 2013. Available at: <http://mobithinking.com> (last accessed December 26, 2013).
3. Available at <http://appadvice.com/appnn> (last accessed December 26, 2013).
4. Konshak C, Levin D, Morris WH. *mHealth: Global opportunities and challenges*. Virginia Beach, VA: Convurgent Publishing LLC, 2013.
5. Available at [www.pewinternet.org/~media/Files/Reports/2010/PIP mobile health 2010](http://www.pewinternet.org/~media/Files/Reports/2010/PIP_mobile_health_2010) (last accessed December 26, 2013).
6. Available at www.hhs.gov/open/initiatives/mhealth.recommendations.html (last accessed December 26, 2013).
7. Available at www.epocrates.com (last accessed December 26, 2013).
8. Available at www.mhealthsummit.org (last accessed December 26, 2013).
9. Poropatich R, Lai E, McVeigh F, Bashshur R. The US Army Telemedicine and m-Health Program: Making a difference at home and abroad. *Telemed J E Health* 2013;19:380–386.
10. Forjuoh SN, Reis MD, Couchman GR, Ory MG. Improving diabetes self-care with a PDA in ambulatory care. *Telemed J E Health* 2008;14:273–279.
11. Osunmuyiwa O, Ulusoy AH. Wireless security in mobile health. *Telemed J E Health* 2012;18:810–814.
12. Piette JD, Datwani H, Gaudio S, Foster SM, Westphal J, Perry W, Rodríguez-Saldaña J, Mendoza-Avelares MO, Marinec N. Hypertension management using mobile technology and home blood pressure monitoring: Results of a randomized trial in two low/middle income countries. *Telemed J E Health* 2012;18:613–620.
13. Kumar S, Wang EH, Pokabla MJ, Noecker RJ. Teleophthalmology assessment of diabetic retinopathy fundus images: Smartphone versus standard office computer workstation. *Telemed J E Health* 2012;18:158–162.
14. Martiez I, Escayola J, Martínez-Espronceda M, Muñoz P, Trigo JD, Muñoz A, García J. Seamless integration of ISO/IEEE11073 personal health devices and ISO/EN13606 electronic health records into an end-to-end interoperable solution. *Telemed J E Health* 2010;16:993–1004.