



## Editorial

# Mobile Medicine: Digital Dynamo or Virtual Vaporware

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*See article by Gandhi et al., pages 219–231 of this issue.*

A scant 20 years ago or so, the Internet was still mostly the purview of government researchers and academics. Smartphones and their applications (or apps) were still fledgling to nonexistent. The iPhone was still more than a decade away, and social media was the tabloid press rather than the myriad posting and sharing platforms available today.

Oh, how times have changed. In far less than a generation, digital devices and social media now dominate many people's lives. Whether we admit it or not, many of us are device dedicated and device driven; hence, the advent of the moniker "crackberry" to describe some people's addiction to 1 particular type of smartphone. These devices give us geographic directions, almost instant access to startling amounts of information, and the ability to stay in close touch with family, friends, and our workplace. Our smartphones organize, inform, and often run our day-to-day professional and personal lives. Indeed, given the very rapid manner in which this technology has come to dominate contemporary life, it is amazing that digital health care and mobile medicine, or mHealth, has not enjoyed more success or a more ubiquitous uptake. mHealth could actually improve population health and health care through better communication between patients and their health care professionals, better communication between health care professionals themselves, improved adherence to longevity-enhancing health behaviours, and greater awareness of and adherence to evidence-informed clinical practice guidelines. Regrettably, to date, mobile medicine has been more virtual vaporware than digital dynamo.

There is almost universal acknowledgment that mHealth could substantially improve patient outcomes. Lamentably, the opposite seems to be true. Rather than improving the health and wellness of our patients and our daily professional lives, the digital information explosion and the exponential perpetuation of online access means that almost every health care professional must now deal with dubious, and often

bogus, second opinions from Dr Google on a daily basis. Thus, perhaps predictably, smartphones and instant access to digitally stored information seem to have introduced only obfuscation and confusion into the patient care arena instead of the commonly desired goal of clarity and consistency. The problem of myth communication in the digital world of health care delivery is rapidly expanding and becoming ever pervasive, and this distressing problem does not even encapsulate the future expansion of handheld and mobile devices, software programs, and applications.

Today, digital technology and social media platforms are accelerating at a pace that is truly daunting. It has been estimated that within the next 10–15 years, the smartphone will contain more connections than the human brain and may have shrunk to the size of blood cells.<sup>1</sup> Facebook has more than 1.5 billion users. For all its power and connectivity, however, has digital technology made the delivery of health care better or has it just made it more chaotic? Social media sites that could potentially improve the successful delivery of health care services can become uncensored, unfettered, and unregulated platforms that allow some individuals or organizations to engage in professional or vocational cyberbullying aimed at their competitors or others providing similar services within the same health and disease care communities. In these difficult circumstances, rather than a digital tide that should float all boats, this form of cyberbashing and cyberbullying diminishes entire sectors of the health care system leaving them virtually high and dry. However, these detractors and drawbacks aside, mobile medicine could and should significantly improve patient-partnered care and patient outcomes through better integration and communication within multiple circles of care—between patients, payers, and health care professionals (Fig. 1).

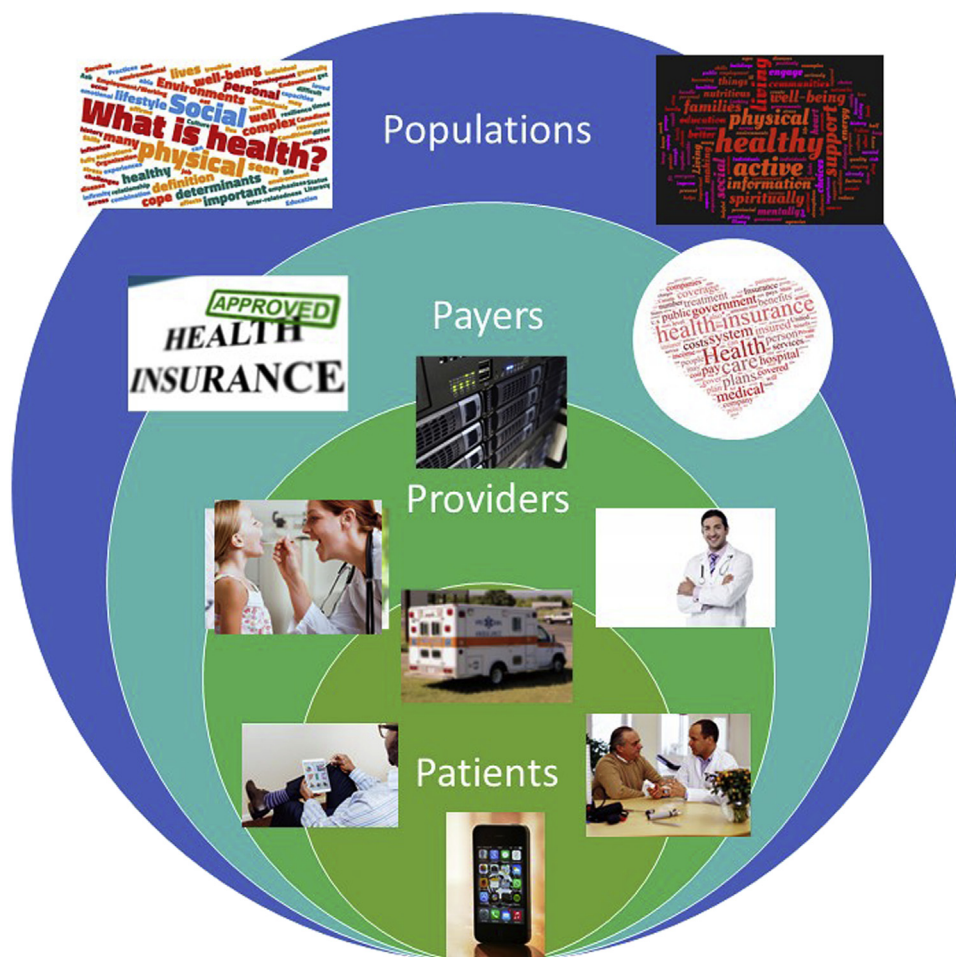
In addition to hardware and social media, software applications have also seen exponential expansion. In July 2008, there were < 1000 applications available through the Apple store. In the summer of 2016, there were more than 2 million applications available from the same marketplace.<sup>2</sup> Therefore, it is not that software or digital applications are lacking in health care or in cardiovascular care in particular. The problem is that many of these applications have struggled and most have failed to find a mainstream space within the everyday delivery of cardiovascular care.<sup>3</sup> They have mostly failed to

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See page 218 for disclosure information.



**Figure 1.** The circles of care that could evolve in a patient-partnered mobile medicine model. Images in figure are public domain or reproduced under Creative Commons license.

find, to paraphrase another health care mantra, the right interface on the right device in the right practice environment with the right metrics for the right patient and the right payer at the right time and in the right place. Furthermore, virtually every 1 of these digital applications or software programs lacks any evidence to support their efficacy or their efficaciousness in improving patient outcomes or reducing health care costs.<sup>4</sup>

In this issue of the *Canadian Journal of Cardiology*, Gandhi et al.<sup>5</sup> present their results of a systematic review and meta-analysis on the effect of mobile health interventions on the secondary prevention of cardiovascular disease (CVD) events. In their introduction, the authors point out that there are > 700 applications available related to CVD. Although this number sounds large, when placed in the context of the millions of applications now available on the Internet, this number represents < 0.0002%. Given the almost universal availability of smartphones and the need for better health care connectivity, the authors speculate that with appropriately designed and available applications, smart devices could make mobile medicine a reality that improves knowledge translation but also increases access to expert care. They also hypothesize that mHealth and mobile medicine could improve adherence to therapeutic interventions. To determine if there is any

current evidence to support these hypotheses in the secondary prevention of CVD events, they performed a systematic review of 7 large publication databases searching for articles in the area of mobile health and CVD outcomes. The primary outcome of interest was whether mobile medicine improved adherence to medical or pharmacologic therapies, and the secondary outcome was adherence to pharmacologic and nonpharmacologic recommendations during patient follow-up. The tertiary outcome involved a search for evidence that mobile medicine was actually beneficial in improving surrogate health targets such as body mass index, smoking cessation, systemic blood pressure, low-density lipoprotein (LDL) cholesterol, exercise adherence, and hard outcomes such as mortality, transient ischemic attack (TIA), stroke, myocardial infarction, and readmission rates.

The results of their systematic search returned almost 4000 potential references, but after review, there were only 14 studies deemed suitable for inclusion in the review. The mobile medicine interventions examined used text messaging or smartphone applications, or a combination of both, to communicate with patients. For their primary outcome, adherence to medical therapy, the use of mobile medicine technology was associated with 89% adherence compared

with 73% adherence in the control group. For the secondary outcome for adherence to either pharmacologic or non-pharmacologic therapies, users of mobile medicine were almost 4 times (odds ratio, 3.86) more likely to be adherent compared with those who did not use this technology. Not surprisingly, however, the effect of mHealth interventions on individual CVD risk factors was far less robust. Overall, the use of digital devices and applications improved blood pressure control but revealed no demonstrable effect on smoking cessation or LDL cholesterol control, with a trend toward better adherence to exercise goals. With respect to the effect of mHealth use on hard CVD outcomes, the authors showed a small benefit in angina reduction and TIA/stroke but no statistically significant effects on hospital readmission or mortality. In addition, there was a suggestion that mHealth could potentially improve symptoms of anxiety, as well as depression, in patients with CVD. Finally, there was also an improvement in the knowledge of food groups and dietary choices in the device groups compared with the control groups.

At first glance, the jaundiced eye, or at least the discerning eye, would observe that the findings of this systemic review and meta-analyses seem to be marginal at best. With the exception of adherence to pharmacologic or non-pharmacologic therapies, the use of mobile medicine or mHealth as a means of improving either surrogate outcomes or hard CVD end points, was underwhelming. Although this is not the first meta-analysis of mHealth interventions in the treatment of CVD,<sup>6</sup> it is 1 of the first to show a positive effect on blood pressure control. Additionally, there is a Cochrane Collaboration review under way on mHealth interventions using text messaging as a means of improving secondary prevention in CVD.<sup>7</sup> This is a reflection of how fast this field is expanding and is a tangible replication of the explosion of the mHealth and mobile medicine fields themselves.

The use of this technology to track patient adherence to prescribed therapies has the potential to significantly improve clinical outcomes given the known positive effect of therapeutic adherence on achieving improved clinical outcomes.<sup>8</sup> With the ever-increasing availability of mobile digital platforms, such as smartphones, in conjunction with the increasing availability of applications that can track patient behaviours, this could lead to significant reductions in redundancy or duplications in patient care services, which often return low value or no value to the health care system. Embedding evidence-informed clinical care pathways into mHealth applications could substantially reduce redundant testing and reduce wait times for patient care services.

Mobile medicine is here to stay. Although it may be at only an embryonic stage of development, like every other embryo, it is growing exponentially. On the digital technology and hardware side, computers now design computers. Computers do not sleep, do not take vacations, do not require stress leave, and are learning to improve their performance over time. Computers also design and write computer code. In this kind of development environment, it is only a matter of time, perhaps a very short time, before mobile medicine and

mHealth becomes the most widely used patient care model in the management of stable chronic disease conditions such as coronary artery disease and CVD.

To be sure, these are very early days, but the digital dynamo seems to be on a roll. As to whether or not it will turn into virtual vaporware, time will tell, but with struggling world economies, struggling national and regional economies, and the demand from health care payers and patients for ever-better outcomes with lower and lower costs, it seems very likely that in the mHealth and mobile medicine environment, whatever has been conceptualized, promised, or advertised today is likely to become a reality tomorrow. In this sector of patient care, like virtually every other aspect of life, the only constant is change. If we are digitally diligent, it will be change for the better. If we are software sloppy, mHealth and mobile medicine will simply drive up costs while the quality of health care services declines. In the health care value proposition, in which high quality and lower costs generate the highest value, mHealth interventions, particularly in chronic disease management, show great promise. Importantly, however, promising value is far different from delivering value. Promising value in health care with no demonstrable returns on investment is virtual vaporware. In the rapidly advancing and changing worlds of mobile medicine and mHealth, it is this we must avoid.

## Disclosures

The author has no conflicts of interest to disclose.

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