mHealth

FROM SMARTPHONES TO SMART SYSTEMS

EDITED BY

Rick Krohn, MA, MAS
David Metcalf, PhD

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Acknowledgments

I would like to thank the chapter and case study contributors, the staff of HIMSS and our HIMSS editor, Matt Schlossberg, without whom the writing of this book would not have been possible.

—*Rick Krohn*

I would like to thank my teams at both UCF College of Medicine and the Institute for Simulation and Training, Mixed Emerging Technology Integration Lab. The knowledge sharing and direct projects that informed my early understanding of mHealth has been invaluable. In particular, I'd like to thank Dr. Jonathan Kibble, Dr. Juan Cendan, Dr. Roger Smith, David Rogers, Angela Hamilton and the rest of the METIL lab. Kate Stannard provided invaluable editing and transcription. Our friends and sponsors throughout the mHealth ecosystem rallied around this effort to make it successful. Most of all, I thank my lovely wife, Katy, and sons Adam and Andrew for their patience and teaching me about health on a daily basis, whether mobile-enabled or not. Finally, I thank Jesus Christ for my abilities and opportunities to make this book possible.

—*David Metcalf*

Foreword

By Robert B. McCray
Co-Founder, President and CEO, Wireless-Life Sciences Alliance
Chairman, Alliance Healthcare Foundation, San Diego

The healthcare information management industry is dead! Long live the healthcare information access industry!

This is an exaggeration, of course; however, it may not be as far from the truth as many would like. Wirelessly enabled connected health is already disrupting the traditional service model where healthcare information, security and access is centrally managed, maintained and limited, respectively. Just as digital media transformed the entertainment sector and revolutionized the music industry, wireless health will transform the healthcare sector and destroy components that are slow to adapt.

What is the role of the traditional health IT manager in a business swept by huge changes, where information exchange involves billions of sensors and the user base expands to just as many people? This is a key question—among many—posed and answered in this book, *mHealth: From Smartphones to Smart Systems*, edited by Rick Krohn, MA, MAS, and David Metcalf, PhD.

Wireless healthcare could not have arrived at a more crucial time. Large segments of the US and global populations are dealing with overwhelming growth rates in major health problems, most acutely conditions related to obesity and aging. In response, many developed nations are devoting close to or more than 10 percent of their annual GDP to healthcare costs, with the United States claiming the unfortunate top position at 16 percent. These already alarming costs will only rise as the number of patients in these disease categories swells, forcing countries to allocate a greater portion of their GDP every year, thereby placing debilitating financial pressure on their citizens, families, businesses and institutions.

For example, growth in US healthcare costs in the past 10 years has erased income gains for the average family. This is in addition to the ever-present problems of access to quality care, rising and inefficient costs and the growing number of uninsured patients. Add a global economic crisis, major debt issues and changing demographics into the mix, and we face a global disaster of monumental proportions.

Seeking a Solution

While the timely emergence of wireless health alone will not resolve these myriad problems, it offers unique opportunities to reduce cost, increase efficiencies and improve the quality of and access to care.

Wireless technology can reduce costs. Home-based monitoring will help hospitals track patient recovery and compliance, thereby minimizing costly episodes of re-admission. (After Oct. 1, 2012, Medicare will penalize hospitals that inadequately prevent re-admission.) Coordination between departments and providers will reduce wasteful spending and improve quality of care. Lastly, financial sponsors of healthcare

can measure the costs and outcomes for competing providers and technologies and make better purchasing decisions.

Wireless technology will help improve quality. Patient care can be improved using wireless health. A study involving patients with implanted cardiac defibrillators demonstrated that the five-year survival rate for patients who followed up with only in-office visits was 50 percent lower than patients who followed up on the network using a connected bedside monitor.[1]

Wireless technology can increase access and transparency. With rapid consumer adoption of smartphones, physicians can now perform two-way videoconferencing. Patients and physicians both will have access to medical records and vital signs. Wireless technology also allows physicians to serve more patients despite geographical limitations.

How is all this to be accomplished? Wireless healthcare has many available tools. There are more than 5 billion cell-phone subscribers across the globe. Collaboration between IT and the medical device industry will produce most of the wearable wireless devices. The cost of data storage and analytics will decline faster than the already declining cost of content creation. Migration to cloud computing and the improvement of its security will help accelerate the whole process. The list goes on, happily.

I am an optimist and a realist. My optimism leads me to believe that we will deliver more of the potential benefits of the life sciences sector to more of the world's population at a reasonable cost, as is the case with mobile services, energy, water and automobiles. Realistically, institutional resistance to change will slow the realization of this future.

Looking Ahead

I have no doubt that fundamental change is coming to healthcare. The pace of change can be stunning—even where entrenched institutions resist. The music industry's challenges with the digital revolution are a well-documented example.

I will close with two suggestions and a prediction:

- If a device or service can be connected, it should be. How else will a manufacturer be able to answer questions about how its product works in the field or why someone should buy it? How will holdouts sell against the benefits of connectivity?
- In the developing world, incidence of chronic disease and demand for access to health services rival or exceed our challenges in the developed world. US institutions are the world's biggest owner and creator of life sciences knowledge, and 5 billion cell-phone users constitute the largest distribution channel ever created. The US healthcare industry should increasingly focus on the entire world and recognize that the developing world is both a source of customers and of "frugal innovation."
- Heuristic diagnosis is moving toward free. Access to medical knowledge, including personal genomics, is being distributed directly to consumers. So far, these trends have primarily influenced a motivated minority of consumers, especially the "healthy wealthy," but over time they will shift power and responsibility to patients who will have to manage more healthcare decisions

for themselves and their families. Similar to the impact of digital technology in music, consumer electronics, automobile, microchips and others, wireless health will empower customers and change the landscape in healthcare.

The potential of wireless health will be realized in the effective blending of three bodies of learning: high technology, life sciences and human factors. In the long run, the end users (consumers, patients and clinicians) will ultimately determine the successes and failures in wireless health.

WHAT YOU WILL LEARN FROM THIS BOOK

This book explores the emergence of mHealth in the healthcare setting. While the book focuses on the broad range of technologies available, it also tackles the *effect* wireless technology will have on the industry and myriad stakeholders. What infrastructure and architecture is needed to support these technologies? How will the role of various stakeholders evolve? What impact will mHealth have on existing technology? What sort of business model will be needed to ensure success and reduce costs? How do we ensure security and compliance? Looking forward, how might mHealth impact the coming era of consumer-centric healthcare, and how might it reshape access, quality and treatment?

The contributors to this book offer their expertise and analysis to answer these questions, as well as pose new avenues of inquiry essential to the success of every healthcare organization and stakeholder moving forward. In addition, it serves as a practical guide in strategizing and executing an mHealth market and product venture. Finally, this book includes several case studies from healthcare organizations across the country, which will give readers a clear notion of the opportunities and obstacles of implementing mHealth.

Topics discussed include:
- The evolution of the mHealth market.
- Barriers to adoption and opportunities to exploit.
- The role of stakeholders.
- The deployment of current mHealth technologies.
- Infrastructure requirements.
- Business modeling.
- Crafting an mHealth market strategy.
- Security and compliance.
- Complementary technologies.
- The future of mHealth.

Who Should Read this Book?

This book was edited to appeal to stakeholders throughout the healthcare industry, and will be of particular interest to public and commercial payers, providers, employers and consumers who have a stake in technology solutions. This book also is essential reading for IT staff, operations staff, corporate administrators, network staff, clinicians and vendors. The topics covered in the following chapters and case studies will offer readers a broad overview of mHealth and its major issues. It offers stakeholders

information on key points on the journey to wireless technology and provides real-world initiatives by a variety of healthcare organizations.

I hope this book serves as a useful map for your own journey toward wireless healthcare.

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Introduction

> *"That it will ever come into general use, notwithstanding its value, is extremely doubtful because its beneficial application requires much time and gives a good bit of trouble, both to the patient and the practitioner."*

That's an appraisal of the stethoscope from the *London Times* in 1834, but it could just as easily refer to our contemporary experience in attempting to introduce useful health technologies like computerized provider order entry and the electronic medical record (EMR)—an experience characterized by skepticism and tepid growth. The failure of healthcare technologies to establish a commanding presence is symptomatic of a larger issue: an industry undergoing transition. Coupled with societal trends, healthcare's venues, workflows, economics and touch points are undergoing rapid and unstructured transformation, without a clear signpost to guide health IT.

Today, technology and societal trends are converging to create new communication patterns that connect and coordinate the roles of every healthcare stakeholder, including the patient, provider, payer, employer, pharma, public health and more. At the same time, our healthcare industry is steering inexorably toward a distributed-service architecture in which key decision making occurs at the point of care. One of the primary engines of this shift towards decentralization and reorientation of healthcare services is mobile healthcare, or mHealth. mHealth can be broadly defined as the delivery of healthcare services via mobile communication devices. A fuller description refers to the delivery, facilitation and communication of health-related information via mobile telecommunication and multimedia technologies, including cell phones, tablet devices, PDAs and wireless infrastructure in general.

mHealth describes the use of a broad range of telecommunication and multimedia technologies within wireless care delivery architecture. But it is more than simply extending communications channels—its reach can establish true healthcare communities in which every stakeholder can participate. In the space of two short years, mobile health—thanks in no small part to the smartphone—has catapulted to the forefront of essential healthcare technologies. With amazing speed, mHealth is becoming the clinical data medium of choice for clinicians and consumers, typified by compact devices and tools that are cheap, reliable, persistent and convenient. It's the care management platform that the EMR always should have been, with an important distinction—it's reaching its potential.

The scale of mHealth interventions range from simple, direct-to-consumer/direct-to-patient communications to more complex applications and systems that remotely coordinate and actively manage patient care. In its fullest flowering, mHealth will serve as a springboard to address healthcare's most intractable problems—quality and cost—and may well become the centerpiece of healthcare programs aimed at chronic disease management, public health, wellness and prevention. But mHealth isn't just about the smartphone—and its impact on the industry is just beginning to be felt.

mHealth offers an elegant solution to a chronic problem facing clinicians: accessing the right information where and when it is needed within highly fluid, distributed organizations. Healthcare is fertile ground for mobile solutions, because they remove geography and time as barriers to care by establishing connectivity with remote locations and remote workers, and by creating new points of contact with patients. mHealth changes the frequency and intensity of healthcare delivery, allowing for persistent, pervasive healthcare services to be delivered anytime, anywhere. It establishes effective new treatment modalities—telehealth, remote patient monitoring, self-care and home health, among others. But beyond clinical connectivity, mHealth holds the promise of quality improvement, cost reduction, wholesale gains in population health, access to care and a better allocation of health-delivery resources. With mHealth, clinicians, patients and other stakeholders are able to continuously monitor and manage health conditions on the fly. It's becoming embedded into healthcare operations—mHealth is integral to a number of care delivery strategies, including the medical home, the health information exchange, the care team and patient-centric healthcare.

Mobile solutions hold great promise for keeping people healthy, managing diseases and reducing healthcare costs. For years, telehealth has provided clinical services for individuals who lack physical access: farmers in remote communities, soldiers near the battlefield and prison inmates. Now, these technologies have demonstrated the ability to directly impact the health characteristics of all consumers. Mobile devices are the most personal technologies that consumers own—they enable consumers to establish personal preferences for sharing and communicating, and they enable health and wellness to be delivered through mass personalization.

Mobile devices and applications have come a long way from the "bag" phone and walkie-talkie-sized devices of the mid-1990s, and are now a truly practical—and ubiquitous—feature of daily life. The healthcare industry has taken note and is deploying mobile networks and point-of-care devices to support the electronic exchange of medical information.

Mobile development in healthcare is being driven by innovation in the tech sector, cost-saving initiatives by providers and payers and overwhelming demand by consumers. The tools of mobile computing—smartphones and PDAs, tablet PCs, patient monitoring devices and laptops—are opening new vistas of opportunity for clinical collaboration. Telemedicine, voice recognition and home monitoring have been around for years, but the wave of mHealth adoption owes its popularity to a convergence of form and function. Mobile devices have made dramatic leaps forward in terms of cost, bulk, weight, durability and performance. Innovative applications of mobile technologies like GPS, radio frequency and cellular, as well as evolving wireless standards like 4G and ZigBee are producing an explosion of mHealth tools and applications.

The potential universe of mHealth applications spans the payer, provider and healthcare consumer markets. To meet this demand, vendors and developers are offering an ever-widening array of devices, such as wearable monitors and testing devices, and delivering innovative mobile applications such as GPS for Alzheimer's patients, OTC drug reference for consumers, a handheld EMR viewer and text-based medication reminders. There are thousands of mobile apps for healthcare already on the market, with more on the way. They include e-prescribing, medical calculators, deci-

mHealth Applications	Sample Deployments	Benefits
Chronic disease management.	Wearable monitors.	Pre-emptive interventions.
Medication adherence.	Medication reminders and safety alerts via text, e-mail and or smartphone application.	Increased patient satisfaction.
Remote patient monitoring.	Safety and location tracking systems.	Reduced cost.
Access to personal health information.	Personal health records.	Aging in place and nursing home diversion.
Communication among clinicians, patients and other caregivers.	Web-based social networking.	Increased self-management.
Personal fitness and wellness.	Nutrition, activity and quality of life web-based monitoring systems.	Improved health and wellness.
		Increased quality of life.
		Decreased caregiver burden.
		Improved communication among clinicians, patients and other caregivers.

Table 1. Technology Applications and Potential Outcomes of mHealth.

sion support tools, personal health records, patient medical and eligibility queries, for starters. A general market scan of mHealth applications include:

- Public and population health.
- Emergency response systems.
- Professional and patient communications (e-mail, texting, social networking).
- Point-of-care documentation.
- Mobile synchronous (voice) and asynchronous (SMS) telemedicine diagnostic and decision support to remote clinicians.
- Mobile EMR.
- Financial and administrative applications.
- Clinical care and remote patient monitoring.

- Health extension services.
- Health services monitoring and reporting.
- Consumer education.
- Pharmaceutical clinical trials.
- Health promotion and community mobilization.

A closer look at several of these applications reveals the cause-and-effect relationship of mHealth that can be translated into improved clinical workflow, improved quality and patient satisfaction, and reduced costs. (See Table 1.)

We're still in the opening rounds of mHealth, and there are significant unknowns that will determine its ultimate course. Will multiple communication channels translate into a deluge of resource consuming and electronic patient-provider conversations? Will new privacy and security protocols evolve to "bulletproof" wireless data exchange? Will the next generation of wireless standards push mHealth beyond communications and into the realm of diagnostic imaging? Within the next few years mHealth is likely to evolve in unexpected ways, but one thing seems clear: mHealth is going to deliver EMR functionality to a worldwide audience—faster, cheaper and with a much steeper adoption curve.

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