Upward Mobility: A Look at How mHealth Is Redefining Healthcare

Chris Hayhurst
Mobile health technologies are affecting every facet of the industry—and changing the nature of work for clinicians and healthcare technology management (HTM) professionals alike.

As a neonatologist at the University of Maryland Medical Center (UMMC) in Baltimore, Colleen Hughes Driscoll, MD, knows what it’s like to work under pressure. The newborns she sees are often premature and critically ill, and a medical error—or a delay in intervention—could lead to permanent injury or death. Similar to many physicians, she minimizes the risk that something might go wrong by relying on a combination of her own professional experience and that of the clinical team around her, as well as by turning to medical technologies like oscillatory ventilators and continuous electroencephalographic monitoring systems.

And now, Driscoll has another tool at her disposal: a new text-messaging and touchscreen notification and alert system she and others at UMMC developed in-house.

For obvious reasons, Driscoll explained, her job requires her and her colleagues in the UMMC Neonatal Intensive Care Unit (NICU) to work “extraordinarily closely” with the obstetricians in Labor and Delivery (L&D).

“It has to be a symbiotic relationship,” she said. “We need to have very clear communication.”

Driscol has had great success throughout her career—she’s widely respected in her field and serves as an assistant professor of pediatrics at the University of Maryland School of Medicine. Nonetheless, a few years ago, as she surveyed her surroundings, she decided it was possible to do even better. She had recently completed an advanced training program in healthcare delivery improvement through the Intermountain Healthcare Leadership Institute. (She also leads quality improvement efforts at the UMMC’s Drs. Rouben and Violet Jiji Neonatal Intensive Care Unit.)

Returning to work, Driscoll saw the two units in a new light. “I was finding that when the L&D folks needed us for an emergent delivery, a lot of the times when we wound up having issues it was because the communication wasn’t clear or it was incomplete,” she said.

The system they used, Driscoll explained, included a dedicated green landline phone in L&D that was hardwired to another red-colored phone in the NICU. “They would call us when they needed us, and they would give whatever information they could give. Then, that information was taken by a secretary in our unit, who would broadcast it overhead through the whole NICU.”

Sometimes the information that was conveyed lacked the details she and her colleagues needed to be able to respond to the emergency as efficiently as possible. And on occasion, as they listened to an announcement, they’d misinterpret what they heard, Driscoll said.

“We have two wings where babies tend to deliver on: the C wing and the D wing. Well, ‘C wing’ and ‘D wing’ can sound a lot alike, so it wasn’t uncommon for our team to be at the completely wrong hallway waiting for a baby,” she said.

Their call system had other drawbacks as well, Driscoll recalled. The noise that accompanied each announcement seemed unnecessary, especially for patients—it served as a distraction to everyone other than the intended recipients.

In addition, broadcasting information throughout the unit “didn’t feel private or
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Q&A

Colleen Hughes Driscoll, MD

BI&T asked Colleen Hughes Driscoll, MD, neonatologist and assistant professor of pediatrics at the University of Maryland School of Medicine, for her thoughts on mHealth and its impact on healthcare overall.

How do you think mobile health technology is changing the face of healthcare?
The impact of mobile health on healthcare globally can be quite broad when you consider both the inpatient and outpatient setting. As a busy mother of an injury-prone 8-year-old boy, I’m acutely aware of the potential benefits that telemedicine can bring to the outpatient setting. As a critical care intensivist, I need devices and technologies that can support the fast-paced clinical workflow that comes with caring for critically ill patients. Thinking beyond this, how can mobile health reduce the number of people who require hospitalization? How can we use health technology to reach patients from resource-poor or remote regions? Being able to achieve these goals requires that clinicians and engineers embrace the Internet-of-Things concept. There are limitless possibilities for changing the way we care for patients through technology. It is really a very exciting, and somewhat overwhelming, time.

Given the need for mobile technologies in healthcare, how can device makers meet the demand?
Healthcare workers are under enormous stress on a daily basis. They often are short staffed and dealing with alarm fatigue. They constantly have to multitask and sometimes need to work around barriers to care delivery within a very complex healthcare system. Having a clear understanding of how even just one of these stressors can affect patient care adversely is so important when designing devices. Frontline healthcare workers need technology that can facilitate communication among caregivers and patients, help reduce the regulatory burdens of documentation, and allow for increased situational awareness. The best way for engineers to design devices that can achieve this is by immersing themselves in the frontlines of care delivery. Closely partnering with clinicians throughout the design process is key.

Conducted in 2018, the Spyglass research also found that three of four hospitals either have or are working on mobile strategies “to address the communications, collaboration, and computing requirements” of their clinical teams. And it found that 68% are relying on middleware to “collect, monitor, and manage” the data, alerts, and alarms produced by medical devices and other digital systems.

Similarly, a 2017 study conducted by HIMSS Analytics (a division of the Healthcare Information and Management Systems Society) found that smartphones and tablets now are widely accepted tools within the typical healthcare environment.

Among the findings: 77% of clinicians were using smartphones and tablets to access clinical information, 71% were using mobile tech to connect to the electronic health record (EHR), and 46% were relying...
on these devices to communicate and consult with other clinical staff.²

And that was two years ago. Today, of course, it's obvious to nearly everyone—clinicians and their patients—that mobile health technology is on the verge of becoming the predominant health technology. Clinicians are using “mHealth,” as it’s known, to communicate with patients over HIPAA-compliant email and text-messaging systems, and patients are tracking their vital signs using mHealth apps on their smartphones and watches.

It’s been well over a year since Apple announced an update to its Health Records application that allows users to view their medical records on an iPhone.³ Since then, the company has received two Food and Drug Administration (FDA) clearances for other mHealth applications, including an Apple Watch electrocardiogram (ECG) app.⁴ (Apple isn’t the only major technology company pushing its way into the healthcare industry. Among those vying for the sector’s attention are Google, Microsoft, Fitbit, and many others.)

### Clinicians and Mobile Tech Use

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*Source: HIMSS Analytics. 2017 Essentials Brief: Mobile (reference 2)*

Given the parallel trends in the mobile device space between consumer usage and reliance on devices by health professionals, Jim Piepenbrink, deputy executive director of the AAMI Foundation, says it's useful to divide mHealth into two distinct categories: mobility and mobile health.

The way he sees it, “Mobility is within the walls of the hospital, where the HTM professional is either bringing their own device”—usually a smartphone—“or they’re utilizing something the organization has

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**As a health professional, in what ways would you like to see mobile technologies benefit you?**

Developing medical devices for the mobile world involves creating more “communicative” devices. That is, devices should be able to sense information, store data, and logically convey those data through multiple modalities to help caregivers and patients recognize a critical or important change in health status. The devices should make it simple to gain the greatest amount of useful information, without allowing too much noise in the data. If the device can do this well, then the user’s skill level is irrelevant. I consider myself a late adopter of technology, but when presented with a well-designed application that provides information that can make my life better, it’s easy to adapt. I believe that we can create technology that is so beneficial that people would be crazy not to embrace it.

**What are the greatest challenges when it comes to ensuring that mobile technology is developed and used safe and effectively?**

There are several big challenges in this area. First is that the technology design and implementation are safe from a cybersecurity perspective. As a healthcare worker using mobile technology or as a patient whose life depends on mobile technology, we assume a level of privacy and security similar to how we expect our mobile banking and consumer purchases to be safe and secure. As a clinician, I rely on our information technology (IT) and engineering experts to ensure cyber safety for our patients.

Another major challenge is overcoming the tendency for healthcare workers to make errors. As humans, we will always make mistakes when caring for patients in a complex environment. Mobile technology, if not designed well, adds another layer of complexity. It is essential for engineers to heavily weigh human factors in the design of new products—not just with hardware but also with software interfaces. I personally believe that designing with a focus on reducing human errors is essential for any mobile technology intended for use in the healthcare setting.

Last, in my opinion, there is only one way to ensure that a mobile technology solution is truly a solution: by having a clearly defined clinical problem to be solved and having the data to determine whether the implemented technology solved that problem. Any number of healthcare technology solutions are available in the marketplace, but an “out-of-the-box” solution won’t necessarily help patient care delivery. The most successful technology implementations happen when the project team understands the clinical problem from the start and only implements solutions that can meet the intended need. In my experience, even minor differences in technology can affect healthcare delivery dramatically. Often, the only way to see the difference is by careful examination of process and outcome data.
purchased,” whether it’s a smartphone, tablet, or something else.

Those devices would be used for secure texting between providers, for example, or for sending waveform data from individual patients across the hospital network to providers. Also included in this category, said Piepenbrink, who has 30-plus years of HTM experience and served as director of clinical engineering at Boston Medical Center, would be telephony communication between a patient’s family and the provider.

Mobile health, on the other hand (in Piepenbrink’s view), is external to the hospital. “That’s where we’re talking about things like smart scales or the Apple Watch, where patients are using the device at home, but they’re still under the watchful eye of their provider.”

Currently, he said, the “mobility” category of mHealth is having more of an impact on the HTM community, because those mobile devices are integrated with the health technologies (e.g., cardiac monitors) supported by these professionals.

“Mobile health,” however, is gaining ground quickly and presents a growing opportunity for HTM, Piepenbrink said. “Particularly as hospitals focus on decreasing length of stay and moving patients back to their homes. I think most organizations have the capability to support home-based equipment like infusion pumps and ventilators if afforded the resources to do so. I think that’s potentially fertile ground for HTM.”

James Welch, who provides medical product innovation and development services as president and chief strategy officer at ARC Biomedical Consultants in Bend, OR, agreed (see sidebar on this page). With mobile technology now more than a decade old, “it’s become mainstream for healthcare providers just like it’s become mainstream for healthcare consumers,” he said. “That means we can no longer think of healthcare delivery as something that occurs only in brick-and-mortar acute care facilities. And for HTM professionals, this has revolutionary implications.”

For example, Welch said he wears a ring on his finger that measures his vital signs and sends the data to a cloud-based server that his physician can then access from almost anywhere. Someone else might use another mobile device to send blood pressure readings to their cardiologist or SpO₂ (peripheral capillary oxygen saturation) readings to their pulmonologist.

These hand-held devices, Welch noted, “are becoming primary systems for onboarding all kinds of information. So the services that HTM professionals are expected to

mHealth Safety: The Role of HTM

Many of the technologies that use mobile platforms as their gateways into the EHR have not been cleared by the FDA, noted James Welch, president and chief strategy officer at ARC Biomedical Consultants—and even those that have been approved may not be worth implementing “if the risks outweigh the benefits.”

For that reason, he said, HTM professionals have an important role to play around ensuring that their facilities make informed decisions about the mobile technologies they decide to use. “It’s like smart infusion pumps, where drug libraries are integrated with the pumps. Every hospital purchases these pumps, but if they’re not implemented properly with the right governance, the right safety, and the right oversight, then many clinicians will just override them.”

The result, Welch said, is the “illusion of a safer system, when in fact you’ve made the system less safe.” Mobile technologies are similar in that they require planning, risk management, and support. “And if your infrastructure is not capable of supporting a critical [mobile] application like alarm notification, then somebody could die.”

HTM professionals, according to Welch, should embrace mHealth and its associated challenges because “all of those elements needed to maintain safety are well within your wheelhouse.” He recommended “learning as much as you can about these technologies, and creating alliances with your chief patient safety officer and the leaders of your IT department.” Further, he suggested getting out of “fix-it mode” and instead “shifting into medical application mode.”

Clinical engineers, biomedical equipment technicians, and others in HTM are optimally positioned to help guide their leadership toward taking advantage of these new technologies “to improve care, improve patient safety, and lower costs,” added Welch, and if they approach mHealth “with open eyes,” they have a lot to offer their institutions.

“There are charlatans out there—companies that say they’re ‘medical grade’ without any real explanation of what that actually means. So lean in to mobile tech, but be a little bit skeptical,” advised Welch. “And definitely don’t ignore it, because there’s no turning back.”
provide, the evaluation mechanisms that they provide, the guidance and consultant services they offer—in all of these areas, as they’re working with the products that connect to these mobile platforms, clinical engineers and biomedical equipment technicians are going to have to move well beyond their traditional spaces.”

**Improving Communication in Clinical Settings**

While Welch called the mHealth shift a “renaissance,” many HTM professionals on hospital floors already consider it business as usual. At Texas Health Huguley Hospital Fort Worth South, for example, where Melissa Gillin, CRCST, CSPM, is manager of sterile processing, the two team members managing durable medical equipment outside of the department each carry an iPad.

“They have a program they use to track all of the requests from the hospital,” Gillin explained. “So if they need a pump—if they need it picked up or delivered or cleaned or serviced—all the requests come to that mobile device.” When a call comes in, the employee can use the device to indicate that they’re taking the job right away or putting it on hold. If they accept the job immediately, they can enter their start and end times. And if there’s a delay, they can enter the reason why. “It’s instant communication between the employee and the department that needs that work done.”

Before they implemented the mobile system, Gillin said, the communication process was much less efficient. “A nurse would have to go to a desktop computer and put in the order, then it would print to sterile processing. But if our techs were out on the floor, they wouldn’t get it until they came back to the department” to check the printer, which in some cases could be a long time.

“If they were tied up doing something else, then we’d have a patient who wasn’t getting the equipment they needed,” explained Gillin. “So the nursing staff, when they didn’t get their order fast enough, they’d call sterile processing, get ahold of an employee, and tell them what they needed. Then, that employee would take the pump”—or whatever the device was. “But in the meantime, while they were out delivering it, someone else might come in and see the printed order,” she said. That individual might then take another pump and deliver it to the nurse as well. “So now you’d have two pumps with the same patient, and two employees who took an order. It was often a waste of time and wasted equipment.”

Staff also use mobile technologies at Huguley for patient and employee rounding, Gillin said. For example, a nurse will visit patients in their rooms and ask them how they’re doing, whether they need anything, and inquire about their pain level. Responses are recorded on a hand-held tablet and forwarded immediately to the nursing director.

“That way, if there’s anything that needs to be taken care of for that patient, they’re aware of it, and it allows us to trend and track patient experience on the unit,” Gillin explained. For employee rounding, the process is similar: They use a tablet to track employee experiences and needs, with questions that ask them not only about their work lives but also about anything in their personal lives that might have an impact on their work.

“So we’re able to trend it out to what that personal connection is with them. And because it’s mobile, we can do it anywhere. We’re walking around the halls, seeing employees, and saying, ‘Hey, let’s stop and talk for a minute.’ Then, we can put that information in right away,” Gillin said.

One thing they try not to do at Huguley is use smartphones for communication between staff. “It is permitted, but we’re asked to go to a private and secluded area if we’re going to text,” Gillin said. Their reasoning is that when patients or their family members see staff texting, they may not understand they’re doing so for work. “It kind of sets a bad precedent—that we’re not paying attention to you; we’re playing with our phones.”

**mHealth Development Considerations**

If ensuring appropriate smartphone etiquette is a consideration for staff at Huguley Memorial Medical Center, the recent focus for Tobey Clark, CCE, CHTM, AAMIF, engineering supervisor with Instrumentation and Technical Services (ITS) at the University of Vermont...
Making Mobile Global

Tobey Clark, of UVM’s Instrumentation and Technical Services (ITS) department, also serves as codirector (with colleague Michael Lane) of the organization’s World Health Organization (WHO) Collaborating Center for Healthcare Technology Management. The center, Clark explains, is focused on developing and conducting online training courses and on-site seminars on HTM and support for low- and middle-income countries around the world. His role in that position covers a lot of ground, Clark said, but one particular area he’s interested in involves helping hospitals that lack developed EHR systems use mobile technologies as healthcare tools.

“I think there’s a real opportunity around smartphones specifically, because at this point we’re seeing that smartphones are almost everywhere, even in the poorest areas of the world.” The devices, according to Clark, could be “very useful for collecting patient data and interacting with patients” and, when used with the right applications, could provide many of the same services the typical EHR offers in most modern U.S. hospitals.

Clark said he’s seen a number of apps that claim to provide this kind of functionality, but one of the most promising—in his opinion—is a tool called “MEDSINC” from THINKMD. The Burlington-based company’s mission, according to its website, is to “eliminate preventable deaths by developing solutions that expand and redistribute clinical assessment capacity and competency by combining next-generation clinical intelligence software with mobile technology” to increase access to healthcare services and decentralize healthcare delivery.7 MEDSINC, according to THINKMD, “provides immediate clinical severity assessment and illness screens” for a growing list of serious health conditions, including anemia, malnutrition, and respiratory problems.

“The key thing about it is it can run on any smartphone,” Clark said. “It’s browser based, and it can be easily used by nonclinicians.”

Additional information on MEDSINC and THINKMD can be found at www.thinkmd.org, while more details about the more than 800 WHO Collaborating Centers worldwide is available at www.who.int/about/who-we-are/structure/collaborating-centres.

(UVM), involved mobile technology privacy and security.

Earlier this year, at a hotel in Burlington, Clark served as moderator for a panel on the subject during a workshop on medical device security. The panel explored issues with at-home health monitoring specifically, but the concerns that were raised have implications for HTM professionals in the hospital environment.

“Most of the attention in the past has been on general issues with cybersecurity and mobile devices, and now it’s moving more toward the personal health information derived from the devices patients are wearing, whether they’re prescribed by a physician or not,” he said.

During the panel, questions were raised about the possibility for data corruption on mobile devices, Clark said. “If you have a device in the home that’s sending data to the hospital with a modem you’d get at a place like Best Buy, how can we know it’s going to be safe? Do we need to have medical-grade modems in people’s homes or are commercially available models OK? And do we need to get alignment with the cable providers and those who provide connections to the home? Do they need to understand these issues as well?”

The staff that are part of ITS, Clark explained, primarily use Microsoft Surfaces for their work, and the main mobile tech issue they run into is getting strong Wi-Fi connections. “We’re an independent service provider, so when we go into a hospital, we’re not employees of that facility. That means we’re often having to use the hospital desk Wi-Fi, or in some cases, we’re using a cellular connection.”

Security, usability, and functionality are top concerns for other HTM leaders as well— including at least one who is based overseas. “In the UK,” said Rob Turpin, healthcare market development manager for the BSI Group (also known as the British Standards Institution), “we see mobile technologies as tools that can drive efficiency and provide better diagnoses within our National Health Service.”

They can do so, he explained, by allowing patients “to self-manage conditions” and take preventive steps to avoid unnecessary hospital visits, but they do come with multiple “big questions” that must be addressed before they can be implemented.

“Firstly, are these mobile health solutions safe and effective, and what’s the evidence that supports them? And who’s going to pay for these solutions? How do healthcare services
actually purchase these solutions, and how will those solutions impact the way things are done currently within hospitals and other care settings?"

Finally, Turpin said, there’s the difficult question of which healthcare apps and mobile solutions on the market are most worth using in the first place.

“The thing I always wonder is whether this new app is just following the trends, or is it addressing a real-world problem?” There is definitely high demand for good mobile health solutions, he feels, but where he’s seen these tools working best “is where developers have gone into a hospital, or to a healthcare practice, and spoken to the frontline clinicians” to identify pressing issues.

Then, said Turpin—and preferably after the developer determines how the product might be regulated as a medical device—“that’s when they should take those problems to propose a mobile solution. When it works that way, I think it can work very well, as long as people look at the right information, and the regulations and the standards, at the earliest opportunity.” (The app Mersey Burns, he said, is a perfect example of a clinician-facing tool he believes was developed in the right way. The free app—the first such tool to be regulated as a medical device in the UK—runs on a wide range of smartphones and helps clinicians working with burn patients.)

**Innovations and the Unexpected**

Dr. Colleen Hughes Driscoll, of UMMC, wasn’t interested in creating an app—or, for that matter, a tool for use by anyone outside of her organization. She did want to develop a system, however, that would resolve the communication issues her team experienced every day, and she was convinced she could do so with a mobile solution.

That development process, which began in 2015, ultimately led to a wireless text-messaging system that won the Intelligent Health Association’s “Grand Award” for 2016. Writing
about the project in an article published in the May/June 2017 issue of American Journal of Medical Quality, Driscoll and her three coauthors explained how they used middleware (with help from the UMMC Clinical Engineering department) “to create a wireless connection between the bedside computers in L&D with the hand-held devices” of the clinicians in the NICU. It was the first such system, they wrote, “to demonstrate that a wireless delivery messaging system can improve the consistency of communication for neonatal resuscitation.”

The platform eliminated the need for an overhead communication system, which reduced the noise issues in the two departments, and allowed an alarm in a patient’s room to transmit directly to a nurse’s mobile phone. And finally—and perhaps most importantly—if a nurse received an alarm and could not respond immediately, they could forward the alert to a coworker via their phone.

The text-messaging functionality of the system wasn’t something she gave much thought to at implementation, Driscoll recalled. “I was even a little dismissive of it at first. It was just something that came with the middleware—I didn’t think we’d really use it or have a need for it.”

She quickly realized she was mistaken. Within two hours of giving people their phones, most were already texting one another. “It was amazing, and not only because of the texting itself, but in other ways that I didn’t expect, like the way it helped with culture building,” said Driscoll.

Nurses, for example, started using their phones to tell colleagues there was a fresh pot of coffee in the lounge. “That used to be something we would overhead page, and it would just be a nuisance to everyone but the people who wanted coffee.” It was an instant improvement, Driscoll said, “and it was so simple it hadn’t crossed my mind.”

In the three or four years since they introduced the system, it’s gone through a number of iterations to make it an even better fit for UMMC, Driscoll added. By listening to feedback from her colleagues—and with technical help from the organization’s clinical engineering systems architect, Samuel “Sami” Gurmu—it’s morphed into the mobile platform they have today.

Nurses still carry their phones, and they can still text and receive and forward alerts, but now their patients (expecting or new mothers) can also use the system through a touch-screen panel on the wall at their bedside. That panel, Gurmu explained, is tied-in with clinicians’ phones and with the EHR. He facilitated the integration through close work with vendors, as well as ensured that the final product would meet the needs of staff by asking lots of questions initially.

“That’s what I’d tell anyone who wants to do something similar,” he said. “Talk to your end users and talk to everyone involved—information technology, the doctors and nurses, anyone who understands the current workflow and the changes that will make things better.”

A mobile solution, Gurmu said, then can be tailored to the situation. “You can’t try to give them tools you think they want. You have to give them what they actually need.”

References