

Chapter 2

From Telemedicine to Telehealth to eHealth: Where Does mHealth Fit?

Overview

Diabetes, high blood pressure (BP), and other chronic diseases can cut years from a person's life and reduce the quality of life during those years. Sadly, despite the state of our medical knowledge, these diseases are on the increase in the USA, fueled by the growing obesity epidemic among children. Treatment for chronic diseases accounts for a significant portion of our health-care dollars and has hidden costs to individuals and to the system. Chronic care is by definition long term, often lifelong, and often involves complex self-care protocols that are difficult and time consuming for patients, especially children and the elderly, to follow. Because the consequences of changes in relevant health markers can be life threatening in some chronic illnesses, the supervision of self-care by a trained clinician is essential. For example, a rise in blood glucose for a diabetic can signal the need for additional insulin. If the insulin is not administered in time, the person can become unable to deliver the needed treatment independently. Remote monitoring, tracking health data from afar, can help doctors and nurses intervene when needed to save lives, prevent hospitalization, and decrease costs associated with inpatient care.

When the field of telemedicine (literally, "medicine at a distance") emerged more than 40 years ago, it was principally focused on providing diagnostic and health monitoring services to patients living in remote or rural areas. Early telemedicine programs were predominantly hospital-based, and telemedicine effectively expanded the market area it served and increased referrals to the sponsoring hospital. The most widely used data transmission technology at that time was hard-wired telephone lines, with some opportunities for video interfaces. For patients, the greatest benefits of early telemedicine programs were reduced travel time and costs, and access to specialist consultation services not available locally. Technology innovations supporting high-speed communications and more robust computer processing coupled with reform initiatives have enabled the migration of telemedicine over the past decade to a mainstream health-care delivery mode supporting a broader array of health-care services and benefits for both providers and individuals (Galewitz 2012; Brown 2013). Data from a *Hospital & Health Networks* survey has shown

that 70% of the “most wired” US hospitals offer some form of telehealth (Jackson 2011; Page 2011).

Currently, there are two drivers for the rapid expansion and adoption of computer-based health-care products and services—the availability of affordable technology and the changing health-care delivery environment. Since the necessary technology has been available for some time, why has technology alone been insufficient to drive significant industry changes? The short answer is “money.” Prior to health-care reform, there was little financial incentive for providers to develop telemedicine beyond its basic remote monitoring programs unless it served a specific organization strategic goal. But money is a powerful motivator in health care. Newly implemented readmission penalties for providers serving Medicare and Medicaid patients are expected to drive hospitals to develop telehealth programs that monitor and manage postdischarge treatment to prevent unplanned readmissions. And, as health-care delivery is distributed more fully along the continuum of providers and facilities, these applications will diffuse more broadly as well.

As this chapter will show, remote monitoring of important health indicators such as BP and blood glucose and transmission of relevant information are key elements of telemedicine services that can be well met by mHealth apps. Current technology makes this type of monitoring easier and more convenient than early systems and expands the process from one-way information transmission to information exchange between patient and provider. mHealth products will help to transform telemedicine from a provider-driven tool serving selected patient populations to one that facilitates patient engagement and empowerment across the continuum of health-care services.

What Is Telemedicine?

For this book, we will rely on a modification of the definition developed by the American Telemedicine Association (ATA), which defines telemedicine as

the use of medical information exchanged from one site to another via electronic communications to improve a patient’s clinical health status. Telemedicine includes a growing variety of applications and services using two-way video, email, smart phones, wireless tools and other forms of telecommunications technology (ATA website).

When the term “telemedicine” entered our vocabulary several decades ago, the health-care industry operated very much in a medical model of “sick care,” and the concept was used to describe information transmitted for diagnosis or treatment of specific conditions. As our medical model has grown more inclusive of managing health as well as managing disease treatment, the term “telehealth” has emerged and the terms are used interchangeably, just as we use medicine and health in our daily language. The distinction is not precise; both refer in general to using telecommunication devices to transmit information related to health care. As our focus is explaining how mHealth applications can extend and add value to information and services delivered through telecommunication devices and computers, we prefer

Table 2.1 Services provided via telehealth. (Source: American Telemedicine Association website www.americantelemed.org/)

Service	Description
Primary care and specialist referral services	May involve a primary care or allied health professional providing a consultation with a patient or a specialist assisting the primary care physician in rendering a diagnosis. This may involve the use of live interactive video or the use of store-and-forward transmission of diagnostic images, vital signs, and/or video clips along with patient data for later review
Remote patient monitoring, including home telehealth	Uses devices to remotely collect and send data to a home health agency or a remote diagnostic testing facility (RDTF) for interpretation. Such applications might include a specific vital sign, such as blood glucose or heart ECG or a variety of indicators for homebound patients. Such services can be used to supplement the use of visiting nurses
Consumer medical and health information	Includes the use of the Internet and wireless devices for consumers to obtain specialized health information and online discussion groups to provide peer-to-peer support
Medical education	Provides continuing medical education credits for health professionals and special medical education seminars for targeted groups in remote locations

the “telehealth” label. Thus, we propose to modify the ATA definition as *the use of information exchanged from one site to another via electronic communications to monitor, maintain, or improve an individual’s health status.*

The ATA website, http://www.americantelemed.org/learn_ lists an array of services considered telehealth that include transmission of published health information, continuing medical education programming, patient portals, and call centers for real-time clinician consultations. The services typically provided using a telehealth model fall into four broad categories. Table 2.1 lists and describes each of the four categories.

So many information-based services are labeled telehealth by virtue of the digital transmission factor that it is necessary to make the distinction that the technology itself, while a necessary element, does not constitute a telehealth application. Generally speaking, health information technology (HIT) enables telehealth, which is the actual delivery of a health-related service from one site to another site remote from the first.

In addition to categorizing the types of services provided, the ATA has classified the most commonly used design models for telehealth programs. *Networked programs* link tertiary care hospitals and clinics with outlying clinics and community health centers in rural or suburban areas. The links may use dedicated high-speed lines or the Internet for inter-site communication links. The ATA estimates

the number of existing telemedicine networks in the USA at about 200, providing connectivity to more than 3000 sites.

Point-to-point connections use private high-speed networks. This type of system is used by hospitals and clinics that deliver services directly or that outsource specialty services to independent medical service providers. Examples of outsourced services include radiology, stroke assessment, mental health, and intensive care services. *Monitoring center links* are the model of choice for cardiac, pulmonary, or fetal monitoring and for care and services provided to patients in their home. Often regular landline telephones or wireless connections are used to communicate directly between the patient and the center although some systems use the Internet. *Web-based e-health patient service sites* provide direct consumer outreach and services over the Internet. Under telemedicine, these include those sites that provide direct patient care.

Impact of Health-Care Reform: The Affordable Care Act (ACA)

The market for remote monitoring technology, especially for home telehealth care and disease management, is predicted to reach US \$ 295 million by 2015. And, as the market for telemedicine grows, it is expected to shift away from traditional services toward consumer-focused products, too. Some experts anticipate that growth will also occur in remote monitoring of intensive care units (ICUs). The eICU is seen as a viable way to reduce costs and respond to physician and nurse shortages associated with staffing ICUs 24/7 (Caramenico 2012). However, these applications can be costly—eICU units can cost US \$ 6–8 million to establish, not including staff salaries.

The ACA creates a variety of financial incentives for hospitals with Medicare patients to use remote monitoring. For example, patients with chronic diseases such as congestive heart failure (CHF) are expected to increase significantly, especially with the trend toward an aging population, and facilities with extensive inpatient stays and readmissions are being penalized by new reimbursement programs. Thus, the ability to remotely measure the patient's weight, BP, and oxygen levels to monitor changes and ultimately reduce or avoid hospital admissions becomes a driver for hospitals under ACA incentives (Lowes 2013).

Mario Gutierrez, executive director of the Center for Connected Health (CCH) Policy, suggests that the ACA is creating the “perfect storm” for expansion of telehealth as a delivery mode. In his opinion, expanded insurance coverage will increase service demand to an extent that cost control will require virtual patient engagement (Bowman 2013).

Telehealth Research

Research in the early telemedicine era had a strong focus on cost effectiveness and patient satisfaction, and results were inconsistent among studies. Generally speaking, clinical outcomes differed among the various programs as did cost savings,

and patients typically based “satisfaction” on the ease of use and personal time and money savings. Using the *Journal of Telemedicine and Telecare* as an industry indicator, the volume of research on patient satisfaction appears to have declined in recent years. Possibly, the pervasiveness of computers in an individual’s work and personal life make computer-assisted health care more acceptable and satisfaction is a less relevant concept than when the technology was unfamiliar to many people. Conversely, the number and variety of applications seems to be increasing. Again, the pervasiveness of computers in business and society, and the advent of mobile computing, are easy explanators for this observation. Research topic trends aside, robust research offers important information to guide product development and to establish care protocols.

The Whole System Demonstrator (WSD) program, sponsored by Britain’s Department of Health, is the largest randomized control trial of telehealth and telecare in the world. The intent of the study was to quantify the impact of telehealth to inform investment decisions in programs that could enable people to live independently and to take control and be responsible for their own health and personal care. Data collected for this study showed that remote monitoring decreased patient deaths by 45%, reduced emergency visits by 15%, and reduced associated costs for health-care services. As a result of these findings, Britain’s Department of Health embarked on a project known as 3 Million Lives to install remote monitoring devices in the homes of 3 million patients (Britain’s Department of Health 2011).

A Swedish study found that mobile phones provide a fast and safe method of reporting pain postoperatively in real time. This finding is important because early pain management is a key factor in treating postoperative pain to prevent postoperative emergency department visits and also in reducing the risk of developing a chronic pain syndrome that can affect the quality of life and prove costly in recurrent treatment. However, because the study sample was small (37 participants), further studies are required to better inform policy (Stomberg et al. 2012).

A recent telehealth study found that 7% of US physicians are using videoconferencing chats with patients, and they use them more often for routine follow-up visits than for urgent care or acute care conditions. This approach is less costly and more convenient for patients, which leads to improved patient satisfaction with the overall encounter. It is also a clear shift toward using telehealth technology for the convenience of local patients, in contrast to the earlier model of providing specialty services to remote patients. The study also found that psychiatrists and oncologists are more likely to use video chats than other physician specialties (Manhattan Research 2011). In these specialty areas, the need for quick response to patient needs may be a key driver over convenience.

According to a 2013 study, follow-up telephone calls to postambulatory surgery patients can safely substitute and be as effective as face-to-face visits in selected low-risk cases. From the patient perspective, this telehealth approach decreased travel time and expense while improving patient satisfaction. From the provider perspective, the telehealth calls freed up time in clinics to see new patients (Hwa and Wren 2013).

Because less than 50% of patients with high BP in the USA have their BP under control, telehealth represents a practical and cost-effective method to improve BP management for these patients. A 12-month study conducted by researchers at HealthPartners Research Foundation in Minnesota used home telemonitoring combined with actual pharmacist case management via phone conversations to improve BP management. Home BP monitoring, in which patients routinely measure and transmit their BP measurements, was found to improve patient satisfaction too. Home monitoring offers advantages over face-to-face traditional office visits in which misclassifications often result from white-coat hypertension, a situation where the patient's BP increases simply because it is being measured in a clinical setting, which causes anxiety in some patients (Margolis et al. 2013).

Studies of telemonitoring interventions for patients with chronic diseases have increased within the past decade. Moreover, the evidence produced by these studies has become more and more important to a wide range of policy makers, clinicians, insurers, and other key health-care stakeholders. Despite the importance of this research, little formal assessment of these studies in the aggregate has been conducted. One recent study of methodological quality calls into question the research methods used. There appeared to be a lack of scientific rigor used in evaluating the claims of reduced costs and improved quality for home telemonitoring (Kitsiou et al. 2013).

The VA Story

A total of 289 hospitals made the *Hospitals & Health Networks* 15th annual "most wired" list, including the Veterans Administration (VA) hospital network. Moreover, the VA, which is the nation's largest health delivery system, with 152 medical centers and 1400 outpatient clinics and other facilities, was recognized for taking technology "beyond the four walls of the hospital" and for ambitiously using telemedicine to assure that veterans get care as close to home as possible, and often at home (Weinstock 2013).

So far, the biggest use of telemedicine has been by the military and the VA (Baum 2012). In fact, the VA has used home telehealth services to manage chronic conditions at an unprecedented scale when compared with other health services organizations (Broderick and Lindeman 2013). And, the VA uses aggressive approaches to increase the number of veterans who benefit, such as the Federal Ruling issued on March 06, 2012 that waived co-payment charges to veterans for home video telehealth services (VA Final Ruling 2012). This exemption opens the telehealth program to all veterans, including those who previously could not afford to participate because of co-pay barriers.

The US Department of Veterans Affairs signed a 5-year, US \$ 28.8 million contract with AMC Health, a New York-based provider of telehealth solutions and services. VA telehealth programs reach approximately 500,000 veterans and are expected to extend that number to 800,000 by the end of 2013. A total of 1.3 million consults were reported for 2012. AMC Health represents an outcomes-based approach to telehealth that aligns with the VA's telehealth goal to actively engage

patients so they proactively self-manage chronic conditions (AMC Press Release 2013). In addition, the VA is committed financially to expanding its telehealth programs into other areas, including palliative care and dementia care. In April 2011, the VA awarded US \$ 1.38 billion in national contracts for home telehealth devices and services over a 5-year period. Well over 90,000 veterans were expected to enroll in its home telehealth program by the end of 2012 (Broderick 2013b).

The VA's commitment to telemedicine is long-standing. Since the 1990s, information and communications technologies, including telehealth, have been at the center of system-level transformation to furnish continuous, coordinated, and comprehensive primary and specialty care for its veteran population. The VA Office of Telehealth Services houses a program called Care Coordination Home Telehealth (CCHT), established in 2003 targeting chronic conditions such as diabetes and hypertension and posttraumatic stress disorder (PTSD). CCHT uses remote monitoring devices in veterans' homes to communicate health status and to capture and transmit biometric data, which is monitored remotely by care coordinators, who are usually nurses or social workers, but can also include physicians, pharmacists, dietitians, and occupational therapists (Broderick 2013b).

Promising results from program efforts have been reported, including reduced hospital admissions and high rates of patient satisfaction. Decreases in health resource utilization were largest in highly rural settings (50.1%) and urban locations (28.2%), and patient acceptance was high, with only 10% of patients declining participation in telehealth home services (Broderick 2013b). The technologies used most in CCHT are messaging and monitoring devices (85%), videotelemonitors (11%), and videophones (4%). The messaging devices ask patients questions that assist in monitoring their health status. Monitoring devices record vital sign data. Videophones and videotelemonitors are used in audio-video home consults (Broderick 2013b).

In 2011, American Well teamed with the VA to provide online behavioral health services to patients in Minnesota and remote oncology consultations to patients in Nebraska. These types of collaborations are decreasing facility-level costs to the benefit of the system as a whole. A single VA hospital in rural Oregon saved more than US \$ 88,000 in travel expenses alone during the FY 2011 by shifting 3224 patient encounters from traditional face-to-face visits to telehealth services (Cerrato 2012).

The VA has reported reductions in emergency visits and hospital admissions using remote care coordination at its Clarksburg, West Virginia hospital. About 95% of patients accessing services remotely from the Clarksburg hospital live in rural areas. Increasingly, the VA is using home monitoring for care coordination of patients diagnosed with chronic diseases such as diabetes, CHF, pulmonary disease, or hypertension, and those who are living in Ohio, Delaware, Pennsylvania, or West Virginia are monitored remotely by the Clarksburg facility. Patients routinely send readings from a device that is connected to a wired or cellular phone. A nurse monitors the submissions and makes follow-up calls to patients and a physician when readings are abnormal (Charleston Gazette 2010).

The VA's telehealth program includes home monitoring, video consults, and "store-and-forward" telehealth, which refers to the capturing of digital images, video, audio, and clinical data and storing this information on a computer or mobile device for forwarding at a convenient time to caregivers (AMC Press Release 2013).

Meeting the Needs of Rural and Underserved Populations

Telehealth has the potential to bring health-care services, especially specialty medical care consults, to rural, remote, and underserved populations in the USA. But if those populations do not have access to affordable broadband services on which mobile technology relies, how will telehealth programs fulfill these expectations? The Federal Communications Commission (FCC) established the Rural Health Care Program 16 years ago, with the goal of securing funding for broadband infrastructure and services for rural and underserved areas. To date, the FCC has fallen far short of this goal. Government oversight has criticized the FCC for lack of progress and failing to adequately develop assessment programs and measurement goals. Meanwhile, the ATA complained that the FCC annually reserves more than US \$ 300 million in funds that could be used immediately to help improve Americans' access to health services and help reduce the cost of health care (Wicklund 2011). Growth markets in telemedicine include both rural and underserved areas. California became a first mover with the Telehealth Advancement Act of 2011 that expanded access to health care in rural areas and inner cities by offering more telehealth services (Telehealth 2011).

The CCH, a nonprofit division of Boston-based Partners Health care system, employed nontraditional interventions aimed specifically at altering behaviors in underserved populations. The center has primarily connected with the underserved through text messaging, mostly because of its simplicity and availability to this population group. Text messaging interventions have focused on prenatal and addiction patients. Prenatal care works well for program evaluation because start and end dates are clearly established. Seventy-two percent of women involved in prenatal programs reported feeling more connected with their OB/GYN physician and the physician practices had better show rates for appointments. The center is in the process of building apps to use for pain management (Perna 2013).

UnitedHealthcare joined with Cisco in implementing its new "Connected Care" program which connects patients in underserved areas with primary care physicians, specialists, and hospitals by using telehealth applications. Physicians conduct virtual patient examinations in real time using a two-way video screen and also interact with the patient and an on-site nurse at the point of care performing the actual medical tests (Keller 2010).

Increasingly, individuals in small rural areas are being treated by doctors and nurses using webcam-enabled telehealth. Approximately 25% of the US population resides in rural areas that are medically underserved. Furthermore, the need for care will increase as the population ages in remote areas such as South Dakota where the

proportion of people over the age of 65 is 72% higher than in the rest of the USA and is expected to double by 2020 (Abrams 2012).

Avera Health Network, which began in 2009 with a US \$ 13 million start-up grant from the Helmsley Charitable Trust, is believed to have the only long-distance critical care program in the USA and perhaps the world. The nonprofit network provides a range of telehealth services such as high-definition two-way video consulting that make it possible for experts to be available 24/7 in locations throughout the Dakotas (North & South), Minnesota, Iowa, Wyoming, and Nebraska. Four main services provided by the network include eConsult, eICU Care, eEmergency, and ePharm. As of October 2012, Avera Network, based at Avera McKennan Hospital in South Dakota, reported an 18% decrease in ambulance and helicopter transfers to major hospitals, resulting in approximately US \$ 6.6 million saved and keeping health care in local communities (Abrams 2012).

Telehealth gives hospitals the opportunity to provide specialty medical care that is cost effective and convenient to rural patients. In sparsely populated western states such as Washington, travel time for specialty care at an urban medical center can take up to 10 hour round trip. In addition, telemedicine can build referral patterns for transport of critical patients. Especially important is that telemedicine services can improve clinical outcomes for discharged patients, which contributes to a hospital's effectiveness ratings and reimbursement and contributes to sustainability and growth (Page 2011).

The Business of Telehealth

In addition to the partnerships forged in meeting the needs of the rural and underserved populations, opportunities for business development and relationships exist in other health markets. The development of many personal use mobile health apps are conceptualized around the device itself such as cell phone or tablet. The question has become, *What can we do now that the consumer has a smartphone?* Meanwhile, the evolution of telemedicine represents using the mobile device as a means to solve a variety of problems, including decreasing costs, increasing access to care and services for patients, and ultimately improving the quality of care and health status. Smart clothing that integrates wearable electronic sensors into clothing is in the works for remote patient monitoring (RPM). With a smartphone, the individual often is required to manually enter the data, whereas smart clothing would track and report vital signs automatically—without needing the wearer to do anything. John Vu, CEO of Misfit Wearables, a core start-up company that looks to integrate wearable sensors into everyday clothing is realistic about the challenges of developing smart clothing, including battery life and complete invisibility. But the savvy CEO also sees the potential impact of smart clothing on remote monitoring (Farr 2013).

In 2012, Sprint launched a new gateway device with the veteran home monitoring company Ideal Life of Toronto, Canada. The product is similar to what Verizon and Qualcomm offer, a series of at-home remote monitors for BP, weight, glucose

readings, mobility, and other vital sign data. Data are collected from monitors using wireless technology and stored in a cloud database that can be accessed by physicians and caregivers. Alerts are sent when readings exceed normal ranges. Well-designed home monitoring systems make integrating remote monitoring data easier for a hospital or other care provider (Jackson 2012).

In 2011, Walgreens partnered with the IT giant Cisco to furnish telehealth and on-site clinical services for more than 40,000 Cisco employees and their family members at the company headquarters and the Cisco campus in North Carolina. Walgreens will run Cisco's LifeConnections health center, the brick-and-mortar clinic at the company's headquarters in San Jose and also provide telehealth services, including virtual physician visits, at the North Carolina campus. Both Cisco and Walgreens have previous telehealth collaborative experience. Cisco is already involved in a joint effort with the health insurer UnitedHealth Group. The two created a nationwide network to enable video medical imaging, audio communication, and health record information to be exchanged between health-care providers and patients from remote locations such as retail stores and office settings. Cisco and UnitedHealth Group successfully tested the telehealth program in a pilot study with more than 300 Cisco employees in San Jose over a 7-month period in 2009 (Mearian 2011).

Physician entrepreneurs are in the telehealth game as well. A 37-year-old cardiologist with an MBA founded Telemed Ventures and became CEO of Smart Care Doc, a telehealth business with the goal of providing affordable health care in areas underserved by providers (Baum 2012). However, most companies involved in telehealth are venture-backed start-ups. Walmart had a poor experience in their 2005–2007 efforts, and if (when) Walmart gets involved in telehealth in a big way, it will probably be with an established health-care partner. The struggles with telehealth are not unique to Walmart as many plans of the large, established insurers such as UnitedHealthCare and Blue Cross have also struggled with telehealth services (Cannon 2012). The critical question for entrepreneurs, investors, and insurers is whether pilot projects and partnerships, which can be successful at the local level, will translate effectively and profitably to a much larger national scale.

Benefits, Disadvantages, Challenges, Barriers, and Opportunities

Benefits

According to the ATA, the growth enjoyed by telehealth ventures to date has occurred because of four main drivers—access to needed services, cost savings, improved quality, and patient interest. From its inception more than 40 years ago, telehealth applications have been promoted for their ability to bring health-care services to patients in distant locations. Not only does telehealth improve access for patients but it also allows physicians and health facilities to expand their reach, beyond their own offices. Given the provider shortages throughout the world—in

both rural and urban areas—telehealth has a unique capacity to increase service to millions of new patients.

Reducing or containing the cost of health care is one of the most important reasons for funding and adopting telehealth technologies and has received as much attention in the literature. Telehealth research has shown reductions in the cost of health care and increased efficiency through better management of chronic diseases, shared health professional staffing, reduced travel times, and fewer or shorter hospital stays.

The third focus of the familiar health-care trilogy—quality—has received its own share of investigation. Studies have consistently shown that the quality of health care services delivered via telemedicine is as good those given in traditional in-person consultations. In some specialties, particularly in mental health and ICU care, telemedicine frequently delivers a superior product, with better clinical outcomes and patient satisfaction.

Finally, considering demand, it is clear that consumers want telehealth products. For the individual patient, the greatest impact of telehealth is personal—how it directly benefits the patients, their families, and their communities. Using telemedicine technologies reduces travel time and related stresses for the patient. Over the past 15 years, study after study has documented patient satisfaction and support for telehealth services. Such services offer patients the access to providers and medical services that might not be available otherwise, without the need to travel long distances (ATA website).

A major benefit of remote monitoring in particular is the potential cost savings to the system, especially as we move toward covering the previously uninsured and the growing number of seniors. Remote monitoring is especially critical in reducing readmissions, both hospital and emergency department. Dramatic decreases in hospital readmissions (75%) have been seen in a 2-year pilot program conducted with Indianapolis-based St. Vincent Health, using remote videoconferencing between nurses and discharged patients. Johns Hopkins is using remote patient training and education, including on-demand videos, streamed to patients' hand-held devices that answer patients' questions about postoperative care (Slabodkin 2012)

Technology Barriers

Currently, remote monitoring systems generally do not feed data directly into electronic health record (EHR) systems. Because of this lack of interoperability, physicians may be forced to either view and manage two separate sources of patient information or reenter remotely captured data into the EHR. However, vendors are working to eliminate this barrier (Lowe 2013).

One of the key challenges of remote monitoring is standardizing the data streams from various remote monitoring devices and systems. While most vendors provide some type of proprietary web interface for clinicians to interact with the data they collect, few clinicians have the time to learn the nuances or to log into multiple proprietary systems to view data. What clinicians require is product standardization so they can access needed data from any system on any type of device (Jackson 2012).

Challenges

Telehealth is not without challenges. Perhaps the biggest challenge is logistics; that is, arranging to have a physician or qualified individual online at the very moment a patient is ready to ask a question. There is no available pool of primary care physicians to standby because these physicians are in short supply and high demand, especially under health-care reform guidelines. Other challenges include patient acceptance, privacy and security concerns, reimbursement ambiguities, and provider liability issues (Cannon 2012). These issues have been acknowledged since the early days of telemedicine, and resolution does not appear imminent.

Do we need healing hands? The laying on of hands has been a long-standing tradition in the delivery of health care. And, there is extensive research demonstrating the value of “touch” in medicine. A simple pat on the back can calm cardiovascular stress, reduce anxiety and depression, and make the patient feel safer. But with patients who are in underserved or remote areas or who cannot afford travel costs or time off from work, in-person contact is not possible or feasible. Thus, telehealth may represent a viable alternative for them (Cerrato 2012). Dr. Eric Topol, a cardiologist and the chief academic officer for Scripps Health, a San Diego-based nonprofit health care network, acknowledges that something will be lost when most face-to-face visits with physicians are replaced by telecommunication data exchanges. However, he says that we are getting “virtual touch” rather than actual touch. While technology can create anxiety in some dimensions, it can also empower patients to assume more control and responsibility for their health (Simon 2011).

Opposition to telehealth is also coming from physicians. The promise of better service is a real threat to traditional physician practices, which often have inefficient systems that cause patient dissatisfaction. Retail clinics became tough competitors for physician practices because they offer patients convenience, including extended hours, good service quality, and lower costs. Telehealth can go beyond those benefits, helping consumers stay healthy anywhere at any time courtesy of smartphones, tablets, and PCs. Studies have shown that consumers like and often prefer virtual visits. A major study by Cisco found that fully 74% of consumers are “open to virtual doctor visits” using technology to improve access and convenience, especially when the e-visit with an online physician is followed by a telephone or e-mail “check-in” a few days later to see how the patient is feeling (Brown 2013; Cisco Press Release 2013). When was the last time your primary care doctor or their office staff called to inquire about your status following an in-office visit?

A recent study showed that there are notable impediments blocking extensive physician use of telehealth. In particular, the major impediments include HIPAA security issues, reimbursement, and physician liability for telehealth-enabled care (Manhattan Research 2011). Some of the barriers to telemedicine have absolutely nothing to do with technology. Instead, they are about money and regulations. The single biggest impediment to the development of telemedicine is reimbursement. As with many aspects of health-care delivery, the payment policies of the public insurance programs, Medicaid and Medicare, are key drivers in the deployment and ac-

ceptance of telehealth applications nationally. Although the federal Medicaid statute does not recognize telehealth as a distinct service (Medicaid.gov website), Medicare's definition of telehealth (42 CFR 410.78) recognizes the use of interactive telecommunications, audio and video at a minimum, to improve a patient's health.

With regard to Medicaid, states have the flexibility in covering and reimbursing for telemedicine services. In general, telehealth is viewed as a cost-effective alternative to the more traditional face-to-face way of providing medical care (e.g., face-to-face consultations or examinations between provider and patient), and states have a great deal of prerogative or flexibility to determine the scope of their telehealth programs, including:

- Whether (or not) to cover telehealth at all
- What types of telehealth to cover
- Where in the state telehealth can be covered
- How telehealth is provided/covered
- What types of telehealth practitioners/providers may be covered/reimbursed, as long as such practitioners/providers are "recognized" and qualified according to Medicaid statute/regulation
- How much to reimburse for telehealth services, as long as such payments do not exceed Federal upper limits

If the state decides to cover telemedicine, but does not cover certain practitioners/providers of telehealth or if its telehealth coverage is limited to certain parts of the state, then the state is responsible for assuring access and covering face-to-face visits/examinations by these "recognized" practitioners/providers in those parts of the state where telehealth is not available (Medicaid.gov website).

Some states do not license telehealth providers, or they place restrictions on how providers interact with telehealth patients. In Maine, a telemedicine visit is billed the same way as a traditional doctor's visit, and Maine law requires private insurers to pay for telemedicine e-visits just as they would for traditional office visits (Tice 2011). However, when it comes to eICU visits, the reimbursement is not there and without reimbursement, eICU visits are proving to be financially unsustainable. However, the eICU concept, which was introduced in 2004 at Johns Hopkins, remains a viable method for many facilities to extend resources to smaller hospitals, especially in rural areas (Abrams 2012).

MaineHealth's VitalNetwork is an 8-year-old critical care monitoring platform that collects vital signs and other medical information from patients in hospital ICUs. This information is shared with eICU specialists in a "command center" in Portland who then consult with clinicians at the point of service and also interact via video connections at the patient's bedside. The network serves Maine's more remote hospital locations that do not have access to expensive resources such as ICU specialists on staff. MaineHealth announced that it will shut down its eICU service on October 1, 2013 claiming lack of reimbursement and budget constraints (Wicklund 2013b).

Some physicians question why their profession is being asked essentially to provide services over the phone for free. They point to lawyers, accountants, and others

who routinely bill for phone consultations (Cohen 2013). If you contact your lawyer by phone to obtain advice, the expectation is that the meter is running and you will receive a bill for the time spent on the phone with the lawyer. Moreover, asking physicians to provide free telephone consults may be a marketing tool for insurers rather than a method for increasing remote access (Cohen 2013).

However, there is some evidence that reimbursement for telemedicine may be changing. Virtual doctors' visits appear to be attracting large insurers and employers. An example is NowClinic online care, a subsidiary of UnitedHealth Group, which is the parent company of the largest US health insurer, UnitedHealthcare, which offers patients web and phone primary care medical services that are both inexpensive and available 24/7. NowClinic began in 2010 and currently operates in 22 states. Other large insurers such as Aetna and Cigna, as well as large employers including General Electric and Delta Airlines, are signing on. In addition, drug stores such as Rite Aid have begun using NowClinic in selected stores in Michigan and Pennsylvania because it is a less expensive option to hiring either physicians or nurses to staff store clinics (Galewitz 2012).

Legal Issues

As it becomes increasingly a more common practice for physicians to do telehealth consults, there needs to be clear guidance about specific situations that may be deemed inappropriate and subject to sanction. While the practice of telehealth may be legal as a delivery option in a given state, it does not mean that there are no restrictions that necessitate guidance to eliminate confusion among physicians (Bompey 2010). State medical boards make it difficult to practice telemedicine, especially if the care is delivered interstate. Many state boards require a prior doctor–patient relationship or even a previous medical examination, which effectively prevents telehealth from being a stand-alone option for care delivery. However, some medical boards are loosening requirements. Nine states, mostly rural, such as Tennessee, Nevada, and New Mexico have eased the process (Galewitz 2012). The Governor of Pennsylvania, Tom Corbett, has also signed legislation to expand telemedicine's use for Medicaid patients. At least 36 other states provide reimbursement for Medicaid patients (Baum 2012).

In 2011, California enacted the Telehealth Advancement Act that eliminated the need for in-person visits as a precursor to receiving telehealth services. Under previous law, telehealth providers had to have at least one in-person visit with a patient before initiating any virtual visits. They also had to obtain special written consent from the patient to allow telehealth care. The new law permits verbal consent and notification instead. In addition, the law eliminates the requirement that telehealth visits be provided in a doctor's office or hospital (Jackson 2011c).

In addition to these state-level actions, the CMS removed credentialing barriers to telemedicine. Medicare's new telehealth credentialing policy permits the hospital receiving telemedicine services to grant privileges to the telehealth physicians using information provided by the physician's home hospital. This means that the hospital

receiving the telehealth services no longer has to conduct separate credentialing investigations and approvals, both of which were time consuming and costly and put an undue burden on smaller hospitals that could not afford the vetting process (Lowe 2011).

In addition, malpractice insurance will also need to change if telemedicine is to grow. This includes permitting physicians to make treatment decisions over the phone rather than restricting physicians to phone triage. Triage services are limited to determining the time frame within which patients need to be seen in person, now versus later, and whether they should be seen at the emergency department or the physician's office (Cohen 2013).

Opportunities

Ultrawideband technology, which is not new, has the potential to expand the market for advanced remote patient care by providing continuous real-time health diagnosis. Even though the technology has been around for over a decade, it has been used mostly in military radar applications. But the capacity to transmit enormous amounts of data quickly, using little energy, could prove extremely useful for telehealth applications. A study done by Oregon State University (OSU) researchers suggests that a patient's body heat could actually provide the power for the sensors. They envision a network of tiny wireless sensors, possibly embedded in a Band-Aid or similar-sized patch, which could monitor vital signs and more. The measurements could be transmitted to a PC or smartphone. As described, this would be a noninvasive, inexpensive way to monitor risk factors and possibly prevent life-threatening events such as a heart attack. The study suggested that the product could be commercialized and made publicly available within the next few years (Jackson 2011b; OSU News Release 2011).

According to Dr. Ido Schoenberg, chairman and CEO of American Well, a well-known telehealth services vendor, and other experts, there are limitations to what can be done online—but you can do a lot (Cerrato 2012). Insurers have identified telehealth's potential for better management of their policy holders' risk factors. For example, Blue Cross Blue Shield of Louisiana and Blue Cross Blue Shield of Massachusetts joined with American Well to provide physician consultations to policyholders of those companies using iPads, iPhones, Android devices, and webcam-equipped PCs. American Well also works with WellPoint, one of the largest US insurers. In short, insurers are eager to pilot test telehealth projects that enable better chronic disease management (Golia 2013).

WellPoint also is using the CareMore model, a coordinated care approach to caring for seniors that includes remote monitoring. WellPoint acquired CareMore, a company whose clinics serve seniors across the southwest and whose care model routinely achieves impressive patient outcomes while saving money. The CareMore model focuses on managing chronic diseases and prevention and uses telehealth applications such as wireless scales to alert clinicians to sudden weight gains that might be warning signs of dangerous fluid buildups for patients with CHF (Main and Slywotzky 2011).

Focused Collaboration

The world-renowned Joslin Diabetes Center, an affiliate of Harvard Medical School, announced that it would begin offering telehealth services nationally in conjunction with American Well. This means that countless patients will have easy access to world-class endocrinologists (Cerrato 2012). The large insurer, Humana, and Intel are working together on a pilot project to monitor vital signs of patients with CHF. Because chronic illness accounts for 75 % of health-care costs, insurers are looking for new ways to monitor high-cost patient populations. Patients use an Intel Health Guide, an electronic computer device to measure and submit their weight, BP, and other health data. Nurses with Humana track the information and interact virtually with the patients using web video, phone, and e-mail (Keller 2011).

In 2010, the California Telehealth Network (CTN) was launched with goals of increasing patient access to specialists while reducing costs and improving patient outcomes. CTN is a peer-to-peer network where providers can share X-rays and other diagnostic tests simultaneously and also view procedures and treatments from remote surgical centers and emergency rooms in real time. CTN is expected to become the largest telehealth system in the USA with approximately 850 facilities linked. Sixty percent of network providers will be rural although the network could also be used to reduce waiting times for urban patients seeking specialty care. CTN is jointly funded with US \$ 30 million from the FCC, the University of California, and other private and public entities. The network is supported by AT&T, which is providing infrastructure and network services as part of a 3-year, US \$ 27 million contract (Yin 2010).

AT&T also partnered with St. Joseph Health System in Orange, California to create a series of clinic-based telehealth kiosks that function as self-serve health care. The kiosks contain vital sign monitoring equipment, conferencing capability, and other information transmission functions. The kiosks are located at both physician and patient sites and can be accessed by phone (Jackson 2011a).

Outlook for Physicians

Physician support for remote diagnosis depends to some degree on their medical specialty. Primary care specialists and internists report being more optimistic about the potential for diagnosing patients virtually, especially with the quality of cameras now built into most PCs. On the other hand, specialists such as neurologists see limitations to virtual visits and consultations because of the inability to get feedback from requisite hands-on assessments, including palpation and direct testing of motor resistance and reflexes (Cohen 2013). However, the shortage of neurologists is pushing telemedicine into emergency rooms. A number of teleneurology companies offer videoconferencing equipment and emergency neurological consults for acute stroke, which is the third leading cause of death in the USA (Jenks 2010).

Seniors and Telehealth

Remote care technology has the potential to help seniors manage their care effectively and stay connected to their health-care team. Despite common perceptions that people over the age of 65 either cannot learn how to use technology or refuse to use it altogether, recent studies demonstrate that seniors are quite “tech savvy.” In fact, one 9-month study showed that even the frail elderly were able to use a web-portal telehealth service (Finklestein et al. 2011). Moreover, older populations have adopted remote care technology in order to take better care of themselves (Madden and Zickuhr 2012; Older Populations 2013). Seniors may be less experienced with technology when compared with younger adults and it is recognized that the declines in perceptual, motor, and cognitive functions that come with growing older can affect their ability to use technology (Smith and Zickuhr 2012). But this does not mean that new product designs and training cannot overcome such obstacles.

Recent studies report that more than half of seniors are active online, and approximately 70% use the Internet daily. Furthermore, seniors are integrating technology into their daily lives and 40% identify themselves being extremely to very comfortable using the Internet (Koppen 2010; Madden and Zickuhr 2012). Older adults are more likely to use technology when the perceived benefits are apparent and assist them in accomplishing goals (The SCAN Foundation Technology Summit 2010).

Thus, the opportunity for mHealth entrepreneurs and developers is to recognize that the trend of older adults using technology is expected to increase. Seniors represent an untapped market segment with growth potential, especially as the 78 million baby boomers age and continue to redefine the next decade much as they did the 1960s. Baby boomers want to stay active and healthy during their retirement years. Baby boomers use technology for accessing news, online banking, social networking, and entertainment almost twice as much as the current older generation and just as much as the young adults. Furthermore, baby boomers are also emerging as early adopters of eHealth options. They are 98% more likely to visit health websites compared to the average Internet user. In addition, they are increasingly exposed to online health-care services at their workplace (Greying Gadgets 2009; Hesdanun 2004; Older Populations 2013). Finally, independence is a critical concern for seniors. They want to remain in their own homes, and in control of their own lives, as long as possible and remote care technologies offer the possibility that they will be able to do so.

Lessons Learned: Early Adopters

The Commonwealth Fund, a highly visible and well-known private foundation whose stated goal includes working toward a high performance health system, published case study research results for several major telehealth projects of early adopters, notably the VA, Partners Healthcare (Partners), and Centura Health at Home (CHAH). The findings of this research showed that remote patient monitoring

(RPM), including home telehealth and telemonitoring, can help improve care coordination, patient experience, and reduce hospital admissions and costs. These technologies remotely collect, track, and transmit health data from the patient, who is at home, to a provider. The technology also can be used to facilitate communication among patients and providers and engage patients in management of their own health care (Broderick and Lindeman 2013).

Partners is a large integrated health system in Boston. Partners' programs in home telehealth have been driven by its CCH, which has pilot tested and implemented telemedicine and remote monitoring solutions that have demonstrated a positive impact on patient engagement in self-care, which has resulted in improved care and clinical outcomes. In 1995, Partners established Partners Telemedicine to use consumer-ready technologies to deliver remote care. This entity evolved into CCH, which focuses on applying technologies to conditions that have clear measures of success, either in terms of clinical outcomes, such as reduced infection or mortality, or financial returns, such as cost savings or return on investment (ROI). An example is the heart failure program. The Medicare payment reductions for 30-day readmissions associated with poor heart failure outcomes translate into negative financial outcomes. Partners' Connected Cardiac Care Program (CCP), which has enrolled more than 1200 patients since its inception in 2006, connects heart failure patients to providers through remote monitoring and has seen significant reductions (50%) in heart failure hospital readmission rates. Cost savings from the program are estimated to be more than US \$ 10 million (Broderick 2013a).

Meanwhile, CHAH looked to build on its success in employing telehealth in decreasing preventable readmissions by expanding its services to home-based Medicare beneficiaries. CHAH is the first home health agency in Colorado to implement a telehealth system that was based on two-way video technology supporting virtual visits for patients with a very high acuity level. In expanding efforts to include the routine monitoring of patients with chronic conditions, CHAH's traditional clinical call center was broadened to include 24/7 telephonic telehealth services staffed by RNs. This extended model enabled better continuity of care and more effective use of health-care resources. The changes permit a limited nursing staff to manage a larger number of patients on a daily basis and provided different levels of monitoring depending on patients' needs, from acute to chronic care. Successful integration of telephonic telehealth included working with vendors to select solutions that scale while meeting the broader patient population's needs (Broderick and Steinmetz 2013).

Telehealth and Transformation of the Delivery System

Is telehealth a key enabler for transforming the US health-care delivery system? Because we are living longer, the number of patients with chronic illness is growing. Caring for these patients will be costly unless technology enables new channels for delivering telehealth services. The Internet, computer tablets, smartphones, remote

monitoring, and wireless applications and devices, including wearable devices such as a wrist watch or a small bandage that can monitor patients continuously (Brown 2013), all contribute to the phenomenal technological capability in the telehealth infrastructure. Meanwhile, the telehealth growth curve has accelerated rapidly in the past few years due in large part to technological advances, more applications, and the emergence of wireless connectivity. In particular, consumer familiarity and acceptance of technology is an important part of telemedicine's accelerated progress. Reportedly, 6 billion people on the planet have access to cell phones (Brown 2013), which creates a world marketplace beyond our imaginings.

Of the health-care decision makers responding to a 2010 survey by Intel Corporation at the Annual Meeting of the ATA, 89% reported an expectation that telehealth will transform health care in the next 10 years (Intel Press Release 2010). Furthermore, they expect telehealth will have a major role in improving the quality and delivery of care to an increasingly chronically ill and aging population. In addition, clinical decision makers believe that the adoption of technology and telehealth solutions will cut costs and improve patient outcomes. Top perceived barriers to implementing telehealth solutions included third-party reimbursement for services provided and fear of technology (Intel Digital Health Survey 2010; Intel Press Release 2010). Table 2.2 highlights significant findings from the survey. Particularly noteworthy is the expectation that legislation will be needed to facilitate the expansion of telehealth in the USA.

Mobile technologies, including smartphone apps, wireless sensors, and other innovative tools, demonstrate transformative potential. The technology can not only improve diagnosis and treatment but also change the way both doctors and patients think about health care. Mobile technologies allow both patients and clinicians to monitor vital signs, note changes, and verify that medications have been taken—all without ever having a face-to-face meeting (Simon 2011).

What Is Trending in Telemedicine?

From SoloHealth's stations, slated for installation in 2500 Walmart and Sam's Club stores, to video consultations with doctors, to smartphone apps that track BP and heart rate, consumer health technology is attracting big-name backers such as retailer Walmart, health insurers Wellpoint and UnitedHealthcare, and companies that make or distribute medical products, such as Johnson & Johnson and Cardinal Health (Appleby 2013). Walmart's interest is especially significant, given the giant retailer's reach, the growth of its pharmacies and retail medical clinics, and its willingness to explore and use alternative delivery methods such as telehealth.

UCLA Health System partnered with CVS MinuteClinics, the largest national retail clinic chain with nearly 600 clinics in CVS pharmacies nationwide. UCLA physicians will serve as off-site medical directors for 11 in-store clinics in Los Angeles County. David Feinberg, president of UCLA Health System, reported that if the partnership with CVS is successful, there could be a possibility for UCLA specialists to evaluate patients remotely at a MinuteClinic. Currently, CVS MinuteClinics

Table 2.2 How health-care and IT professionals feel about telehealth. (Source: derived from Intel Digital health Telehealth in the US Health Care System Preliminary Topline Survey findings (May 2010), A phone survey conducted between April 29 and May 10, 2010 of health-care and IT professionals in the USA)

Category	Findings	Percentage
Aging population	Telehealth has the potential to be widely used among baby boomers	75%
Aging population	Perception that the US health-care industry will rely heavily on telehealth practices to address the aging population over the next 10 years	60%
Quality	Telehealth will improve health-care quality because physicians will have better access to patient data through ongoing monitoring	87%
Barriers	Reimbursement is a barrier to implementing telehealth	29%
Barriers	Fear of technology (e.g., lack of buy-in from clinical staff or concern about how patients will be able to use the technology)	20%
Advantages	Improved quality of care is the biggest perceived advantage to telehealth adoption	42%
Expectations	Telehealth is going to dramatically change the way we manage patient care in the US over the next 10 years	89%

will be referring those patients requiring specialty care or a permanent primary care physician to other local providers including those at UCLA (Terhune 2012).

Mount St. Mary's Hospital and Health Center launched the first telehealth group medical practice in the USA using the innovative "Online Care" platform. This extends access to high-quality medical services throughout Mount St. Mary's communities, including poor and vulnerable populations, and into the homes of local residents. The telehealth group medical practice will use participating doctors, associated medical providers, and their staffs for online visits, thereby giving patients the opportunity to interact with them much in the way they do in person. The Online Care practice is a collaborative effort among Mount St. Mary's, Blue Cross Blue Shield of Western New York, and Ascension Health, the nation's largest Catholic and nonprofit health system, of which Mount St. Mary's is a member. Online Care is a telehealth service provided by Blue Cross Blue Shield and powered by American Well™ technology (Jacobs 2011).

Conclusions

This chapter describes the evolution of telemedicine from a provider-driven tool to an enabler of patient engagement and empowerment. Telemedicine began in the USA more than 40 years ago with goals of extending access to individuals living in remote and rural areas. Rural providers would send X-rays and other tests to specialists and hospitals and communicate using technology, including satellite and video transmission. There were financial challenges, both related to reimbursement and

the cost of providing the service. And, there were licensure issues, especially when physicians were diagnosing and treating patients across state lines. Meanwhile, the technology has advanced, and the cost of telemedicine services has declined with the advent of digital communication and the emergence of mobile computing. And health-care reform is expected to move more care online to expand access and reduce costs.

While we now are capable of delivering telehealth services anywhere, we are not doing so in large volume because we have not figured out how to pay for it through insurance, and we have not produced new business models to support development (Brown 2013). Most health-care experts are in agreement that telehealth represents great potential for improving patient access and reducing labor costs, especially in rural and remote areas where there are physician shortages, particularly specialists (Cannon 2012).

Because of the trend toward adoption of mobile products and services, telehealth has become a part of the evolving self-care revolution. Examples of this include the unmanned self-service health kiosks, developed by SoloHealth with planned deployment in 2500 Walmart stores. As Americans gain insurance coverage under the federal health law, thereby putting increased demand on primary care doctors and spurring interest in cheaper, more convenient care, more examples will emerge. When an additional 30 (or 40?) million Americans get in line for a doctor's appointment, consumers may look to alternatives such as retail clinics located in Walgreens, CVS, or Walmart to get their checkups. In California, our largest state, an estimated 4 million additional people will receive health coverage under the ACA (Appleby 2013).

Are mHealth and telehealth becoming obsolete concepts? It looks that way to Jonah Czerwinski, senior advisor to the Secretary of the US Department of Veterans Affairs and who also serves as leader of the VA Center for Innovation. Even though the two terms are clearly popular in health care, Mr. Czerwinski believes that wireless connectivity is rapidly becoming the *new normal* for health care and that "connected" health care is emerging as the standard of health care for the VA (Wicklund 2013a).

Or is it a case that telehealth is becoming so commonplace that it is actually accepted as a component of the medical workplace; that clinicians expect to use telemedicine in their daily routine of treating patients and patients expect to access health care anywhere at any time? Doing what we *can* with mobile is not the same as doing what we *should* with mobile. As we saw in Chap. 1, goals of benefit, usability, and consistency are driving mHealth and the development of telemedicine reflects the impact.

Is telemedicine sustainable? Thus far, the biggest use of telemedicine has been by the military and VA. A key reason for this fact is that the VA is a single payer system with the infrastructure to facilitate technology diffusion. Although the number of people who would use telehealth on a broad scale if it were offered to them is unknown, some telehealth companies have focused on specialty areas such as strokes because of concerns that there are not currently enough people using it for primary care (Baum 2012). However, as the technology advances, it is anticipated

that telemedicine will go mobile in a big way and will eventually reach out and touch all of us—virtually.

A busy telecommuting Mom sits at her laptop with her screaming 2-year old son on her lap. It is 2:30 p.m. on a Tuesday afternoon. She is in the middle of drafting a press release for her boss and participating in a virtual consult with a physician from her pediatrician's virtual on-call system. Late Monday evening, using the laptop's webcam, she sent her pediatrician a photo of her son's rash, which has been rapidly spreading over his body. Her son is clearly in distress even as she attempts to comfort him on her lap. The on-call pediatrician is evaluating her son's vitals, which were exchanged at the beginning of the consult via a mobile app. A nurse and a pharmacist join in the virtual consult. By 3:00 p.m., a prescription has been ordered and is scheduled for delivery within the hour. At 4:30 p.m., Mom is back at work on her laptop; her son dozing nearby. An e-mail from the physician appears in her inbox—just checking in. The busy telecommuting Mom smiles and hits the reply button.

References

- Abrams, L. (11 December 2012). Where ER doctors work entirely via webcam. *The Atlantic*. <http://www.theatlantic.com/health/archive/2012/12/where-er-doctors-work-entirely-via-webcam/265935/>. Accessed 12 Dec 2013.
- AMC Press Release. (4 September 2013). U.S. Department of Veteran Affairs awards 28.8 million telehealth contract to AMC Health. <http://www.marketwatch.com/story/us-department-of-veteran-affairs-awards-288-million-telehealth-contract-to-amc-health-2013-09-04>. Accessed 01 Oct 2013.
- American Telemedicine Association (ATA) Website. <http://www.americantelemed.org/learn>. Accessed 10 Oct 2013.
- Appleby, J. (19 February 2013). Walmart health screening stations touted as part of 'Self-Service Revolution'. *Kaiser Health News*. <http://www.kaiserhealthnews.org/Stories/2013/February/19/self-health-care-kiosks-walmart.aspx>. Accessed 11 July 2013.
- Baum, S. (5 July 2012). Why a cardiologist started a telemedicine business at Walmart. <http://medcitynews.com/2012/06/why-a-cardiologist-started-a-telemedicine-business-at-walmart/>. Accessed 11 July 2013.
- Bompey, N. (5 April 2010). Practice of telemedicine snags local doctor: Lawsuit follows state sanctions. <http://www.citizen-times.com/article/20100405/NEWS/304050018>. Accessed 13 April 2010.
- Bowman, D. (16 September 2013). ACA creates 'Perfect Storm' for potential telemedicine success. *FierceHealthIT*. <http://www.fiercehealthit.com/story/aca-creates-perfect-storm-potential-telemedicine-success/2013-09-16>. Accessed 01 Oct 2013.
- Britain's Department of Health. (5 December 2011). Whole system demonstrator program: Headline findings. <https://www.gov.uk/government/news/whole-system-demonstrator-programme-headline-findings-december-2011>. Accessed 30 Dec 2013.
- Broderick, A. (January 2013a). Partners healthcare: Connecting heart failure patients to providers through remote monitoring. The Commonwealth Fund, case studies in telehealth adoption series. <http://www.commonwealthfund.org/Publications/Case-Studies/2013/Jan/Telehealth-Synthesis.aspx>. Accessed 04 Feb 2013.
- Broderick, A. (January 2013b). The Veterans health administration: Taking home telehealth services to scale nationally. The Commonwealth Fund, case studies in telehealth adoption series. <http://www.commonwealthfund.org/Publications/Case-Studies/2013/Jan/Telehealth-Synthesis.aspx>. Accessed 04 Feb 2013.
- Broderick, A., & Lindeman, A. (January 2013). Scaling telehealth programs: Lessons from early adopters. The Commonwealth Fund, case studies in telehealth adoption series. <http://www.commonwealthfund.org/Publications/Case-Studies/2013/Jan/Telehealth-Synthesis.aspx>. Accessed 04 Feb 2013.

- commonwealthfund.org/Publications/Case-Studies/2013/Jan/Telehealth-Synthesis.aspx. Accessed 04 Feb 2013.
- Broderick, A., & Steinmetz, V. (January 2013). Centura health at home: Home telehealth as the standard of care. The Commonwealth Fund, case studies in telehealth adoption series. <http://www.commonwealthfund.org/Publications/Case-Studies/2013/Jan/Telehealth-Synthesis.aspx>. Accessed 04 Feb 2013.
- Brown, E. M. (July 2013). The year ahead for the ATA and telemedicine. *mHealthNews*. <http://www.mhealthnews.com/blog/year-ahead-ata-and-telemedicine>. Accessed 11 July 2013.
- Cannon, A. (1 August 2012). Another fork in the road for Walmart. *The ConvUrgentCare Report*, 5(8), 1–5.
- Caramenico, A. (6 January 2012). Remote patient monitoring market to hit \$ 295 million by 2015. *FiercehealthIT*. <http://www.fiercehealthit.com/node/14799>. Accessed 12 Sept 2013.
- Cerrato, P. (3 April 2012). Telemedicine dilemma: Savings or healing hands more important? *Information Week*. <http://www.informationweek.com/healthcare/mobile-wireless/telemedicine-dilemma-savings-or-healing/232800145>. Accessed 22 July 2013.
- Charleston Gazette. (20 July 2010). <http://wvgazette.com/News/201007170327>. Accessed 30 July 2013.
- Cisco Press Release. (4 March 2013). Cisco study reveals 74% of consumers open to virtual doctor visit. <http://newsroom.cisco.com/release/1148539/Cisco-Study-Reveals-74-Percent-of-consumers-Open-to-Virtual-Doctor-Visit>. Accessed 08 June 2013.
- Cohen, B. (31 July 2013). Remote patient visits by phone or email: Yes or no? *Medscape*.
- Farr, C. (9 August 2013). Misfit wearables CEO: ‘Wearables are not that wearable—yet’. <http://venturebeat.com/2013/08/09/misfit-wearables-ceo-wearables-are-not-that-wearable-yet/>. Accessed 01 Sept 2013.
- Finklestein, S. M., Speedie, S. M., Zhou, X., Potthoff, S., & Ratner, E. R. (2011). Perception, satisfaction, and utilization of the VALUE home telehealth service. *Journal of Telemedicine and Telecare* 17. doi:10.1258/jtt.2011.101208. Accessed 30 Dec 2013.
- Galewitz, P. (6 May 2012) Virtual doctors visits catch on with insurers, employers. *USAToday.com*. <http://www.usatoday.com/money/industries/health/sorty/2012-04-427/virtual>. Accessed 17 July 2012.
- Golia, N. (14 June 2013) Three insurers take the plunge into telehealth. *Insurance Technology*. <http://insurancetech.com/business-intelligence/three-insurers-take-the-plunge-into-tele/240156687>. Accessed 02 July 2013.
- Greying Gadgets. (31 March 2009) *How older Americans shop for and use consumer electronics*. Consumer Electronics Association.
- Hesdanun, A. (8 April 2004). Boomers closing digital divide. *CBS News*. <http://www.cbsnews.com/stories/2004/04/08/tech/main610937.shtml>. Accessed 08 June 2013.
- Hwa, K., & Wren, S. M. (2013). Telehealth follow-up in lieu of postoperative clinic visit for ambulatory surgery: Results of a pilot program. *JAMA Surgery*. doi:10.1001/jamasurg.2013.2672. Accessed 11 July 2013.
- Intel Digital Health Survey. (May 2010). Telehealth in the U.S. Health Care System: Preliminary topline survey findings. <http://www.ok.gov/odmhsas/documents/Future%20of%20Telehealth.pdf>. Accessed 25 May 2013.
- Intel Press Release. (2010). <http://www.intel.com/pressroom/archive/releases/2010/20100518corp.htm>. Accessed 25 May 2013.
- Jackson, S. (24 February 2011a). California hospital debuts clinic-based telehealth modules. <http://www.fiercemobilehealthcare.com/story/california-hospital-debuts-clinic-based-telehealth-modules/2011-02-24>. Accessed 01 March 2011.
- Jackson, S. (20 June 2011b). Remote monitoring potential of ultrawideband for hospitals too large to ignore. <http://www.fiercemobilehealthcare.com/story/could-ultrawideband-help-predict-heart-attack/2011/06-20>. Accessed 11 Dec 2012.
- Jackson, S. (12 October 2011c). New telehealth law eliminates need for in-person visits. <http://www.fiercemobilehealthcare.com/story/new-telehealth-law-eliminates-need-person-visits>. Accessed 11 Dec 2012.

- Jackson, S. (10 January 2012). Sprint enters remote health business. <http://www.fiercemobile-healthcare.com/story/sprint-enters-remote-health-business/2012-01-10>. Accessed 10 Jan 2012.
- Jacobs, L. (13 September 2011). Mount St. Mary's hospital launches online care and telehealth group medical practice. <http://niagaracounty.wgrz.com/news/health/59141-mount-st-marys-hospital-launches-online-care-and-telehealth-group-medical-practice>. Accessed 08 June 2010.
- Jenks, S. (8 June 2010). Healing b2-way video. <http://www.floridatrend.com/fdcp/?1276018047977>.
- Keller, A. (1 May 2010). Unitedhealthcare connects patients in underserved areas to doctors miles away through state-of-the-art videoconferencing software. <http://www.floridatrend.com/article.asp?aID=5218>. Accessed 28 April 2010.
- Keller, A. (10 May 2011). Healthcare innovators: Telehealth. <http://www.floridatrend.com/article.asp?aID=5409>. Accessed 28 April 2010.
- Kitsiou, S., Pare', G., & Jaana, M. (2013). Systematic reviews and meta-analyses of home telemonitoring interventions for patients with chronic diseases: A critical assessment of their methodological quality. *Journal of Medical Internet Research*, 15(7), e150. doi:10.2196/jmir.2770. Accessed 24 July 2013.
- Koppen, J. (June 2010). Social media and technology use among adults 50+. AARP. <http://assets.aarp.org/rgcenter/general/socmedia.pdf>. Accessed 06 June 2012.
- Lowes, R. (3 May 2011). CMS removes credentialing barrier to telemedicine. *Medscape Medical News*. <http://www.medscape.com/viewarticle/742028>. Accessed 18 Feb 2013.
- Lowes, R. (14 February 2013). ACA will help spark boom in remote patient monitoring. *Medscape Medical News*. <http://www.medscape.com/viewarticle/779399>. Accessed 18 Feb 2013.
- Madden, M., & Zickuhr, K. (6 June 2012). Older adults and internet use. Pew Research Center. <http://pewinternet.org/Reports/2012/Older-adults-and-internet-use.aspx>. Accessed 01 Oct 2012.
- Main, T., & Slywotzky, A. (November 2011). The quiet health-care revolution. *The Atlantic Monthly*. <http://www.theatlantic.com/magazine/archive/2011/11/the-quiet-health-care-revolution/308667>. Accessed 06 June 2013.
- Manhattan Research. (2011). Taking the pulse press release. <http://www.fiercemobilehealthcare.com/press-releases/seven-percent-us-physicians-use-video-chat-communicate-patients-1>. Accessed 30 Dec 2013.
- Margolis, K. L., Asche, S. E., Vergdall, A. R., et al. (2013). Effect of home blood pressure telemonitoring and pharmacist management on blood pressure control: A cluster randomized clinical trial. *JAMA*, 310(1), 46–56.
- Mearian, L. (30 November 2011). Cisco, Walgreens team up on virtual doc visits for employees. *Computer World*. http://www.computerworld.com/s/article/9222289/Cisco_Walgreens_team_up_on_virtual_doc_visits_for_employees. Accessed 30 Dec 2012.
- Medicaid.gov Website. (n.d.) <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Delivery-Systems/Telemedicine.html>. Accessed 30 Dec 2012.
- Older Populations. (2013). Older populations have adopted technology for health care innovations white paper. http://www.careinnovations.com/Data/Downloads/Guide_Product/Guide_White-Paper_OlderPopulationsHaveAdoptedTechForHealth.pdf. Accessed 03 Dec 2013.
- OSU News Release. (16 June 2011) "Ultrawideband" could be future of medical monitoring. *OSU News & Research Communications*. <http://oregonstate.edu/ua/ncs/archives/2011/jun/%E2%80%99Cultrawideband%E2%80%9D-could-be-future-medical-monitoring>. Accessed 01 Oct 2012.
- Page, D. (11 December 2011). Telemedicine: Now it's a must. *Hospital & Health Networks*. <http://digital.hnhmag.com/DigitalAnywhere/viewer.aspx?> Accessed 13 Dec 2011.
- Perna, G. (29 July 2013). The promise of mobile: Connecting to underserved populations. *Healthcare Informatics*. <http://www.healthcare-informatics.com/article/promise-mobile-connecting-underserved-populations>. Accessed 07 Aug 2013.
- Simon, S. (27 March 2011). Medicine on the move; mobile devices help improve treatment. *Wall Street Journal (Online)*. <http://online.wsj.com/article/SB10001424052748703559604576174842490398186.html>. Accessed 13 Dec 2011.

- Slabodkin, G. (5 December 2012). mHealth summit 2012: Remote monitoring invaluable for reducing admissions. <http://www.fiercemobilehealthcare.com/story/mhealth-summit-2012-remote-monitoring-invaluable-reducing-readmissions/2012-12-05>. Accessed 30 Dec 2012.
- Smith, A., & Zickhur, K. (13 April 2012). Digital differences. Pew Research Center. <http://pewinternet.org/Reports/2012/Digital-differences/Main-Report.aspx?view=all>. Accessed 30 Dec 2012.
- Stomberg, M. W., Platon, B., Widen, A., Wallner, I., & Karlsson, O. (Fall 2012). Health information: What can mobile phone assessments add? *Perspectives in Health Information Management*, 1–10. <http://perspectives.ahima.org/health-information-what-can-mobile-phone-assessments-add> ? Accessed 30 Dec 2012.
- Telehealth. (11 December 2011). Closing the gap between providers and patients. *Hospital & Health Networks*. <http://digital.hhnmag.com/DigitalAnywhere/viewer.aspx?> Accessed 15 Jan 2013.
- Terhune, C. (30 July 2012). In-store clinics look to be a remedy for healthcare law influx. *Latimes.com*. <http://articles.latimes.com/2012/jul/30/business/la-fi-clinic-medical-care-20120730>. Accessed 20 Dec 2012.
- The SCAN Foundation Technology Summit. (2010). Enhancing social action for older adults through technology. The Center for Technology and Aging, p. 24. <http://www.phi.org/uploads/application/files/6ozrdkasm3dmzdf33z169oy76xe6alixy78summlkdcwgspvwa0.pdf>. Accessed 15 Oct 2011.
- Tice, L. (26 October 2011). Patient advocates to start telemedicine program. *Sun Journal*. <http://www.sunjournal.com/news/business/2011/10/26/patient-advocates-start-telemedicine-program>. Accessed 01 Nov 2011.
- VA Final Ruling. (6 March 2012). Exempting in-home video telehealth from copayments. Federal Register Volume 77, Number 44 FR Doc No: 2012-5354. <http://www.gpo.gov/fdsys/pkg/FR-2012-03-06/html/2012-5354.htm>. Accessed 23 Oct 2012.
- Weinstock, M. (7 July 2013). 2013 most wired. *Hospitals & Health Networks*. http://www.hhnmag.com/hhnmag/jsp/articledisplay.jsp?dcrpath=HHNMAG/Article/data/07JUL2013/0713HHN_Coverstory&domain=HHNMAG. Accessed 11 July 2013.
- Wicklund, E. (15 July 2011). ATA takes FCC to task for delays in rural telehealth programs. *Healthcare IT News*. <http://www.healthcareitnews.com/news/ata-takes-fcc-task-delays-rural-telehealth-programs>. Accessed 15 Oct 2013.
- Wicklund, E. (August 2013a). Is 'mHealth' becoming obsolete? *mHealthNews*. <http://www.mhealthnews.com/news/mhealth-becoming-obsolete>.
- Wicklund, E. (August 2013b). Maine health system dumps eICU service, citing sustainability issues? *mHealthNews*. <http://www.mhealthnews.com/news/maine-health-system-dumps-eicu-service-citing-sustainability-issues>. Accessed 15 Oct 2013.
- Yin, S. (19 August 2010). California debuts telehealth network that will link 850 facilities by 2012. <http://www.Fiercehelthcare.com/story/California-debuts-telehealth-network-will-link-850-facilities-2012-08-19-2010>. Accessed 13 Dec 2011.