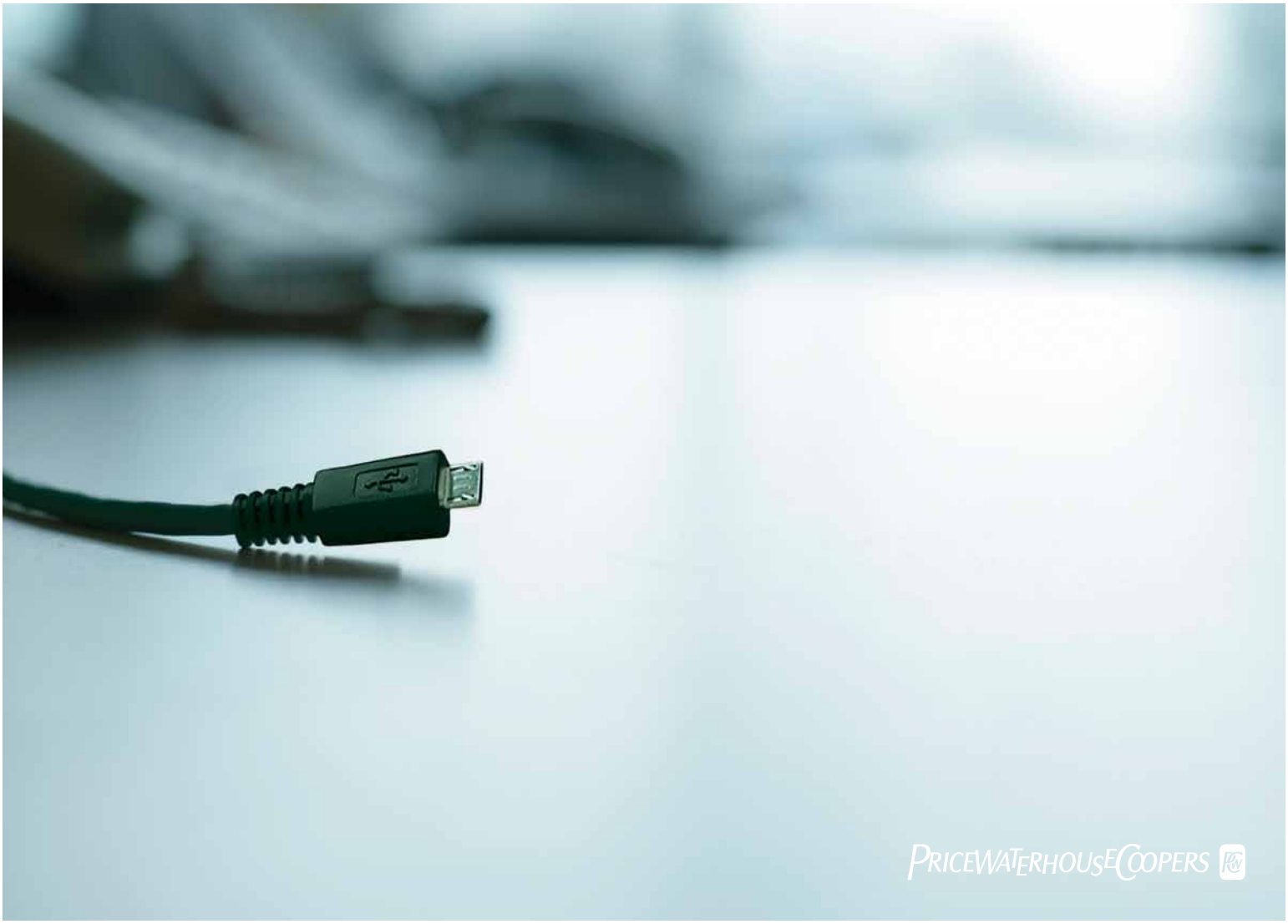
Health Research Institute

Healthcare unwired

New business models delivering care anywhere



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September 2010

The heart of the matter

Mobile technology is untethering healthcare and enabling the practice of care anywhere

Mobile technologies hold great promise for keeping people healthy, managing diseases, and lowering healthcare costs. For years, telehealth has provided clinical services for individuals who lacked physical access: farmers in remote communities, soldiers near the battlefield, inmates in prison. Now, these technologies have demonstrated the ability to benefit almost any individual. Mobile devices are the most personal technology that consumers own. They enable consumers to establish personal preferences for sharing and communicating. They can enable health and wellness to be delivered through mass personalization.

Unfortunately, the payment wires are crossed. Providers get paid based on volume of services delivered, and mobile health has been shown to reduce the need for hospital admissions and physician office visits. Why would providers adopt technologies that gouge their incomes? An industry that is paid based on volume will not adopt technologies that reduce volume. However, new payment models enveloped in the new health reform law set up a framework to pay providers based on outcome, not volume. In this environment, mobile health could provide needed connections: for patients who delay care because they're too busy to wait in a doctor's office; for physicians who don't have enough time to spend with patients; for device companies that want to monitor the performance of their devices; for pharmaceutical companies that want to ensure patients are taking the medicines they need; for hospitals that don't have the capital to build more beds.

In addition, a host of new players are developing easy to use, affordable "care anywhere" devices, services, solutions and networks that are attractive to consumers. Organizations, that want to play a role in making "care anywhere" a reality, will need to provide real value in order for adoption to occur.

An in-depth discussion

Mobile health is creating business models that unlock access to new players and technologies that support preventative, acute and chronic care

Executive summary

The mobile health industry is brimming with new health applications, devices and services that are boosting individuals' ability to connect better to their health. Forty percent of consumers surveyed by the Health Research Institute (HRI) said they would pay for remote monitoring devices and a monthly service fee to send data automatically to their doctors. HRI estimates the annual consumer market for remote/mobile monitoring devices to be $7.7 billion to $43 billion, based on the range consumers said they would be willing to pay. Real value will need to be demonstrated in order for adoption to occur. And that value begins with understanding two key customers: the individual and the physician. New business models will continue to evolve, but can fit into three main categories.

The operational/clinical business model enables provider, payer, employer, medical device and drug companies as well as nontraditional healthcare organizations to run their business operations better and more efficiently. These include transactions and services for customers, whether they are clinical in nature or related to the overall management of health.

HRI's survey showed that physicians value better decision making and ease of work flow. They're open to mobile health but believe that lack of leadership support, privacy/security and reimbursement could be roadblocks to adoption. Key physician survey findings that inform the operational/clinical model were as follows:

- Mobile health can improve the use and the value of physicians' time. One-third of physicians surveyed by HRI said they make decisions based on incomplete information. They believe the greatest benefit of mobile devices will be to help them make decisions faster as they access more accurate data in real-time.

- Forty percent of physicians surveyed said they could eliminate 11% to 30% of office visits through the use of mobile health technologies like remote monitoring, email, or text messaging with patients. Such shifts could rewrite physician supply and shortage forecasts for the next decade and beyond.

- Physicians are interested in different types of applications. Primary care physicians (PCPs) are most interested in prescribing medication wirelessly, and specialists, in accessing electronic medical records (EMRs) wirelessly.

- In-person consultations are still the main method of reimbursement, but physicians are getting limited reimbursement for phone consultations, email consults, telehealth and text. Payment models that address how mobile health reduces costs are more effective, but require changes in delivery-care processes.

- Providers in search of additional funding should consider marketing mobile health solutions. According to the survey, consumers said hospitals are the preferred place to buy mobile health products and doctors are overwhelmingly the most trusted in terms of getting health information.

The consumer products and services model enables individuals to understand key health metrics and share that information with those who matter most in their lives (e.g., family, providers, fitness trainers). HRI survey findings showed:

- Cell phones are a ubiquitous device to inform and activate consumers. The simple act of texting has picked up momentum, with nearly 80% of Medicaid patients texting regularly, the highest rate of all other insured and uninsured individuals.

- Healthcare could learn from other markets in which consumers pay a premium for instant gratification. The HRI survey showed that individuals who delayed care more than five times in the last year are more willing to pay out-of-pocket for doctor visits, electronic or in-person.

- Only half of consumers surveyed said they would buy mobile technology for their health, so it's important to know who these consumers are. Of those, 20% say they would use it to monitor fitness or wellbeing and 18% want their doctors to monitor their health conditions. While 40% of respondents would be willing to pay for a monthly mobile phone service or device that could send information to their doctor, they would prefer to pay less than $10 for the monthly mobile phone service and less than $75 for the device.

- Physicians agree that patient compliance is a major obstacle and 88% would like their patients to be able to monitor their health on their own. Weight and blood sugar topped the list, with vital signs not far behind.

- Markets for mobile health are counterintuitive:

  - Even though surveys show women make most health decisions for the family, the HRI survey showed that men are twice as likely as women to use their cell phone to get health-related reminders.

  - Even though patients who are in poor health would seem to be targets of these applications, the survey showed that consumers who are in good health are more likely to pay for them.

  - Even though most Americans are insured through group health policies, the survey showed that individual policy holders were more likely to buy mobile health applications and to pay out of pocket for electronic visits with physicians.

  - Even though physicians aren't currently using email and text as often as they'd like to for simple patient communications, they are highly skilled in this area. Physicians use mobile Internet more than twice that of other consumers, according to the HRI survey.

Infrastructure business models connect, secure and speed up information and services.

- **Integration.** Health systems are largely ignoring the importance of integrating mobile health into other IT efforts, such as EMRs. Two-thirds of physicians surveyed said they are using their personal devices for mobile health solutions that aren't connected to their practice or hospital IT systems.

- **Security.** When physicians were asked about barriers to adopting mobile health in the HRI survey, “worried about privacy and security” was the top answer, cited by one-third of PCPs and 41% of specialists.
- **Bandwidth.** Hospital IT networks are struggling under the need for more bandwidth to support rapidly expanding data transactions and exchanges.

Mobile health efforts from multiple stakeholders

Stakeholder	Target health-related issue	Who	Mobile health solution
Employer	Rising healthcare costs of self-insured employers	Safeway	Competition among locations to promote healthy lifestyles and incentives for lowering healthcare premiums for employees
Provider	Efficiency in coordinating care/physician work flow	Good Shepherd Health System	Developed own iPhone app to help physicians access patient records, track vitals, order medication and coordinate with care team
Provider	Physician to physician consultation to enhance patient care	Physicians from Duke, Harvard and JTCC	Virtual physician network for video mobile consults, starting with cardiology and oncology. Partnership among physicians at Duke University Medical Center, Harvard’s Beth Israel Deaconess Medical Center, John Theurer Cancer Center (JTCC) and Zibbel, a health solutions technology company.
Health insurer	Finding physicians in network or checking claims	Aetna	Mobilizing “doc” finder and claims check
Pharma	Patient compliance in diabetes monitoring	Bayer	Digital glucose monitor (DIDGET) that integrates with the Nintendo game console
Retail pharma	Cost information and prescription management cumbersome to obtain	CVS Caremark	iPhone app for prescription drug information and member management of prescription refills, history, and retail location finder
Telecom	Bandwidth and capacity constraints on hospital networks	Verizon	4G and more robust Wi-Fi networks to allow for increased capacity for image and data transfer
Retail	Access to remote monitoring devices	Best Buy	Partnership with Meridian Health to explore consumer access to healthcare monitoring devices through retail stores and determine the opportunity to leverage existing customer service team for installation and technical support.

The appetite for mobile

Mobile health is creating new value: less expensive solutions, new ways to manage care, and better health outcomes. However, new business models are required to unlock access to technologies and players that support preventative, acute and chronic care.

The market for mobile Internet is booming although healthcare solutions are still trying to fit in. While only about 8% of American adults have mobile Internet access, the market is growing rapidly, fueled by faster and faster connection speeds. As Figure 1 shows, the market is estimated to quadruple between 2010 and 2014, according to PricewaterhouseCoopers' estimates.

The next generation of technology supports downloads up to 7Mbps (compared to the current 1.5Mbps). With the number of broadband households in the United States projected to increase from 75.6 million in 2009 to 113.8 million in 2014, more information will be able to be exchanged at the home.[1]

To try to better connect the $2-trillion health industry and its consumers, the Federal Communications Commission (FCC) has established a new healthcare taskforce to focus its national broadband efforts on connectivity through health IT solutions like e-care to improve access/utilization, care coordination and ensure privacy and security.[2] Its active discussions with the Food and Drug Administration (FDA) will determine the FCC's role of regulating general purpose communication and the FDA's jurisdiction over devices used for medical purposes. "While no final decisions have been made, the goal of our agencies is to remove the barriers to innovation that could help open up a range of new prevention and healthcare solutions," said Mohit Kaushal, MD, the FCC's healthcare director. Kaushal added, "The two ends of converging solutions from the telecom industry and the healthcare industry create a middleground that needs clarity and transparency." The impact of their decisions could affect the speed of innovation as well as the investment in innovation.[3]

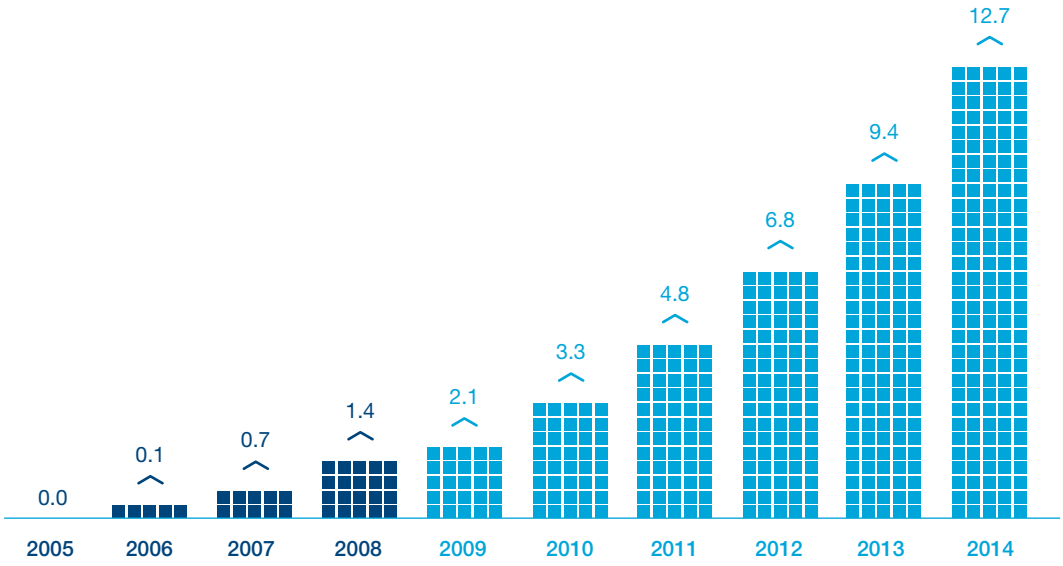
To date, more than 10,000 medical and healthcare/fitness-related applications are available for download to smartphones and hundreds of other devices.[4] Forty percent of consumers surveyed by HRI said they would pay for remote monitoring devices and a monthly service fee to send data automatically to their doctors. **HRI estimates the annual consumer market for remote/mobile monitoring devices to be $7.7 billion to $43 billion, based on the range consumers said they would be willing to pay.**

The new digital health environment is laced with its own lexicon—mobile health ("mHealth"), digital health, telehealth, eHealth—but the "basic phenomena is a very powerful machine that is always networked and on the person. The key difference is on the person," said John Glaser, former chief information officer, Partners Healthcare. "Right now, mobile activities are concentrating on extending the range of existing applications." Glaser discusses three classes of activities: communication (e.g., SMS, email), transactions (e.g., changing a flight, booking a hotel) and knowledge (e.g., getting directions, health information). "You need to start from the need and build up—mobile could be an avenue or it may not be. For example, a child who has asthma and needs to track her daily capacity results doesn't just need a piece of technology. She needs support from her parents." This points out a forth class of activity—the need for integration of all aspects of a solution.

1 PricewaterhouseCoopers Global Entertainment and Media Outlook 2010-2014.
2 U.S. Federal Communications Commission. National Broadband Plan: Connecting America (2009). Chapter 10, accessed on August 23, 2010, http://www.broadband.gov/plan/10-healthcare/.

Figure 1: Mobile Internet access market

in billions $



Mobile Internet access revenue

Projected mobile Internet access revenue

Mobile Internet access revenue: fees paid by consumers to Internet service providers or to wireless carriers for Internet access via mobile devices.

Source: PricewaterhouseCoopers Entertainment and Media Outlook, 2010–2014

3 Neil Versel, "FDA, FCC discuss medical smartphone apps as industry adjusts to regulatory culture," FierceMobileHealthcare, July 27, 2010, accessed August 23, 2010, http://www.fiercemobilehealthcare.com/story/fda-fcc-discuss-medical-smartphone-apps-industry-adjusts-regulatory-culture/2010-07-27.

4 "Apple iTunes App Store Metrics, Statistics, and Numbers for iPhone Apps," last modified August 23, 2010, http://148apps.biz/app-store-metrics/?mpage=catcount.

Figure 2: Early research shows mobile health reduces provider revenues

	Where	What	Result
Diabetes	Pennsylvania	Post discharge remote monitoring	42% drop in overall cost per patient[5]
	Cleveland	Cell phone size wireless transmitter transferring vital signs to electronic health record	71% increase in number of days between office visits[6]
Congestive heart failure	Trans-European Network-Home-Care Management System	Remote monitoring of patients who received implantable cardiac defibrillators	35% drop in inpatient length of stay; 10% reduction in office visits; 65% drop in home health visits[7]
Chronic obstructive pulmonary disease	Canada	Remote monitoring of patients with severe respiratory illness	Reduced hospital admissions by 50%; acute home exacerbations by 55%; hospital costs by 17%[5]

Clearly, mobile health offers benefits to both busy patients and busy physicians. Several research studies show that mobile health applications reduce provider revenues (See Figure 2). Hospitals, physicians and other providers are paid primarily by volume, generally referred to as a "fee-for-service" business model; the more you do, the more you are paid.

Despite an explosion of wireless technologies, patient visits outside of in-person consults remain infrequently reimbursed. HRI's physician survey showed phone consultations for chronic disease management lead the pack while wellness and maintenance was the least reimbursed (See Figure 3).

And while some industries have figured out ways to get paid for electronic transactions and services (e.g., music downloads), healthcare has not. The third-party payer system reduces the role of consumers. Public and private health insurers are primarily responsible for paying for healthcare, and they generally have not pushed for adoption.

"The technology of telehealth is well ahead of the socialization of the telehealth idea and we are at a tipping point for utilization to begin taking off," said David Jacobson, staff vice president of Business Development, State Sponsored Business at WellPoint.

5 Max E. Stachura, MD, and Elena V. Khasanshina, MD, PhD. "Telehomecare and Remote Monitoring: An Outcomes Overview." The Advanced Medical Technology Association, October 31, 2007, accessed July 29, 2010, http://www.advamed.org/NR/rdonlyres/2250724C-5005-45CD-A3C9-0EC0CD3132A1/0/TelehomecarereportFNL103107.pdf.

6 "Cleveland Clinic/Microsoft Pilot Promising; Home Health Services May Benefit Chronic Disease Management." March 1, 2010, accessed on August 25, 2010, http://my.clevelandclinic.org/media_relations/cleveland_clinic_pilot_with_microsoft_promising.aspx.

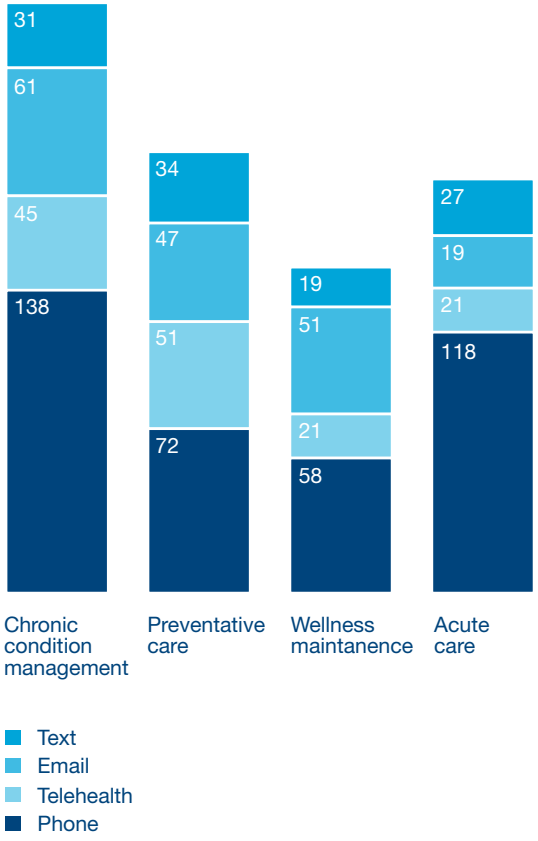
"Government programs currently don't pay for several of the applications that could help boost outcomes. Key barriers are around licensing regulations and determining what Medicare is going to pay for," added Carolyn Carter, who leads the WellPoint California telemedicine program.

Roy Swackhamer, chief information officer of SCAN Health Plan, points out that payers want to see evidence. "Everyone is doing pilots, but it needs to be scaled so a physician with 500 congestive heart failure patients can take advantage of the data. We need predictive algorithms that can be used with data aggregation tools in order to analyze trends and perform predictive analysis."

Understanding how to use such information hinges on applying a business model that marries technology to financial reward and creating new work flows that move from analog to digital health delivery. "There are lots of dashboards; however, there's not enough attention paid to the people doing the work," said Mark Moffitt, former chief information officer, Good Shepherd Health System in Longview, Texas. "Once we developed a customized iPhone application that allowed physician access to patient information and decision-making, we had those who were willing to pay for half of the device just so they could use the application."

Much of the momentum behind mobile health has been from companies outside health—technology and telecommunications companies that are looking to expand their footprint in the health industry through mobile technologies. The opportunities can extend to many other stakeholders—from health and fitness companies or gyms that can integrate personal data tracking with mobile phones to entertainment companies who connect with people through health e-games. Figuring out what role to play as a business begins with understanding the failures and pain points that are occurring in the current system for two key groups: the individual and the physician.

Figure 3: Reimbursement of care through nontraditional channels
by number of physicians



Source: PricewaterhouseCoopers HRI Physician Survey, 2010

7 John G.F. Cleland, MD, Amala A. Louis, Alan S. Rigby, PhD, Uwe Janssens, MD, Aggie H.M.M. Balk, MD, and others. "Noninvasive Home Telemonitoring for Patients with Heart Failure at High Risk of Recurrent Admission and Death," Journal of the American College of Cardiology 45,no.10 (2005): 1654.

Three business models for mobile health

Mobile health encompasses a wide array of companies that sell products and services in health and wellness through technology applications. We see a plethora of pilots dotting the landscape. Providers are incorporating mobile into their work flows of caring for patients, some even developing their own applications and spinning them off as businesses. Health plans are experimenting with mobile as a way to reach out to their members for transactions and new ways to engage them in healthy behaviors. Employers are text-messaging employees in their health promotion/monitoring campaigns. Pharmaceutical and life sciences companies are using mobile to support drug adherence. Interestingly, all sectors are converging in patient-centered care models that ignore venue-based, volume-based payment.

Current business models fall into one of these three categories:

- Operational/clinical capabilities
- Consumer products and services
- Infrastructure to connect, secure and speed up information and services

Operational/clinical

The oft-repeated goal of "bending the cost curve" is being taken seriously by many providers, payers, device companies and pharmaceutical makers. Health reform is rearranging the incentives, shifting the payment system to one that rewards performance and outcomes rather than volume. In this environment, the greater financial rewards go to organizations that demonstrate savings over traditional health delivery. Mobile health applications can expand access and reduce costs and in some cases, do both at the same time—a twofer that is rare in healthcare.

As more payers turn to performance-based pay, the business model for providers and pharma/device companies centers on improving care through connectivity and better information that leads to healthier outcomes and greater efficiency. For example, Merck Serono created double-digit growth in a pipeline of generic injectable drugs that were long off-patent.
(See opposite page)

Mobile health can improve use and value of physicians' time

In looking at reducing traditional costs, the focus immediately goes to providers. Physicians are generally paid by task. Their time is valuable but often wasted on tasks that could be automated, eliminated or reduced in scope through mobile health. For example, more than half of physicians surveyed by HRI said a significant portion of office visits could be eliminated through mobile health, which could improve access for patients and ease the number of in-person visits from chronic care patients. Forty percent of physicians said they could eliminate 11% to 30% of office visits through the use of mobile health technologies like remote monitoring, email, or text messaging with patients.

Such shifts could rewrite physician supply and shortage forecasts for the next decade and beyond. A recent study by the Mayo Clinic's Department of Family Medicine supports this view. During the two-year study, e-visits were able to replace in-office visits in 40% of the 2,531 cases. In the study, patients logged on to a secure online portal, where they had detailed histories taken and were able to upload pictures and other files as needed. Physicians responded within 24 hours and patients could access the portal to view results.[8]

8 Steven C. Adamson, MD, and John W. Bachman, MD. "Pilot Study of Providing Online Care in Primary Care Setting." Mayo Clinic Proceedings 85,no.8 (2010): 704-710, doi:10.4065/mcp.2010.0145.

Pharma company uses Bluetooth and nurse reminder calls to boost adherence of injectables

In a five-year journey to reinvigorate a portfolio of generic, off-label or abandoned drugs, one pharmaceutical company found digital/mobile technology could significantly boost patient adherence. While pharma companies typically focus on new drug development, Switzerland-based Merck Serono found that it could create double-digit growth in a pipeline of generic injectable drugs that were long off-patent. The strategy centered on "adding value to the products you already have," said Don Cowling, vice president and managing director of Merck Serono, UK and Ireland. "The future is behind us." Cowling said his team realized that the growth market for pharmaceuticals is in adherence rather than finding new patients since half of all scripts are never filled and half of those are never taken. "People don't buy compliance; they buy pharmacoeconomic outcome," Cowling added.

With six therapy areas of focus, including neurology, fertility, and growth therapies, Merck Serono developed a smart electronic injection device with two-way Bluetooth capability that could track all injections made. Nurses made reminder calls within 30 minutes of a missed injection. For example, at one point, the number of injection-site reactions was growing in patients taking one of the therapies. After changing the needle depth requirement by 3mm, the dropout rate improved by 10%.

Real-time data gathering and feedback through mobile technology boosted Merck's business case for mobile health. The strategy helped the company gain over 50% of new patients for several therapy areas, grow 38% in a static growth hormone market, and decrease 20% of its workforce while doubling the volume of work and create a platform for future therapeutics to be administered.

Lessons learned:

1. Take a systems approach to providing results by personalizing the care delivery experience through technology and provider support/communication and connecting payment to clearly articulated payment goals.
2. Look in past products/services for a pipeline that may not have been maximized.
3. Partner with payers and gain clarity on expected results for payment.
4. Consider the value propositions of: "Either make money, help other people save money, or save lives."

Merck Serono: "Intelligent care" using mobile health to reinvigorate pipeline and generate patient outcomes

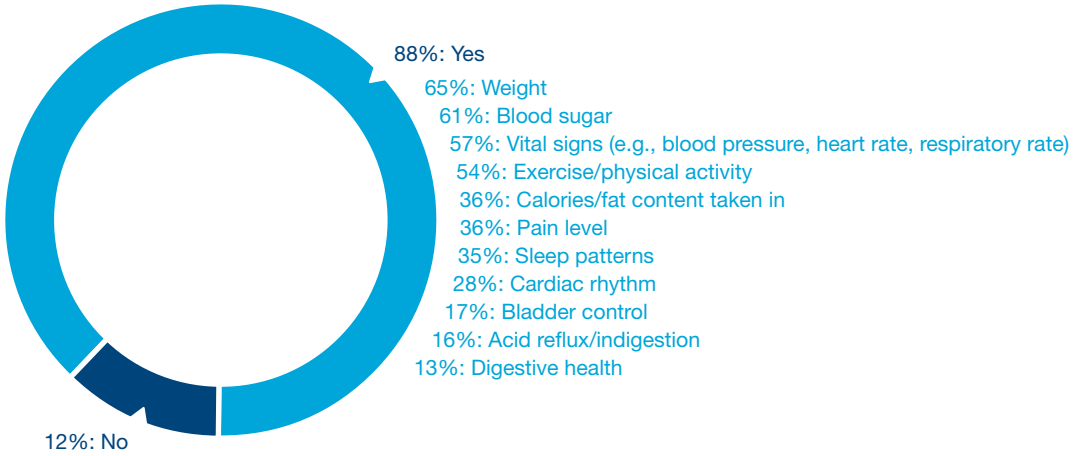
- Molecular diagnostic screening to identify patients who would benefit from treatment
- Wireless easypod™ device to inject drug, record number of doses administered, and share data with clinicians
- Nurse call center intervenes when notified by device of patient non-compliance or problem
- Clinical nurses in physician's office assist in treating patient
- Electronic health record integration of patient information
- Value-based reporting to payer demonstrating patient compliance and improved patient outcomes

Personalized | System-based | Value driven

Outcomes

- Sales growth in declining, off-patent brand
- Sales force reduction
- Smaller administrative cost with improved margins
- Enhanced patient outcomes at lower cost
- Better clinical integration
- More care provided in home settings at lower cost

Figure 4: Physicians wanting patients to track/monitor health at home



Source: PricewaterhouseCoopers HRI Physician Survey, 2010

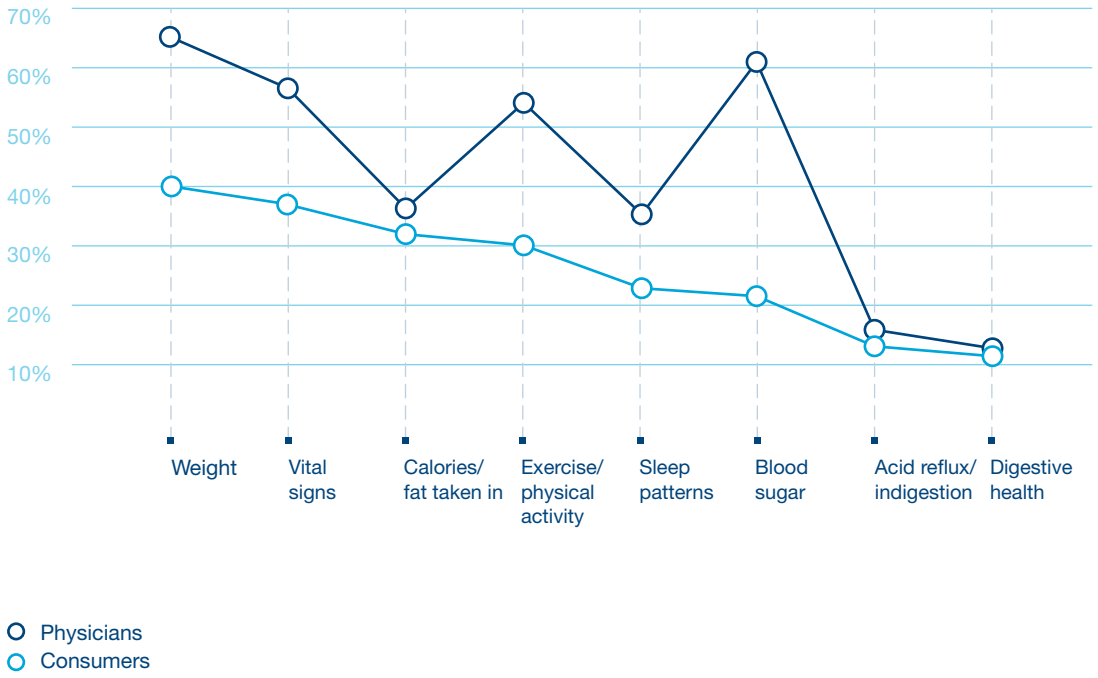
Remote monitoring could be a key way to reduce office visits. Eighty-eight percent of physicians said they would like their patients to be able to track and/or monitor their health at home (See Figure 4). They are most interested in having patients monitor weight and blood sugar but also see value in having them monitor such vital signs as blood pressure as well as physical activity and other health-related information. Consumers indicated their top priorities would be weight and vital signs (See Figure 5).

Remote monitoring also could reduce hospital spending, a goal of both government and private payers. Remote monitoring could be especially effective at reducing hospital readmissions. Research has shown that one-fourth of all Medicare patients are readmitted within 30 days. However, beginning in October 2012, Medicare will no longer pay for certain hospital readmissions and will begin to publish hospital readmission rates. Already, some commercial health plans are also beginning to pay for remote monitoring devices to reduce their readmission costs.[9]

Work flow is important to physicians because they get paid only for the patients they treat. So, they're keenly interested in efficiency. Accessing information where and when it is needed is a top challenge for physicians, according to the HRI survey.

9 Neil Versel. " WellPoint, Aetna, and Humana pilot remote monitoring to cut readmissions." FierceHealthcare, July 29, 2010, accessed August 23, 2010, http://www.fiercehealthcare.com/story/wellpoint-aetna-and-humana-pilot-remote-monitoring-technology-cut-hospitalization/2010-07-29.

Figure 5: What consumers and physicians want to track regarding health

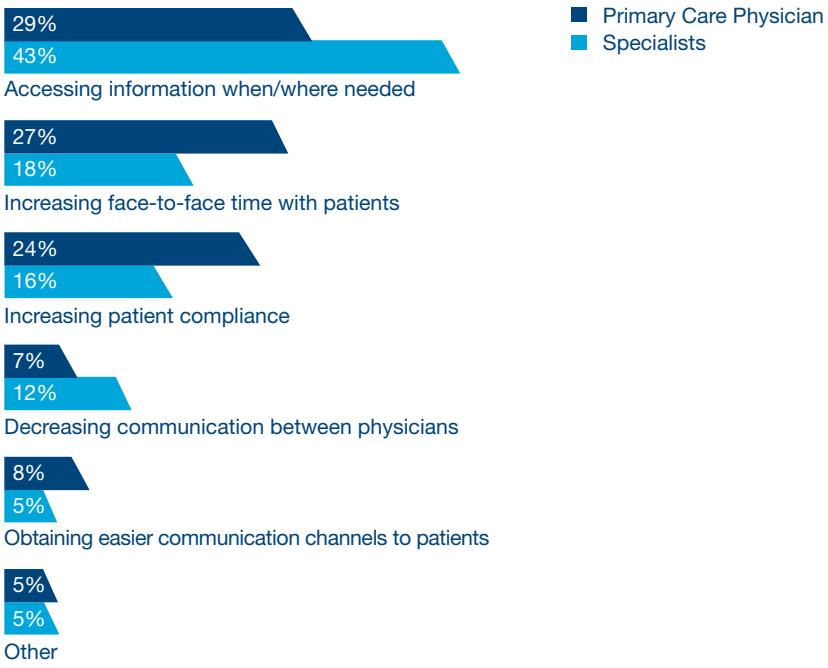


Source: PricewaterhouseCoopers HRI Physician and Consumer Surveys, 2010

Currently, one-third of physicians said they make decisions based on incomplete information for nearly 70% of their patients. Specialists and PCPs find that their biggest obstacle when seeing patients or running their practice is accessing information when and where they need it (See Figure 6). Only half of physicians surveyed access EMRs while visiting and treating their patients. “Meaningful use” requirements, which go into effect in 2011 and require interoperable use of EMRs, are expected to improve timely access to information.

Yet mobile health solutions will have to ensure that they aren’t making physicians less productive. Physicians want to see exceptions in the data, not all the data. Too much information could actually slow care down. Hospitals can help the physicians who bring in patients by filtering the data they send electronically. “For example, a physician who has seen patients with chest pain that have inconsistent outcomes, can query for every patient over the age of 55 who came in with chest pain and was given aspirin. This potentially allows

Figure 6: Biggest obstacle when seeing patients or running practice



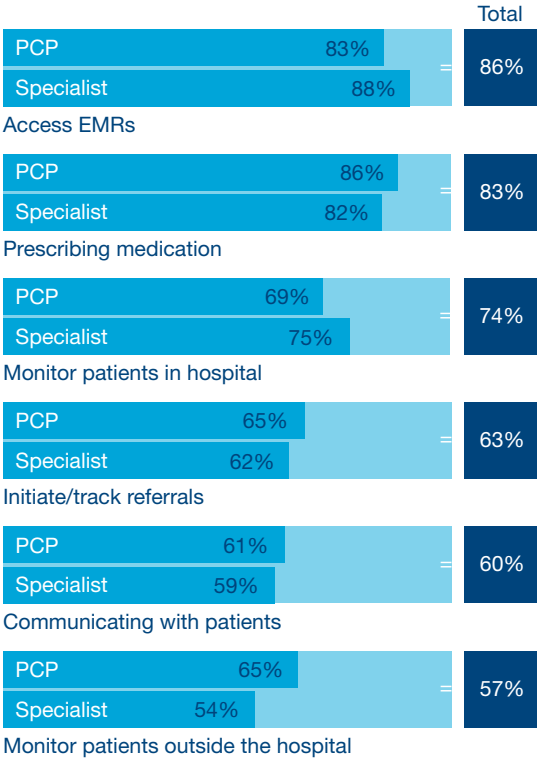
Source: PricewaterhouseCoopers HRI Physician Survey, 2010

hospitals to improve outcomes or work flows based on the data," said Johnny Milaychev, product manager of New Wave Software, a veteran clinical integration vendor.

Another example is e-prescribing wherein physicians' most common orders are automatically populated on their devices, said Donald Burt, MD, chief medical officer of PatientKeeper, a physician information technology firm. He said PatientKeeper's 25,000 daily physician users spend 20% of their days on mobile devices. He added that experienced nurses can post order requests on physicians' phones and they can sign or modify them wherever they are. Both specialists and PCPs have a high degree of interest in e-prescribing (See Figure 7).

Having information at their fingertips ensures physicians that their time is used more effectively. Of physicians who are using mobile devices in their practices, 56% said the devices expedite their decision-

Figure 7: Physician interest in performing various tasks wirelessly



PCP: Primary Care Physician
Source: PricewaterhouseCoopers HRI Physician Survey, 2010

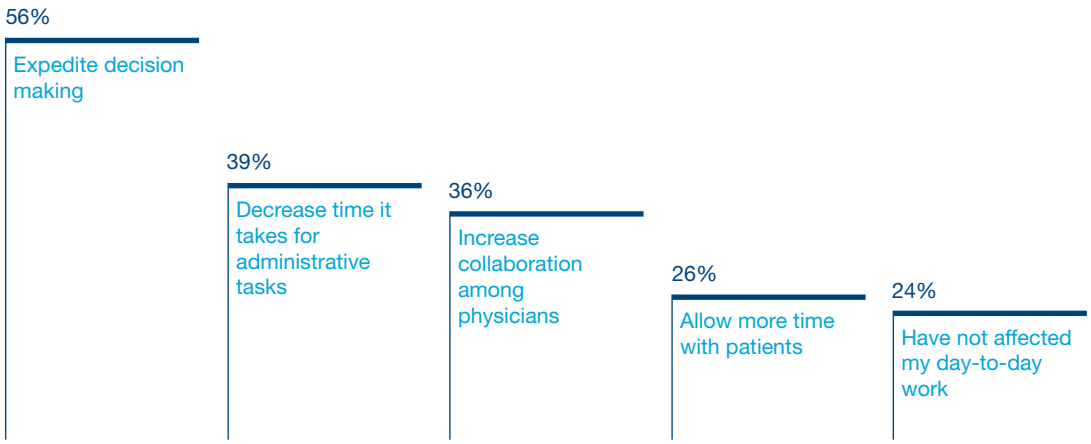
making and nearly 40% said they decrease administrative time (See Figure 8). Mount Sinai Hospital in Ontario, Canada connected its physicians to EMRs through their iPhones. Its VitalHub program has changed the way its physicians work; they pull up patient charts, labs, medical references and radiology images. “Chart applications from leading vendors may have a robust backend, but the physician experience is weak. They are struggling with making the chart something easy to deal with. How do we help our clinicians who are going to multiple places for locating information? We go to them,” said Teek Dwivedi, chief information officer at Mount Sinai Hospital. The hospital spun out the intellectual property of Vital Hub into a separate external company with plans to offer the platform model to other institutions on a commercial basis.

Mobile health could drive up volume, creating disincentives

People are busy, and sometimes they don’t take care of themselves because they don’t have the time. Individuals who delayed care more than five times during the past year because it took too long to get an appointment are more willing than those who didn’t delay care to pay out-of-pocket for electronic doctor visits (58% vs. 43%). In some cases, physicians have started their own electronic medical practices in which they charge patients $50 for each consultation. Those who delayed the most care have different preferences for how they’d like their physicians to contact them for simple communications. Those who delayed more than five times prefer communication through cell phone, email, text message, and Facebook more than those that never delayed care during the past year (See Figure 9). Non-traditional communication avenues and electronic doctor visits could be new ways of reaching individuals who don’t engage proactively in their care.

Willingness to pay out-of-pocket continues to be a main barrier to mobile health adoption. Less than half of both Medicaid and Medicare patients would be willing to pay out-of-pocket for electronic doctor visits. Consumers want low-cost solutions and those in very good health are the most likely to track metrics on a mobile device application, creating more challenges in reaching the highest users of the healthcare system—those in poor health with chronic diseases.

Figure 8: Percent of physicians surveyed who said mobile health would have these impacts



Source: PricewaterhouseCoopers HRI Physician Survey, 2010

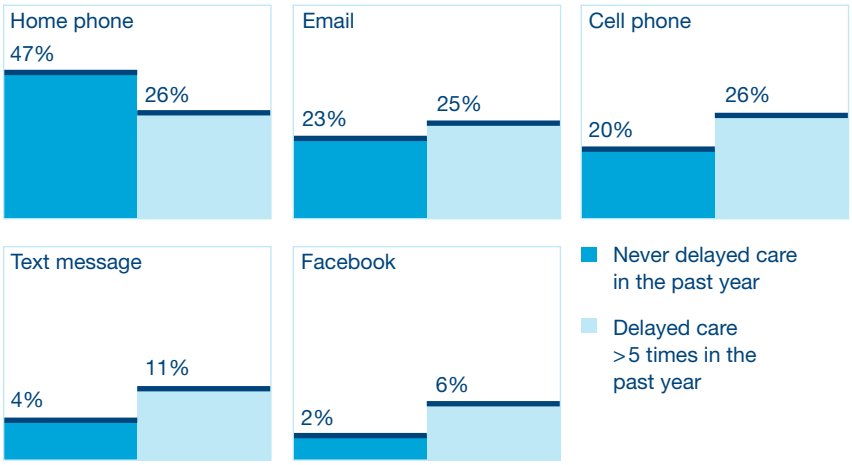
Consumer products/services

The consumer market can be a high-volume, high-value, low-price market where mild proof of efficacy can lead to rapid adoption.

"For consumers, mobile is a synonym for independence," said Yan Chow, director of the Innovation and Advanced Technology Group at Kaiser Permanente. "I think that the ability to be independent and get data when and where you need it gives consumers a lot of freedom. Having consumers be at the center of their own care is a concept Kaiser has been working with for a long time. It gives us the chance to build a new relationship with our members." Rajeev Kapoor, former global managing director of Verizon Connected Healthcare, added, "The paradigm of healthcare has changed. You used to bring the patient to the doctor. Now you take the doctor, hospital, and entire healthcare ecosystem to the patient."

In some cases, organizations are mobilizing applications that they've already hosted online. For example, Aetna made its most popular transactions, such as physician "doc" finder and claims check, available on mobile devices. "We have an overarching member experience strategy that is focused on providing clear, timely, and useful information that helps members make informed healthcare decisions," noted Meg McCabe, Aetna's vice president, consumer marketing and product. "Our technology is about transparency and engagement at any level, and over time we'll build stronger relationships with our members," added

Figure 9: Preferred communication method for routine tasks by those who delayed care



Source: PricewaterhouseCoopers HRI Consumer Survey, 2010

Michael Mathias, Aetna's chief technology officer. "The days of mass communication are over. We can now deliver customized communications through mobile apps, online, telephonically, or through the mail based on our understanding of how each member wants to be communicated with."

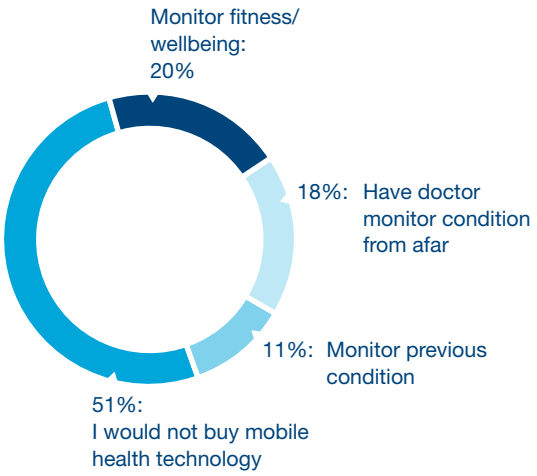
Targeting the mobile health consumers

Only half of consumers surveyed by HRI said they would buy mobile technology for their health, so it's important to know who these consumers are. Of those, 20% say they would use it to monitor fitness/wellbeing and 18% want their doctors to monitor their health conditions (See Figure 10). While 40% of respondents would be willing to pay for a monthly mobile phone service or device that could send information to their doctor, they would prefer to pay less than $10 for the monthly mobile phone service and less than $75 for the device.

Mike Weckesser, director of emerging business-health solutions at Best Buy, points out the challenges of consumer price expectations related to mobile health technology. "In our consumer research, although consumers identified a price threshold, they also expected the payer to reimburse them for those purchases, thereby slanting the data."

Though many consumers have never taken advantage of existing mobile health technologies, 85% of those that have communicated with their doctor by means other than face-to-face were satisfied with their discussion.

Figure 10: Most important reasons consumers would buy mobile health technology



Source: PricewaterhouseCoopers HRI Consumer Survey, 2010

The HRI survey revealed key markets to target for mobile health services and products.

- **Men.** Men are twice as likely as women to use their cell phone to get health related reminders. More men surveyed have Internet service on their phone than women do. Men are three times more likely to check their sports, stocks and medical records and twice as likely to check restaurant ratings, news headlines and get health-related reminders. They also are more willing to incorporate an application into their cell phone to monitor their health (36% vs. 27%). So, this means that solutions for early market adoption should focus on pain points that are important for men.

- **Individual health insurance policyholders.** This small, but growing group of insured, is the most likely to incorporate an application into their cell phones to monitor their health. Likewise, they are the most willing to pay out-of-pocket for electronic doctor visits with nearly one-third saying they would be willing to pay more than $25 per visit. Consistently, they are also willing to pay the most for monthly services of healthcare mobile phone applications and remote monitoring devices and services. Supporting targeting of these individuals is that 40% report having at least one chronic disease. In addition to those covered by individual health insurance policies, half of uninsured individuals would be willing to pay out-of-pocket for electronic visits and 42% of the uninsured have a chronic disease.

- **The healthy.** Consumers who reported to be in very good health are the most likely to incorporate an application into their cell phones to monitor their health, while consumers with chronic diseases are the least likely. After Nike led with its Nike+ running sensor that links to an iPod or iPhone, more personal monitoring devices have hit the market that enable consumers to track personal health, fitness, and wellbeing metrics.

  For example, the Zeo, a personal sleep analysis device, consists of a wireless headband, bedside display, and email-based personalized coaching program and analytical tools. It identifies periods of wake, REM, light, and deep sleep and produces a score each morning relating to an individual's sleep quantity and quality. Likewise, the Fitbit Tracker, a small device worn clipped to clothing, tracks calories burned, steps taken,

Health system, retailer, wireless company team to improve palliative care

Physicians in New Jersey thought there must be a better way to ease the pain of cancer patients. After collaborative conversations with the leadership of Meridian Health System, the idea for an innovative pain journal was born. The journal's intent was to allow patients to record and communicate their pain while resting at home. With more accurate communication, physicians could better understand the pain medication needs of their patients.

The health system didn't think insurers would pay for such a device, but maybe patients might—if it was affordable. With this as a business model, an unusual but powerful collaboration came together:

- **Clinical expertise:** Meridian Health, a five-hospital health system in New Jersey (a teaching hospital, children's hospital, home health and rehab centers). Most of the health system's 1,600 physicians are in private practice, with half in primary care and 100 physicians on staff.
- **Technology expertise:** Cypak, a near field communication (NFC)[10] company that creates consumer tools
- **Retail/tech support:** Best Buy, an international retailer of consumer electronics and technical support

The collaboration developed a product called iMPak's Health Journal for Pain, an electronic diary in which patients are given an auditory queue and answer two or three questions regarding their pain via buttons on the device. The device is a tri-fold, with each section measuring approximately 4 inches by 6 inches. During office visits, physicians download the information, or it can be downloaded at home into a web portal or personal health record. To pair with the health journal, iMPak is developing a smart pill dispenser that monitors adherence. Based on the doctors' preferences, they can be alerted to fluctuations or outliers in reporting. "This may actually allow the physician to increase the billing fee from a level three and four to a level four and five," said Sandra Elliott, Meridian Health's director of consumer technology and service development.

Including Best Buy in the collaboration was a key strategy. "We have learned that we, as a health system, don't truly understand the retail marketplace," added Elliott. "Best Buy does and people go to them for their technology. The wireless networks are going to be a major part of getting technology in the hands of consumers, and we wanted to be able to leverage Best Buy's retail knowledge as well as their Geek Squad for installation. As a health system, our job is to take care of people. We need to come up with strategies to get service fees and technology prices down. Our challenge is to think about how to manage an increasing patient population without building new buildings."

Lessons learned

1. Partnering with those who see patients as consumers. Retailers of consumer health electronics can allow providers to focus on their core services while leveraging the expertise of other industries like technology and retail.
2. Focusing product development on the most critical pain point. Individual and clinician testing is key to developing a useful product.
3. Creating with a future platform in mind. A flexible platform enables a variety of applications spanning multiple disease states.

10 Near field communication is short-range wireless interaction among devices and PCs.

distance traveled and sleep quality. It also wirelessly syncs with a PC where the tracked data is automatically uploaded to a fitness and nutrition website. In addition to these devices, numerous mobile device applications are available free or for a fee that track blood sugar, blood pressure, cholesterol, and pain readings, count calories and fitness activities, and send medication reminders. Consumers can trend data over time and send emails to their doctors on demand. Consumers are now able to monitor a whole host of health indicators on the go.

- **Healthy but likely to slip in health status.** Consumers and physicians agreed on two of the top three health metrics they would most like to track: weight and vital signs (e.g., blood pressure, heart rate, respiratory rate). Where they differ is that consumers rank calories/fat taken in as the third metric they would most like to track, and physicians ranked blood sugar ahead of vital signs. Eric Topol, director of the Scripps Translational Science Institute and vice chairman of the West Wireless Health Institute, cautioned that, "patients may not understand the importance of glucose monitoring. Many patients need to be trained as to what causes large swings in blood sugar and when they are over and undershooting. Physicians know that stable glucose levels are a huge issue. Tackling this issue with remote monitoring devices, if successful, could potentially prevent people at risk from crossing the line to becoming diabetic."

  "Employers can use mobile health to keep their employees healthy," said Brad Wolfsen, Safeway's vice president of Strategy and Health Initiatives. The retail grocer, with 1,775 stores in North America and 186,000 workers, has seen no increase in its healthcare costs for the past five years and is constantly looking for ways to innovate in the areas of benefits, incentives and engagement of employees. Safeway's team-based JumpStart wellness program uses text messaging. The connectivity for all employees was a motivator for the 2,500 participants, who lost 2.6% of weight over 10 weeks. "Mobile is the technology of choice for team-based programs with or without an incentive. The real-time information allows us to build profiles of employee information instead of getting only point information," said Wolfsen.

- **Certain chronic-illness groups of patients.** Those with chronic diseases did say, however, that better access to their health information and regular feedback from their doctors would make them feel more in control of their own health.

Joseph Kvedar, MD, director of the Center for Connected Health at Partners HealthCare in Boston emphasized that while "sensor technology may rapidly be becoming commoditized, integration with EMR and data aggregation systems is not something we have seen done well. We need to get better at gathering information, adding logistical software to get to the intersection of all the data and population health management."

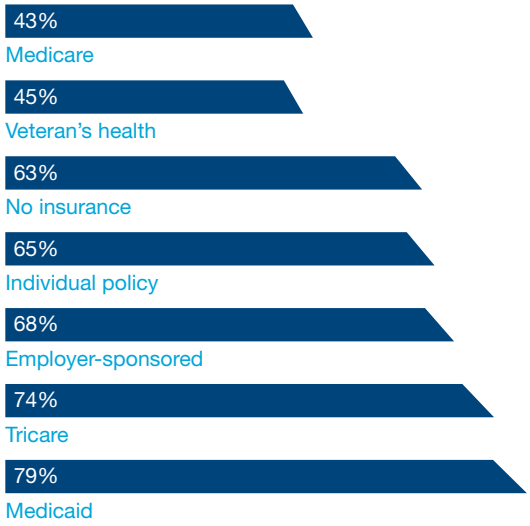
Because 70% of people with two or more chronic diseases own cell phones, there is an opportunity for developers to expand their targeting of the chronic disease population.[11] In addition, females are just as likely to buy a mobile health technology for themselves as they are for a family member or friend, while men are more likely to purchase a mobile health technology for a friend or family member rather than themselves (41% vs. 39%). However, patients with chronic diseases are less willing to pay out-of-pocket for electronic visits with their doctor (48% vs. 52%).

Hospitals/health systems, preferred place for individuals to buy mobile health products

Hospitals and health systems are the preferred suppliers of health-related products for both men and women, though 50% of physicians have never prescribed a remote monitoring device and said they don't have enough information on mobile health. Likewise, the doctor is still overwhelmingly the most trusted source of healthcare information (71%), though physicians report the second biggest obstacle when running their practices is not being able to increase face-to-face time with their patients as they would like to. Mobile can be an avenue through which patients can receive health information from the source they trust the most, though from a mobile adoption standpoint, one-third of physicians cite not having enough information as a barrier to adopting mobile health in their practice.

Consumers are starting to prefer their doctor, nurse, or hospital communicate with them through means other than phone calls, with 23% preferring email for appointment

Figure 11: Text message usage by insurance type



Source: PricewaterhouseCoopers HRI Consumer Survey, 2010

reminders and other simple communications, and Medicare patients are no less likely than other individuals to want to receive communications from their doctor over email.

Medicaid patients are most likely to use text messages

Text messaging has emerged as an effective way to reach a wide population. Nearly half of Medicare patients and almost 80% of Medicaid beneficiaries who own mobile phones say they text regularly (See Figure 11). Wolfsen, of Safeway, pointed out, "If you look at this segment of the population,

11 Jane Sarasohn-Kahn, M.A., M.H.S.A. "How Smartphones Are Changing Health Care for Consumers and Providers." California Healthcare Foundation, April 2010, accessed August 23, 2010, http://www.chcf.org/~/media/Files/PDF/H/HowSmartphonesChangingHealthCare.pdf.

they tend to have less access to digital information and do not necessarily have web access. Mobile can be used to reach these individuals." Medicaid individuals also have the highest percentage (58%) of those sending/receiving more than six text messages per day. Text messaging can be another channel for health related reminders or remote medical monitoring.

Infrastructure

Hospitals are increasingly feeling the constraints of outdated wireless networks. Adequate infrastructure is needed to support high capacity and bandwidth mobile systems within hospitals. New healthcare-dedicated frequencies and 4G wireless networks are some of the ways telecommunication companies are enhancing the infrastructure of hospitals to support advancements in wireless technology. While we all use multiple platforms everyday in all aspects of our lives, like Microsoft Windows, Facebook, the iPhone and the iTunes store, we rarely stop to notice what a platform is or how it works. However, such an understanding is critical to understand the type of infrastructure required to drive the innovations necessary for the adoption of mobile health and wellness solutions.

In addition, developers are focusing on platforms to allow for the greatest flexibility of applications and devices. Platforms enable many technologies and players to participate in mobile health. There are several models of platforms with key characteristics that include the core, peripherals and interfaces. As companies determine their roles in the digital world, they could become hubs into which other services connect. A simple example outside of healthcare is Evernote, where users can organize anything from personal notes, web clippings, electronic documents and pictures on a private online site. It has an optical character recognition (OCR) capability so users can locate their items by a key-word search. New information is automatically synched when an account is accessed via mobile or traditional web.

Key infrastructure markets

- **Security.** When physicians were asked about barriers to adopting mobile health in the HRI survey, "worried about privacy and security" was the top answer, cited by one-third of PCPs and 41% of specialists. However, Bill Braithwaite, M.D., who developed the HIPAA regulations when he was with HHS in the mid-1990s, suggests that data on mobile platforms can be secure with the right measures. "Multi-factoral authentication provides a higher level of assurance that the user is who he or she claims to be," said Braithwaite, who is now chief medical officer of Anakam, a security software company.

  "There are three factors that can be used to identify you as the proper user: something you know, something you are and something you have," added Braithwaite. "Commonly, username and password are used, but both are instances of a single factor, something you know. For stronger authentication, the user must also present a second factor, which could be something you have, such as a registered ID card or cell phone, or something you are, such as a finger print or voice print."

  The financial services industry uses similar security measures for online banking along with behind-the-scenes location login monitoring. "Messaging about our banking

Drug company creates iPhone app for patients with Gaucher's disease to enhance care, speed insurance approval

When Shire's drug, VPRIV, for Type 1 Gaucher's Disease was approved by the FDA in 2010, it targeted the fewer than 5,000 patients in the U.S. with the incurable chronic genetic disease. This small and well-informed community of patients, who receive biweekly infusions, cheered the news of a second drug for them. "The Gaucher community is a very vocal customer base that will advocate fiercely because they went for so many years before treatment," said Ned Kitfield, associate director, U.S. VPRIV Marketing and Commercial Operations. For Shire, the business model for mobile health was one that empowered an already vocal patient community with a tool to manage various aspects of their disease. The result was a robust app, called OnePath, that tracks patient health metrics, provides real-time information to physicians and connects patients to dedicated case managers who streamline insurance coverage issues. OnePath also includes news, calendars, and "iGau," which helps patients track therapeutic goals. iGau allows the patient to track bone pain, haemoglobin levels, liver volume, platelet count, and spleen volume. Patients can take this information to their regular doctor visits "Many patients have been treated for years but don't have an easy way of recording these records. They will say, 'Yes, I feel better,' but the doctor wants to know what the actual results are."

"The patients have infusions every other week. We wanted to create an application that would empower them with information, allow them to communicate with us more easily, and ultimately be able to also communicate with their physicians." Throughout development of the app, Shire reached out to the tight-knit Gaucher's community for advice "We really try to involve members of the patient community, whether in a formal test setting or an informal poll."

Shire's goal was to get the patients to ultimately drive physician adoption of the OnePath app: "We started with the patients because our patients—they are a motivated patient group." Shire's focus currently is enhancing the relationship between the patient and their doctor. "We are not in the loop. We don't have access to any of the data. The patients can communicate with us through the app if they want to or have to." Shire is currently developing a complementary physician app: "Our goal is to create something valuable and enhance the relationship between the physician and patient."

Lessons learned

1. Patient adoption can drive physician adoption; in small disease populations, physicians may be more open to the preferences of their individual patients.

2. Patients want more information at their fingertips. The iGau tracker empowers the patient with information on health metrics to help them and their doctor make more informed decisions regarding treatment. Tools that help patients manage their entire disease could create allegiance to a particular therapy.

3. A small, close-knit disease population can be a good target for a mobile device application as well as connect to social media communities (e.g., Patients Like Me). The Gaucher community is tight-knit and motivated, as many remember not having any treatment available.

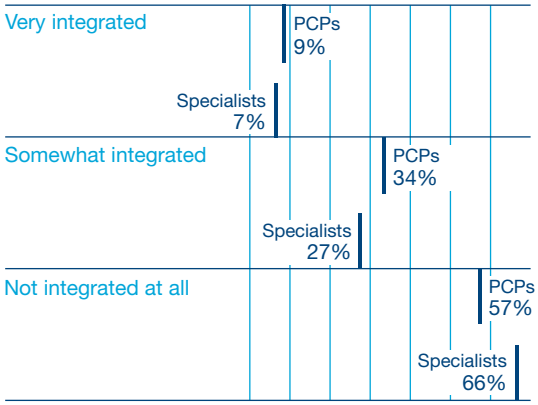
security assurance program is key on the customer side," said Tom Trebilcock, vice president e-business and payments at PNC Financial Services. "You need to first establish trust and assurance with the customer."

- **Integration.** Of the physicians who are using mobile applications and devices, 63% are using personal devices that are not connected to their office or hospital IT systems (See Figure 12). Hospitals in general have not put mobile connectivity at the top of their IT list— 30% of physicians said their hospitals or practice leaders will not support the use of mobile health devices.

  Joseph Kvedar, MD, director of the Center for Connected Health at Partners HealthCare in Boston emphasized that while "sensor technology may be rapidly becoming commoditized, integration with EMR and data aggregation systems is not something we have seen done well. We need to get better at gathering information, adding logistical software to get to the intersection of all the data and population health management."

  Vendors may not be ready to help either. In a PwC survey of hospital CIOs, 42% said they believed their device connectivity vendors were unprepared or they did not know if they were prepared to assist them with medical device interoperability. Such interoperability will be required in the later stages of achieving meaningful use compliance.

Figure 12: How integrated are physician mobile device apps with hospital IT systems?



PCPs: Primary Care Physicians

Source: PricewaterhouseCoopers HRI Physician Survey, 2010

Telecom vendors are, however, working on interoperability for their customers. Qualcomm recently developed a cellular module that allows online health data, from wearable medical devices, to connect and exchange information through several interfaces. "Qualcomm's platform has the capability to link the body area network devices like a smart Band-Aid to personal area networks like wifi to wide area

How do we help our clinicians that are going to multiple places for locating information? We go to them.

—Teek Dwivedi

cellular networks and the Internet," said Don Jones, vice president of business development, health and life sciences. You can mix and match in many different ways."

- **Increasing bandwidth.** Hospitals are starting to feel the crunch of outdated wireless systems. Without a robust infrastructure in place, care providers cannot utilize high-bandwidth mobile healthcare technology. Sprint is using an infrastructure model to help providers extend their ability to provide care outside of the hospital. One partnership geared toward mobilizing physicians and eliminating bandwidth constraints is with Calgary Scientific and its ResMD application. "We're taking a $100K workstation and bringing it to a mobile device like EVO that can display images such as a 3-D brain scan," said Tim Donahue, vice president of Industry Solutions at Sprint. "The network is as important as the device," he added. "EVO has a 1GHz processor in the device and needs a robust 3G or 4G environment to effectively use that kind of information. Even Wi-Fi networks run into capacity and mobility constraints."


Waiting Area
EXIT

What this means for your business

Adoption of mobile health will depend on what you give for the money

Mobile technology is changing the way we think about entertainment, connect with peers and drive our cars. However, it's yet to pierce the ingrained practices of healthcare. Some innovators like Eric Topol, MD, a leader in wireless medical innovations and director of the Scripps Institute and vice chairman of the West Wireless Health Institute, say benefitting from mobile technology starts with thinking differently about how to measure success: "When you measure success of a remote monitoring device for diabetes, it's helpful to think about whether you're talking about the short-term outcome of improving time in the normal glucose range or a longer term effect such as preventing kidney failure. The surrogate measurement of improved time in the normal range could be enough of an outcome to warrant the use of the monitoring device."

Physicians and consumers see mutual value in mobile health. And those intersections lead to opportunity. For example, physicians are interested in remote monitoring and consumers are willing to pay for it. Figure 13 depicts additional consumer and physician attitudes toward mobile health.

Figure 13: Where physicians and consumers meet

Source: PricewaterhouseCoopers HRI Physician and Consumer Surveys, 2010

Where you are and how to start

Whether you're thinking about mobile health, planning for mobile health or leading mobile health, defining and understanding the customer(s) will enable you to determine the most appropriate business model. Each model may target one or more of the following goals: providing a better transaction, giving more knowledge, easing communication and/or integrating solutions and information (See Figure 14). Consider these steps when identifying and executing on the mobile health opportunity:

1. **Customer:** Identify the specific market segment for mobile applications (consumer, employer, provider, pharma, device, payers, etc.)

2. **Pain points:** Identify the current failure and pain points that mobile solutions can more effectively address for the target market

3. **Work flow:** Identify how the current processes, practices and work flow would change by the application of mobile solutions to provide a better outcome

4. **Vision:** Create a vivid visualization of the mobile solution and the characteristics of the offering that would create greater value

5. **Value proposition:** Create the value proposition that identifies, quantifies and measures the cost, convenience, confidence and compensation from outcome improvements from the mobile solution

6. **Platform:** Identify an existing platform or the need to create a new platform upon which the new mobile solution should be launched and the partners required for the platform components

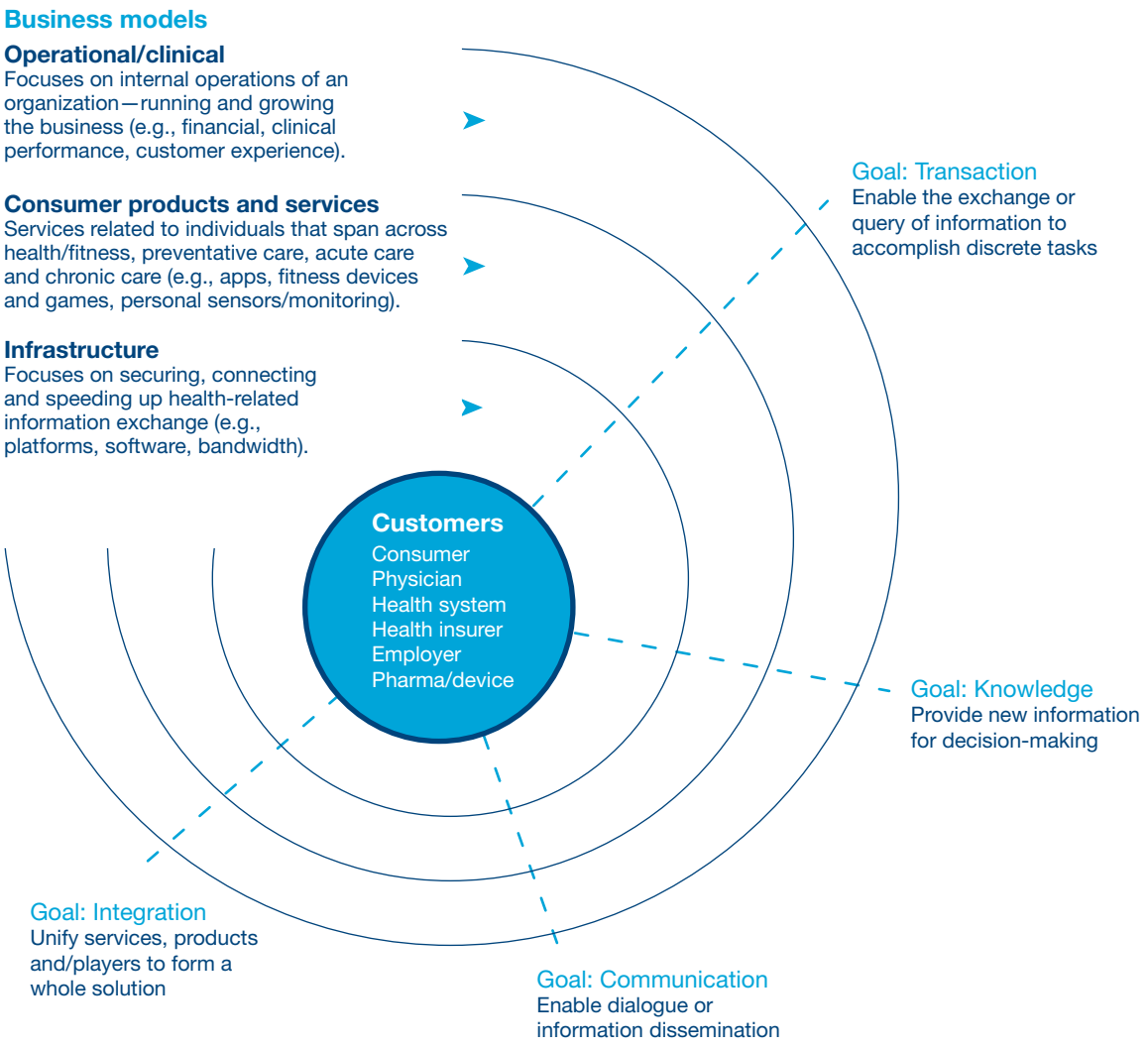
7. **Business model:** Create the business model that delivers the value proposition by leveraging existing or creating new payment options

8. **Develop and launch:** Develop and launch the mobile offering for the target market through pilots and then full launch based upon realizing metrics and milestones of successful adoption

9. **Data mining:** Mine real-time data and information to create increasing value for all stakeholders

10. **Scale:** Expand the platform and business model to address the larger and adjacent markets

Figure 14: Mobile health business models



Source: PricewaterhouseCoopers Health Research Insititute

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Bill Braithwaite, MD, PhD
Chief Medical Officer
Anakam

Donald Burt, MD
Chief Medical Officer
PatientKeeper

Carolyn Carter
Manager, Business Development,
State Sponsored Business
WellPoint

Yan Chow, MD
Director, Innovation and Advanced
Technology Group
Kaiser Permanente

Karen Coppock, PhD
Senior Program Officer
McKesson Foundation

Don Cowling
Vice President and Managing Director
Merck Serono, UK and Ireland

Tim Donahue
Vice President of Industry Solutions
Sprint

Prateek Dwivedi
Vice President and Chief Information Officer
Mount Sinai Hospital, Ontario, Canada

Sandra Elliott
Director, Consumer Technology and
Service Development
Meridian Health

Doug Elwood, MD
Chief Strategy Officer
Zibbel, LLC.

Henry Engleka
Chief Executive Officer
Zibbel, LLC.

John Glaser
Former Chief Information Officer
Partners HealthCare

Aaron Goldmuntz
Director, Business Development
Cardionet

Chris Gray
National Solutions Manager for Healthcare
Sprint

Michael Hansen
Managing Director
Matchbox Ventures

Robert Havasy
Business Analyst
Center for Connected Health
Partners HealthCare

David Jacobson
Staff Vice President, Business Development,
State Sponsored Business
WellPoint

Ted Johnson, MD
Director, Division of Geriatric Medicine
Wesley Woods Center at Emory University

Don Jones
Vice President, Business Development
Health & Life Sciences
Qualcomm

Mohit Kaushal, MD, MBA
Director of Connected Health,
Omnibus Broadband Initiative
Office of Strategic Planning and Policy
Federal Communications Commission

Rajeev Kapoor
Former Global Managing Director
Verizon Connected Healthcare

Ned Kitfield
Associate Director, US VPRIV Marketing,
Commercial Operations
Shire Human Genomic Therapies

Joseph Kvedar, MD
Director
Center for Connected Health
Partners HealthCare

Munesh Makhija
General Manager, Communication and
Informatics for GE Healthcare
GE Healthcare

Michael Mathias
Vice President and Chief Technology Officer
Aetna

Meg McCabe
Vice President of Consumer
Marketing and Product
Aetna

Johnny Milaychev
Product Manager
New Wave Software

Mark Moffitt
Former Chief Information Officer
Good Shepherd Medical Center

Roy Swackhamer
Chief Information Officer
SCAN Health Plan

Eric Topol, MD
Director, Scripps Translational
Science Institute
Chief Academic Officer, Scripps Health
Vice-Chairman, West Wireless Health Institute
The Gary and Mary West Chair of
Innovative Medicine
Professor of Translational Genomics,
The Scripps Research Institute

Tom Trebilcock
Vice President, e-business and Payments
PNC Financial Services

Heath Umbach
Product Marketing Manager
PatientKeeper

Carrie Varoquiers
President, McKesson Foundation
Vice President, Corporate Citizenship

Mike Weckesser
Director, Emerging Business–Health
Solutions
Best Buy

Brad Wolfsen
Vice President, Strategy and Health Initiatives
Safeway, Inc.

About the research

Healthcare Unwired is the most in-depth research to date into mobile health by PricewaterhouseCoopers' Health Research Institute (HRI). HRI conducted 35 in-depth interviews with thought leaders and executives representing healthcare providers, payers, private sector technology organizations, academic medical centers, telecommunication companies, pharmaceutical and device companies, retail companies, communication firms, and employers. HRI also commissioned an online survey in the summer of 2010 of 2,000 consumers and 1,000 physicians regarding their use and preference of mobile technologies in the United States.

Mobile health is being defined broadly as the ability to provide and receive healthcare treatment and preventative services outside of traditional care settings. Mobile health tools can include remote patient monitors, video conferencing, online consultations, personal healthcare devices, wireless access to patient records and prescription applications using a cellphone, smartphone or wireless tablet. Our mobile discussion may also include telehealth, which is more established and include the physical/virtual integration and interoperability of devices like heart rate monitors, pulse oximeters, wireless scales.

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PricewaterhouseCoopers (www.pwc.com) provides industry-focused assurance, tax and advisory services to build public trust and enhance value for our clients and their stakeholders. More than 163,000 people in 151 countries across our network share their thinking, experience and solutions to develop fresh perspectives and practical advice.

Health Research Institute

PricewaterhouseCoopers' Health Research Institute (HRI) provides new intelligence, perspectives, and analysis on trends affecting all health-related industries, including healthcare providers, pharmaceuticals, health and life sciences, and payers. HRI helps executive decision-makers and stakeholders navigate change through a process of fact-based research and collaborative exchange that draws on a network of more than 3,000 professionals with day-to-day experience in the health industries. HRI is part of PricewaterhouseCoopers' larger initiative for the health related industries that brings together expertise and allows collaboration across all sectors in the health continuum.

Health Research Institute Advisory Team

Christopher Wasden
Managing Director
646.471.6090
christopher.wasden@us.pwc.com

Bruce Henderson
Director
513.325.8885
bruce.a.henderson@us.pwc.com

Bo Parker
Managing Director
408.817.5733
bo.parker@us.pwc.com

Cliff Bleustein, MD
Director
646.471.2439
cliff.bleustein@us.pwc.com

Preetham Peter
Director
703.863.5941
preetham.s.peter@us.pwc.com

William Molloie
Partner
619.744.8116
w.molloie@us.pwc.com

Maxim Duprat
Director
917.405.4816
maxim.m.duprat@us.pwc.com

Christine Freyermuth
Senior Manager
617.530.4507
christine.s.freyermuth@us.pwc.com

PricewaterhouseCoopers' Health Research Institute

Kelly Barnes
Partner, Health Industries Leader
214.754.5172
kelly.a.barnes@us.pwc.com

David Chin, MD
Principal (retired)
617.530.4381
david.chin@us.pwc.com

Sandy Lutz
Managing Director
214.754.5434
sandy.lutz@us.pwc.com

Benjamin Isgur
Director
214.754.5091
benjamin.isgur@us.pwc.com

Serena Foong
Senior Manager
617.530.6209
serena.h.foong@us.pwc.com

Joanna Bonventre
Research Analyst
617.530.7563
joanna.bonventre@us.pwc.com

Stephanie Zefferino
Research Analyst
646.471.2867
stephanie.h.zefferino@us.pwc.com

Sarah Haflett
Research Analyst
267.330.1654
sarah.e.haflett@us.pwc.com

pwc.com/us/healthindustries
pwc.com/us/hri
twitter.com/PwCHealth

To have a deeper conversation about how this subject may affect your business, please contact:

Kelly Barnes
Partner, Health Industries Leader
214.754.5172
kelly.a.barnes@us.pwc.com

Christopher Wasden
Managing Director
646.471.6090
christopher.wasden@us.pwc.com

Dan Garrett
Partner, Healthcare IT Practice Leader
610.256.2055
daniel.garrett@us.pwc.com

William Molloie
Partner
619.744.8116
w.molloie@us.pwc.com

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