mHealth
Mobile technology poised to enable a new era in health care
“Smart mobile devices and applications, working in concert with cloud computing, social networking and big data analytics, will be at the core of global health care transformation. These transformative technologies will continue to lead with ways to help rein in cost, broaden access, change behaviors and improve outcomes.”

Pat Hyek
Global Technology Industry Leader
Ernst & Young

Note: all monetary references within this report are to US dollars.
**Introduction**

Mobile technology poised to enable a new era in health care

Smart mobile technology is poised to transform global health care — with a little help from other technology megatrends, such as social networking, cloud computing and big data analytics.

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“The first thing we ought to recognize is that mobile is now part of the fabric — every day in everybody’s life. So if you’re not looking at mobile solutions, then you’re not really looking at all solutions.”

Mal Postings
Global CTO – IT Advisory
Ernst & Young

This is a grand statement, we know. And many factors will influence the depth, breadth and speed of health care’s badly needed transformation, as costs escalate, the global population ages and the developing world demands better and more available access to care. Luckily, we’ve seen smart mobility’s impact before. Again and again, in so many industries, smart mobile devices and their applications have transformed the way people live, work and play. This is because mobile devices act as the linchpin for the other technology megatrends, delivering into people’s hands the critical information and insight they need in a given moment, wherever they are. The information and insights may be produced via social networks, analytics or both; they may be processed and stored in a public or private cloud. And they’re delivered via smart mobile devices and apps.

This report complements the work done for Ernst & Young’s Global Life Sciences Center’s study, Progressions, *The third place: health care everywhere* (see page 53, “Source notes”).

Progressions presents a clear vision of how behavioral change and moving health care out of hospitals and doctors’ offices to wherever patients are will play key roles in improving health care outcomes, expanding access and lowering cost. In researching our own report, we synthesized the insights of our Global Technology Center professionals with extensive secondary research — and again, we saw innumerable examples of the smart mobile “linchpin” dynamic described above at work to bring about the Progressions vision of “health care everywhere.”

Technology companies able to bring to market products and services that accelerate the global health care industry toward that vision may well be positioned to participate in an historic technology-enabled solution to one of humanity’s most pressing problems — as well as an historic growth opportunity. With this in mind, we invite you to explore the results of our synthesis in the “Overview” that follows and four subsequent drill-downs examining the effects of this mHealth transformation on health care consumers — patients, physicians, providers and payers.
Overview

The coming global mHealth transformation

Current situation

As a series of seemingly unmanageable challenges continues to plague global health care, industry stakeholders — from patients to physicians, providers and payers — are increasingly turning to mobile technologies to play a key role in the “cure.” Managing chronic disease and related unhealthy lifestyle choices has left governments in developed nations to struggle with unsustainable levels of health care cost, while millions in the developing world suffer or die beyond the reach of traditional health care.

Meanwhile, behavioral change and treating patients outside the four walls of traditional provider institutions have evolved as core to a health care industry vision of treating patients wherever they are (the third place), while enhancing patient outcomes and lowering cost. This is where smart mobile technology comes in: its ubiquity (90% of the world’s population was within reach of a mobile network in 2010) and the proven ability of smartphones and tablets to effect behavioral change have placed smart mobility at the center of an information technology-enabled vision of health care’s future.

Mobility leads multiple technologies ready to enable health care

In fact, multiple technology megatrends support smart mobility’s health care role, including cloud computing (which could provide mobile access to health information and applications), social networks (which have already begun to provide patient-centric information sharing and peer support) and big data analytics (which could provide anywhere, anytime diagnostic insights). And importantly, these technologies are ready to help now. Their value in support of the three primary goals driving health care change — lowering cost, improving outcomes and increasing access — has been demonstrated in a multitude of small pilots and related examples, although these generally lack the size and control group comparisons that health care industry stakeholders require before widespread adoption.

Health care approaching a tipping point

Technology’s readiness to support the rapidly evolving new global health care vision is important because the industry is approaching a tipping point. According to the Ernst & Young report Progressions, “Health care’s stakeholders — governments, regulators, employers, payers, nonprofits — are aware that the system is broken and that we need a new system for delivering, consuming and paying for care.”

Figure 1 (page 8) suggests the unsustainability of the current health care model, with multiple stakeholders (who can have differing incentives) and siloed information flows. This is a global issue, even though the topic may be hottest right now in the US, where health care costs have reached 17.9% of gross domestic product (GDP). But costs are at 8% to 9% of GDP and growing in most European countries, and are already at 4.5% in China and growing rapidly. The Progressions report cites the cost of chronic disease care as the major global cost factor, accounting for 75% of health care costs. Other research suggests chronic care costs will continue to grow from a substantial burden into “a staggering one over the next two decades.”

The sheer size of the population accessing health care is increasing as well, with growing incomes in emerging nations and the expansion of health care coverage in the
US. There, for instance, health care legislation is in the implementation phase, with state and federal governments setting up health-insurance exchanges and other mechanisms intended to bring coverage to an additional 30 million uninsured Americans.7 While no panacea, health information technology (HIT) is increasingly seen as one way to address the additional demands this new population will place on the already strained US health care system. Throughout the health care system, questions of “who pays?” and “how much?” are on the table. For instance, some are seeing a shift in the purchase of medical devices from physicians to more cost-conscious hospital buyers, requiring changes as far-reaching as design simplification and cost-reduction.8 Policies encouraging generic drugs as a matter of cost reduction are the subject of continual legal battles – with some pharmaceutical companies arguing that research and development funds hang in the balance. There is also widespread acknowledgement that many health care payment and incentive systems don’t work because they encourage the “wrong” behavior, particularly in the US where costs are highest. There, pay-for-service models likely have contributed to the high cost by focusing medical professionals on actions that generate reimbursements, such as office visits, tests and surgical procedures, rather than outcomes – i.e., healthier health care consumers. “This system evolved, in part, because it rewarded activities that were tangible and easily measured by claims data such as encounters, admissions or procedures. Before electronic medical records (EMRs) were adopted, even quality measures were measured by surrogate process markers such as the fact that a lab [test] was done – not what the lab result indicated,” says Dr. Bill Fera, Advisory – Performance Improvement (PI), Health Care, Ernst & Young.

Changing health care incentives could boost mobile adoption ...

Now, however, new forms of pay-for-performance health care models are emerging, such as Accountable Care Organizations (ACOs) and patient-centered medical homes, to incent outcomes-oriented behavior on the part of physician practices and larger health care providers (i.e., hospitals and hospital networks). Mobile technology that enables remote monitoring of patients and that provides patients with rapid access to medical clinicians when questions arise is expected to play a key role in such organizations. For example, just such a telehealth trial in the UK, where the government is the primary payer and provider of health care, yielded a 15% reduction in doctor’s office visits, a 20% reduction in emergency admissions, a 14% reduction in the need for planned admissions and – most strikingly – a 45% reduction in mortality rates.9

“Patient satisfaction in that trial also was very high,” notes Kenny O’Neill, Advisory – PI, Ernst & Young. “Some patients started calling the main unit their ‘little nurse sitting in the corner,’ they liked it that much. It gave them a bit of control back, where before they were more reliant on their caregiver,” explains O’Neill.

“At this moment in time many health care and technology companies are looking for the right strategic partner to develop and expand their mobile platform, while achieving their strategic agenda.”

Sol Vairavan
Transaction Advisory – M&A
Ernst & Young

Ninety percent of the world’s population was within reach of a mobile network in 2010.
... and mobile adoption could boost outcomes-oriented incentives
But despite its critical role in improving outcomes, technology’s ability to provide a digital record that demonstrates the relationship between care and outcomes is equally important. Explains Dr. Fera: "The first time managed care was attempted in the US, primarily as HMOs [health maintenance organizations], most of the clinical record was on paper and bonuses or rewards were based strictly on spend. Essentially, I could be financially rewarded if I were to withhold care. There was no quality aspect, because it could not be readily measured."

However, once outcomes-oriented incentives are in place, "I can be financially rewarded if I’m providing good care, which is keeping my patients healthier and out of hospitals. And I can prove that now through the digital record," Dr. Fera says. This is a key enabler of the envisioned transformation from pay-for-service to pay-for-performance reimbursement and incentive models.

Further, tablets and smartphones can deliver patient information and diagnostic insights to physicians wherever they are — in their offices, on hospital rounds, in a patient’s home or at 35,000 feet, as described in our “Perspective on physicians” (page 23).

For all these reasons, "Technology companies now have an opportunity before them to help solve what may be society’s biggest challenge of this century. And if they do so, their growth opportunity could be commensurate with the size of that challenge," says Ed Tomlinson, Advisory – PI, Ernst & Young.

Health and wellness apps are already driving mobile health technology adoption
While outcomes-oriented payment schemes such as ACOs are still experimental, mobile health and wellness apps are being offered by a wide range of organizations, from sports apparel companies to hospitals. All of these have the common aims of altering lifestyle choices like diet and exercise to foster better health, or helping patients better manage chronic conditions. In a recent US example, medical insurer UnitedHealth Group announced alliances with three mobile app providers: CareSpeak Communications, whose app helps patients manage chronic disease and related medication through two-way text messaging; LoseIt!, which helps manage weight; and Fitbit, whose wireless tracker counts steps taken, stairs climbed and calories burned, and provides a link to a website to analyze the results and compare them with peer groups.

Such alliances draw on ancient wisdom. It was, after all, Hippocrates who famously said, "If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health.”

Hippocrates, however, could not have imagined that the knowledge and incentive necessary to achieve his vision could be constantly streamed to entire populations due to information technology and the ubiquity of smart mobile devices, which have been shown to be powerful agents of behavioral change (see page 15, “Perspective on patients”). Smart mobility’s power to effect change is not limited to developed nations. Mobile-enabled health initiatives also have shown important impact in the developing world. For example, a simple messaging system (SMS) application aiming to improve medication adherence among antiretroviral patients in Kenya improved adherence by approximately 25%, thus improving health and lowering associated costs by up to 7%.
The mobile-enabled health care vision
Given the context, and the cornucopia of health-related mobile technologies and applications already appearing, a near-term vision of mobile-enabled health care – or mHealth, as many have started calling it – has begun to take shape.

The evolving mHealth vision is patient-centric but with information services and data analytics at its core (see Figure 2, page 9). While this may sound contradictory at first, it isn’t. The vision is patient-centric because the various evolving approaches involve one or more of the following: delivering information to the health consumer to empower him or her to make healthier choices; remotely monitoring (through mobile sensors or other mechanisms) information from the patient (such as vital statistics and blood glucose); or delivering information or insight to clinicians at the point of care with the patient. It is this wealth of information, including both personalized, patient-specific data and aggregated big data (appropriately analyzed) that come together to create the knowledge and insight that will lead to customized, improved medical outcomes.

“In this vision, mobile devices are the nerve endings at the edge of a vast information network,” says Mal Postings, Global CTO – IT Advisory, Ernst & Young. “The patient data they provide feeds into the information services at the core, alongside relevant databases encompassing diseases, therapies, medical devices, procedures and related outcomes. Those information services, in turn, power mobile health applications that deliver valuable information or analytical insights that help patients or their caregivers manage their medications, better control chronic diseases, or improve their overall health and wellness.” (See Figure 2, page 9.)

Discharging health care from hospitals and doctors’ offices
A key element of this vision is to move much health care activity out of high-cost venues, such as hospitals and doctors’ offices, and into patients’ homes or wherever they happen to be – what the Progressions report calls “the third place.” By doing so, and by using mobile-delivered information to foster better lifestyle choices and improve medical outcomes, this evolving vision lowers health care costs to a sustainable level, while extending access beyond the reach of traditional health care. The UK trial described earlier shows how such an approach can drive down cost, while improving outcomes. “What is more, continuous data from wearable and implantable sensors could improve drug adherence and could keep people out of hospitals by identifying patients who are trending toward hospitalization several days in advance,” says Stephen Oesterle, M.D., Senior Vice President for Medicine and Technology, Medtronic Inc.11

In the US, however, where health care payers and providers traditionally are separate enterprises, this vision is leading to a buildup of tension among certain stakeholders – for example, between providers and the government. In an April 2012 letter to the US Department of Health & Human Services, the American Hospital Association (AHA) expressed disagreement with certain requirements the agency established under the American Recovery and Reinvestment Act of 2009 (ARRA).12 For example, the AHA specifically objected to providing patient access to medical information via an internet portal. The AHA letter states, “Our members are particularly concerned with the proposed objective to provide patients with the ability to view, download and transmit large volumes of protected health information via the internet (a ‘patient portal’). The AHA believes that this objective is not feasible as proposed, raises significant security issues and goes well beyond current technical capacity.”13

In the long run, Dr. Fera believes it is likely that hospitals in the US will be re-engineered as more outpatient-oriented institutions, and become more vertically integrated with payers.
The evolution of ecosystem “frameworks”

Another element of the vision that we believe must rapidly evolve is a patient-centric mobile ecosystem “framework.” But a critical unanswered question is whether such frameworks will be based on public domain standards or will be walled gardens offered by providers and payers. Such a framework would be the main mechanism by which patients digitally interact with all their clinicians, provider networks and payers. In a public domain model, health care consumers would plug information services from their various providers into their framework, and grant permission for information access or sharing at their discretion. In a walled garden model, the provider or payer would make all those decisions and grant access to the patient.

Information technology at the core of the vision

As Ernst & Young’s Mal Postings points out, “Health care is fundamentally an information business.” So it’s no surprise that information technology is at the heart of the evolving health care industry vision. Much of what needs to be done to achieve the vision is clear, in terms of the organization, analysis and dissemination of medical information and insight. What’s less clear is who will do it: the IT departments of payers or providers, technology companies or governments. In our view, this, too, requires an ecosystem of stakeholders with shared cost and accountability.

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When a consumer experiences the very best from an industry offering mobile solutions – take mobile banking for example – they expect the same level of quality from all other industries, including health care.”

Paul Chabot
Advisory – PI
Ernst & Young

Figure 1: Where we are today – technology innovation poised to enable health care transformation

Transformative technologies emerge:
- Smart mobility
- Social networking
- Cloud computing
- Big data analytics

Change drivers – the need for:
- Cost containment
- Increased access
- Better outcomes

Change challenges:
- Privacy/security
- Customer experience and change management
- Incentives/compensation and rewards
- Liability/tort reform (US)
- Inability to create value from universe of data
- Lack of standards/interoperability
- Need for integrated IT/human capital talent
- Siloed information

Enabling technologies arrive on the scene – offering promises and creating possibilities. For the first time, the universe of data and traditional IT has the potential to be connected into a health care ecosystem that can deliver actionable patient-centric information in a timely manner, overcoming the barriers of multiple data silos across many platforms.

Source: Ernst & Young analysis.
What’s most clear, though, is the critical role of IT expertise. In this regard, a February 2012 paper resulting from a collaboration of two US and one Canadian university was most illuminating. The paper demonstrated a correlation between IT expertise and the costs associated with implementing EMRs. Provider organizations that had deep IT expertise or were in regions where they had access to IT expertise showed significantly lower operating costs two years after EMR implementation; those with little previous IT experience or in regions where IT expertise was lacking showed increased costs after EMR implementation.14

For all of the reasons discussed, momentum has begun to build for mainstream adoption of mobile and related information technologies in support of the emerging health care vision. The following sections explore key factors that are accelerants or inhibitors to the grand mHealth vision.

“In this [mHealth] vision, mobile devices are the nerve endings at the edge of a vast information network.”
Mal Postings
Global CTO – IT Advisory
Ernst & Young

Figure 2: Where we are headed: mHealth value pathway – enabling health care everywhere

The health care vision will be realized when the universe of previously siloed data is standardized by integrating traditional IT with innovative information services. The result is integrated and actionable information that is private and secure and enables the delivery of health care efficiencies, positive customer experiences, modified behaviors and improved outcomes everywhere.

Source: Ernst & Young analysis.
Accelerating the vision

**Demand for mobile services:** Far and away, the most powerful force accelerating the global health care industry toward this mobile-enabled vision is the grassroots demand generated by health care consumers, as well as by physicians, nurses and other clinicians. This widespread demand for mobile services is something we’ve seen before in many industries. “When it comes to mobile, expectations don’t vary by industry. When a consumer experiences the very best from an industry offering mobile solutions — take mobile banking for example — they expect the same level of quality from all other industries, including health care. This sets the bar very high for providers of mHealth solutions. To be competitive, they have to leverage the same leading practices as the best mobile industries,” explains Paul Chabot, Advisory — PI, Ernst & Young.

**A sense of urgency:** Although there is debate about the best solutions, there is widespread agreement that in most developed nations the current health care system is not working, that it is creating an unsustainable economic burden and that the scope of these problems gets worse as populations age. This creates a sense of urgency to experiment with mobile-enabled solutions. Research shows some 125 million Americans already living with one or more chronic diseases, such as diabetes, heart problems or lung disorders.

**Social networks:** From sharing best practices and peer-group support to encouraging and spreading positive behavioral change, social networks provide information flow and a platform for patient-centric experimentation and collaboration among physicians. However, research shows that physicians have so far preferred to avoid interacting with patients via social networks (see page 23, “Perspective on physicians”).

**Successful trials of mobile-enabled health solutions:** Though they may not all meet the requirements of government health regulators, innumerable trials (such as the UK and Kenyan examples cited previously, various health and wellness applications shown to positively change lifestyle behavior and other examples cited throughout the remainder of this report) comprise a mounting body of evidence supporting further adoption of mobile-enabled health. Most recently, Geisinger Health Plan reported a 44% reduction in hospital readmissions for congestive heart failure patients, compared with a control group, in a telemonitoring trial.

**Collaborative care models:** Experiments that have begun in collaborative care models, particularly ACOs, could become a catalyst for accelerating change in current reimbursement paradigms, thereby helping to drive the mobile health revolution.

“Governments are exploring access to wellness care via multiple channels – traditional, online, mobile, telemedicine – so a person’s health can be forged in all the hours and days that their physicians are not directly in front of them. That’s when people’s health is really being determined.”

Aloha McBride
Advisory – PI, Government & Public Health Sector Leader
Ernst & Young
Inhibiting the vision

The big data challenge: This is really two challenges in one. First, a data quality and integration challenge to cleanse and then stitch together each individual provider’s disparate databases in a way that enables the seamless handoff of health information from one part of the health care ecosystem to the next. Then, once data is seamlessly accessible, comes the big data analytics challenge of deriving useful knowledge and diagnostic insight from the huge volume of data. These steps are a prerequisite for developing an outcome-based delivery model with the mobile-enabling information services at the core of the vision described above. The IT departments of payers and providers are best positioned to address this challenge—but if they don’t, technology companies are likely to step into the resulting vacuum.

Privacy and “Big Brother” concerns: Concern that mobile-enabled solutions will expose otherwise private health care information to greater risk may slow adoption of the information technology solutions. For example, Target Brands, Inc. made headlines recently as a result of using big data analysis techniques that caused maternity coupons to be mailed to a teenager who had not yet informed her family that she was pregnant. Whether justified or unfounded, there are questions about how much information consumers will be willing to share if they believe it will be used to raise their health insurance rates, or demand behavioral change against their will. “Where do you draw the boundaries between knowing enough about a person and presenting just the right options to them, and knowing too much and coming off like Big Brother?” asks Catherine Zhou, Advisory – Customer Insight & Analytics, Ernst & Young.

The talent challenge: While there are many health care experts and many technology experts, there are few individuals or even teams with sufficient depth in both arenas to drive the development of mobile-enabled health care as rapidly as stakeholders would like. That point is driven home by the university paper mentioned previously, which found that IT expertise defined the difference between higher or lower hospital operating costs once EMRs were deployed.

Security concerns: Information technology inevitably gives rise to information security concerns. Notably, there are already examples, such as hackers breaking into remotely monitored diabetes pumps. If not addressed with a high degree of confidence, security concerns may slow adoption because mobile transmission inherently increases the risk of data loss and security breaches. A full discussion of mobile security concerns is available in the recent Ernst & Young report, Mobile device security: understanding vulnerabilities and managing risks.

“Where do you draw the boundaries between knowing enough about a person and presenting just the right options to them, and knowing too much and coming off like Big Brother?”

Catherine Zhou
Advisory – Customer Insight & Analytics
Ernst & Young

mHealth gives rise to new security concerns: already, hackers have broken into remotely monitored diabetes pumps.
Ecosystem competition: There’s a natural tendency for each provider, from hospital networks to pharmacies to payers, to develop their own information ecosystem — absent a government mandate for a general framework. If such walled gardens evolve instead of a patient-centric ecosystem with interoperability standards that enable seamless information sharing (when authorized), mobile health technology adoption likely will slow.

The current system of incentives: While there are many small experiments, health care reimbursement paradigms in many developed countries still generally don’t accommodate mobile-enabled care. “This is why even telephone calls – an effective and easy way to make sure patients are doing okay and adhering to their medication plan, especially in between the time they are released from the hospital and their next office visit – are grossly underutilized,” says Dr. Fera.

The bring-your-own-device (BYOD) challenge: While not unique to health care, the challenges enterprises face in securing sensitive information as physicians, nurses and other providers bring their own devices to work is a particularly difficult one for health care organizations. BYOD requires delivering applications that work across multiple platforms with all the necessary security and privacy protections.

Overregulation: How regulators will treat various types of mobile-enabled applications and services remains an open question. “If regulators treat too many things as medical devices it will slow development. The viral growth would be interrupted,” explains Chabot. As this report went to press, the health care and technology industries were awaiting the release of final guidance from the US Food and Drug Administration (FDA) on regulation of certain health and wellness apps that could add months, if not years, and significant cost to the development and deployment of mHealth applications.

Unknown liability: Given the newness of mobile-enabled health care approaches, the liabilities involved for different health care organizations are uncertain. This could impede adoption in certain litigious cultures (e.g., the US) unless blanket indemnification is established (such as was the case in the UK telemedicine trial).

“Governments around the world are closely involved in setting the direction and driving the development of their health care systems. Technology companies must remain closely attuned to the evolving legislative and regulatory climate.”

Uschi Schreiber
Global Government & Public Sector Leader
Ernst & Young

“We’re confident that data of high quality is key to owning your future.”
Heather Budd
Chief Operating Officer
Blackstone Valley Community Health Care (a federally funded community health center in Pawtucket, RI)
Further exploring the mHealth vision

To explore the issues surrounding the mHealth vision, accelerators and inhibitors in more depth, four drill-down discussions begin on page 15. Each discussion explores the issues from the point of view of a different stakeholder: patients, physicians, providers and payers.

Technology companies should review these drill-downs with an eye toward evaluating where opportunities exist for their own company to leverage its technology expertise to help enable mHealth for one or more of these stakeholders.

“Superior health care delivery is fundamentally based on information, timing, decision-making and consumer involvement. Solutions in the arena of mHealth products provide real-time experiences that enhance these fundamentals to a great extent.”

Steven A. Matarelli
Chief Operating Officer, Administration,
Tawam Hospital, United Arab Emirates

mHealth: mobile technology poised to enable a new era in health care
Forty-four million health-related smartphone apps were downloaded worldwide in 2011.

“In a digital world where we can easily and securely access information about how much money is in our checking accounts and renew a driver’s license online, patient rights to access data are badly in need of a 21st century upgrade.”

Deven McGraw, Director of the Health Privacy Project at the Center for Democracy & Technology
Perspective on patients

Consumers press for health care everywhere

Current situation

Mobile technologies that have forever changed so many of the ways in which people live, work and play are now poised to transform their health care, as well. Consumers are urging on the arrival of health care everywhere by demanding mobile service from their physicians, providers and payers. They already use smart mobile devices to trade stock, arm and disarm their home security system, buy a car, find the nearest grocer, reserve a trip around the world. But to date, they have lacked comparable health care information, applications and services. Now they are beginning to bring their increasingly mobile habits to bear in dealings with doctors, hospitals and payers – and in managing their own health.

Worldwide, 44 million health-related smartphone apps were downloaded in 2011. And in the US, approximately 30% of survey respondents reported that they “always” or “frequently” turn to the internet to find answers to medical questions, with most adding this makes them better patients. Four in 10 US consumers have used social media to find reviews of treatments or doctors. Increasingly, access to this social and online health information is via smartphones and tablets.

Technology innovation enables improved health care

Mobile networks now reach 90% of the world’s population. Combined with powerful transformative technology megatrends like smart mobility, social networking, cloud computing and big data analytics, these networks lay the groundwork for patients to get health care not only in expensive hospitals and inconvenient clinics but in the communities and contexts in which they live. Mobility in this “third place” (i.e., beyond the walls of the hospital or of a physician’s practice), as it is called in Ernst & Young’s Progressions report, is not only a matter of technology. It is becoming a core attribute of patients, practitioners, providers and payers, equipping them to work together more effectively toward greater access to health care, lower cost and better outcomes.

Consumers test a range of mHealth capabilities

One of the first big waves of patient empowerment is coming at the intersection of mobile and social networking. On their own, consumers already participate in billions of health-related discussions online, more and more often using smart mobile devices. On PatientsLikeMe.com, just one of many health-related social networks, nearly 150,000 registered users share condition, treatment and symptom information on over 1,000 health issues.

But despite all the numerous reports of emerging mHealth use, it’s important to keep in mind that we are still very early in the adoption curve. A recent report shows that only 23% of consumers have used mobile health solutions today – and that includes mobile phone calls to doctors’ offices. This falls far short of general mobile usage patterns. For example, 64% of consumers have sent a text message, 38% have used their phone to access the internet and 27% use apps.

“Users need not only to understand the possibilities of eHealth tools, but they also need to feel that they have control over how they interact with them.”

European Union eHealth Task Force Report
mHealth apps increase patient access to medical information
Smart mobility is enabling patients to gain more control of their electronic medical records. In the US, Kaiser Permanente’s millions of patients were recently provided with a smartphone application to access health records through a mobile-optimized website. Even prior to launching the mobile service, Kaiser’s patient portal and personal health record, My Health Manager, was already being used by more than 3 million members.

Patients use smart mobility to enhance wellness ...
With their employers’ encouragement and independently, consumers have begun incorporating wellness and fitness applications into their lifestyles. The list of social-mobile fitness apps is long and growing. Some, such as the Nike + FuelBand, incorporate biosensors. Others, such as Runmeter, Walkmeter and Cyclemeter, incorporate GPS capabilities. SoFit is a new gaming platform for mobile fitness. By mid-2012, there were expected to be 13,000 consumer health apps on the iPhone alone.

... and to better manage chronic disease
Monitoring is another mobile application that is growing in scale. Patients using AT&T’s DiabetesManager enter blood sugar information by internet and mobile phones, and their caregivers provide coaching and do tracking.

Patients have not only used mobile applications, but used them effectively. In Kenya, for instance, WelTel provides a mobile text messaging service to monitor and support antiretroviral therapy, and patients using it have shown a 25% greater adherence to their treatment regimens.

Advanced mobile disease detection under development
More is on the way: with 70% of tobacco use occurring in developing countries, a Stanford University team recently developed an award-winning application that links an inexpensive device to a smartphone’s camera to screen patients for oral cancer and instantly transmit the data to dentists and oral surgeons. Increasingly, sensing devices such as blood pressure cuffs are being connected directly or wirelessly to smartphones. Such capabilities are also being built into the phones. For instance, Korean researchers are developing bio-sensing capabilities for smartphone screens, to detect a range of diseases from a drop of saliva or blood.

“Nine million Kaiser Permanente patients can get their medical record today on their iPhone, schedule appointments and email their doctor. Patients love that level of connectivity. They have it in other things that they do, and they’re going to expect everyone else in health care to follow.”
George C. Halvorson
Chairman and Chief Executive Officer
Kaiser Permanente
## Figure 3: Technology innovation and the patient

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<th>Technology enabler</th>
<th>Patient impact</th>
<th>Emerging mHealth use</th>
<th>Quote</th>
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| **Smart mobility**  | Ability to do all of the following from anywhere at any time:  
• Communicate with doctors and hospitals  
• Access health-related information to research conditions  
• Obtain health care from remote and underserved communities  
• Monitor and manage chronic disease  
• Fitness and wellness programs and monitoring  | • China is expected to have the biggest mobile health market in 2017, bringing monitoring and diagnosis applications and information to a widespread population with poor access to health care.44  | “The first thing we ought to recognize is that mobile is now part of the fabric – every day in everybody’s life. So if you’re not looking at mobile solutions, then you’re not really looking at all solutions.”  
Mal Postings, Global CTO – IT Advisory, Ernst & Young  |
| **Social networking**  | Tap into peer-group knowledge to:  
• Compare costs of different providers and physician practices  
• Compare outcomes performance of different providers and physician practices  
• Obtain peer advice on treatment and living with chronic conditions  | • 23% of US internet users living with chronic conditions have gone online to find others who might have health concerns similar to theirs.45  | “A fantasy baseball league participant making decisions on which players to select has more data – by an order of magnitude – than a patient choosing a brain or heart surgeon.”  
Charles Kenney, author, The Best Practice: How the New Quality Movement is Transforming Medicine46  |
| **Cloud computing**  | Enables:  
• Delivery of “heavyweight” health care services and information to lightweight mobile devices  
• Personal health care ecosystems, including secure storage of patient information  | • Some 600 patients participating in the Radiological Society of North America’s Image Share project have reported finding cloud technology to be a faster, more efficient way to store and distribute their medical images.47  | “It’s about making these powerful applications available on these lightweight mobile devices by leveraging cloud power.”  
Paul Chabot, Advisory – PI, Ernst & Young  |
| **Big data analytics**  | Enables:  
• Individualized health care services  
• Targeted wellness and prevention  
• Cost comparison of different providers  | • A new US clearinghouse, cognizant of patients’ privacy concerns, uses a HIPPA-compliant privacy framework to strip patient identification from the data it is analyzing to track patterns of care and outcomes.48  | “We’ve found that certain search terms are good indicators of flu activity. By counting how often we see these search queries, we can estimate how much flu is circulating in different countries and regions around the world.”  
Google49  |

Source: Ernst & Young analysis.
Accelerating the vision

Health care consumers wish for many improvements to the health care system: better access to doctors, transparency in pricing, ownership of their own medical data, convenience in routine matters of scheduling and testing, efficiency of treatment and, ultimately, better health outcomes at a lower cost. Delivery of any of these via mobile technology should tend to accelerate their adoption of mHealth solutions for health care.

Core health care change drivers:
- **Cost containment**
- **Increased access**
- **Better outcomes**

**Consumer expectations**: As patients grow increasingly comfortable with mobile technologies in other parts of their lives, they will look to the health care system to adopt models from banking and retail that are more in tune with the hectic pace of their modern lives. In fact, in online and social media settings, patients have reportedly shown a tendency to expect answers to inquiries within the hour—or at least the day—from health care organizations unused to responding that quickly.

**Growing cost consciousness**: With patients seeing their health care costs continue to rise in the form of medical bills, insurance rates and taxes, increasingly they are expected to turn to such new alternatives as emerging online health insurance exchanges50 and commercial cost-of-care sites such as Health in Reach.51

**Social networks**: Patients’ experiences sharing information on treatments and diagnoses with peer groups in social networks are likely to encourage further adoption of mHealth solutions.

“Today’s health care consumers are better informed, technologically savvy and expect more from their health care system.”

Kevin Price
Global Technology Advisory Leader
Ernst & Young
Inhibiting the vision

Unlike other health care stakeholders, patients have relatively few factors inhibiting their adoption of mHealth technologies. Essentially, their speed of adoption comes down to their perception of benefit versus risk. And while patients are concerned with fewer risks than other stakeholders – they need not worry about legal liability, regulatory compliance, IT talent acquisition, etc. – they have a significant privacy worry that their medical information might be used against them, for example, in terms of health care access and cost.

Of course, governments hold many of the fiscal, policy and regulatory levers to set mHealth in motion, given their responsibilities for health system budgets, economic stability and the public good. But, “Ultimately, it will be the patient who decides how fast and how far the system evolves,” says Ed Tomlinson, Advisory – PI, Ernst & Young. “If a patient feels that an mHealth approach is going to be of benefit, give better health care, less intrusively, less disruptively, then I can see fairly rapid adoption. If the patient feels that it’s going to be more intrusive or give them a worse outcome or require them to go out of their way, then there’s going to be a lot of resistance,” explains Tomlinson.

**Privacy and security issues:** The issues of privacy and security raise the loudest alarm bells for patients. Health information exchanges among doctors, clinics and hospitals, for example, have set off those bells for some patients, who fear their information could be used to raise their insurance rates, impose unwanted behavioral change or otherwise expose them to risk. Such concerns reportedly scuttled plans for a US national exchange of this kind, although there are over 250 smaller exchanges in various stages of development.52 The Information Security and Privacy Advisory Board, meantime, is developing ways to ensure the security of wireless medical devices and says that, “With increasing connectivity comes greater functionality and manageability, but also increased risks of both unintentional interference and malicious tampering.”53 This possibility, which could give pause to anyone relying on such a device, was made all the more real with recent reports of hacking into insulin pumps worn by diabetics.54

**Health system limitations:** It is still true today that few patients have access to their medical data. In 2009, only about one in every five US physicians used even a basic electronic health record (EHR) system, a figure that has since risen to 40%.55 Despite years of work on these systems, in a letter to the US Department of Health & Human Services, the AHA indicates that delays in making them available still continue.56 Without access to their own medical data, patients will hardly be in a position to adopt mHealth.
mHealth: mobile technology poised to enable a new era in health care
Patient outlook

As the health system restructures itself to be more “patient-centric,” patients are also pressing for changes in care that they feel is too costly, inefficient, unaccountable and ineffective.

The profusion of mobile-social mHealth solutions delivered by cloud computing and empowered by big data analytics, described earlier, is just the beginning. New capabilities are being rolled out daily to address the range of needs along the path toward the mHealth vision. “At the moment there’s a whole proliferation of mobile services, not all of which are thought through,” says Mal Postings, Global CTO – IT Advisory, Ernst & Young. The consumerization of medical information and devices is only getting started, as the Progressions study notes. ⁵⁷

Ultimately, though, the Progressions report suggests that patients empowered with their own information in their own settings could trigger huge efficiencies throughout the health system as they take more preventive actions, engage in real-time monitoring, choose better and more cost-effective options and live healthier lives. ⁵⁸

Opportunities for technology companies

- How can we make mHealth apps ever easier and more engaging to use?
- How can we alleviate concerns about security, privacy, reliability?
- How can we make medical devices work seamlessly with patients’ smartphones and/or make smartphones themselves do some of the jobs now performed by medical devices?
- How can we create applications that provide real-time comparative information to assist patients in negotiating costs with their physicians?
Within one year of the iPad’s launch, 27% of physicians surveyed owned tablet computers.

“The digital world – the internet and the cloud and supercomputing and social networking – are breaking medicine out of its cocoon. It’s a superconvergence we’ve seen in other walks of life but not in the health and medical sphere.”
Eric J. Topol, M.D."
The value of advanced clinical mobility apps

A true story from cardiologist Eric J. Topol, M.D., published in an article by the American Medical Association (AMA), illustrates why mobile technology is emerging today as a game changer for physicians. During a cross-country flight, he was brought to a passenger “in obvious trouble.” Typically, according to the article, “Dr. Topol would have had to make an educated guess and hope he could take care of the patient until the plane landed. This time, though, he pulled out his iPhone, and with an app that produces an electrocardiogram, he determined that the patient was having a heart attack. The plane made an emergency landing while paramedics waited on the ground to take the patient directly to surgery.”

Simpler applications are significantly improving medical care in rural areas of the developing world. An example is World Health Partners in India. This for-profit health care business has networks of minimally trained Sky Care franchisees and immediately trained Sky Health Centre franchisees. Mobile phones enable the lesser-trained franchisees to send patient information via text message to remote medical experts in urban centers, who “make a diagnosis and then send a text message back with a recommended prescription or a course of action.”

Smart mobility brings the potential of health IT (HIT) to life

Stories such as these strike to the heart of why clinicians are rapidly adopting mobile technology, even though they have long been viewed “as computer-phobic Luddites, slow to adopt and benefit from health IT.” Mobility – and the easy usability of smartphones and tablets – has “caused physicians to view health IT adoption as something they want to do, as opposed to something they are being forced to do,” according to another AMA article. For example, it has caused many physicians to view EMRs more favorably by enabling instant mobile access to EMR data.

“Strong mobile security and patient privacy standards are needed before physicians will be comfortable using evolving patient-centric medical information ecosystems.”

David Kahan
Advisory – ITRA
Ernst & Young

For all these reasons, mobile device adoption statistics show rapid uptake among physicians.

- An April 2011 poll of 5,490 primary care and specialist physicians found 27% owned tablet computers, a rate five times higher than the general population – just one year after the introduction of the iPad.

- Approximately 80% of 115 medical residents in a Chicago hospital said their tablets made them more efficient, saving roughly an hour each day and often enabling treatments and prescriptions to be ordered earlier than they otherwise would.

- 76% of small- to medium-sized physician and dental practices in a January 2012 survey said they planned to buy tablets in the next 12 months.
# Technology enabler | Physician impact | Emerging mHealth use | Quote
--- | --- | --- | ---
**Smart mobility** | Enables real-time, anytime, anywhere:  
• Access to patient information  
• Access to medical information databases  
• Better ability to monitor chronically ill patients  
• Higher revenue potential (e.g., can see more patients per day) and lower administrative costs (i.e., through find-a-doctor or automated scheduling apps) | 76% of small- to medium-sized US physician and dental practices surveyed in January 2012 planned to buy tablets in the next 12 months.  
"The realm of ‘mobile’ health, with the proliferation of smart apps and integrated, connected devices, soon to have elements of ‘artificial intelligence’ to enhance prevention, tracking and compliance will have the biggest impact and ability to improve outcomes at a lower price in the next decade.”  
Dr. Daniel Kraft, Medical Chair, Singularity University 70 |  
**Social networking** | Enables physician-to-physician collaboration  
• Provides rapid learning environment  
• Enables patient-physician collaboration  
• Enables rapid dissemination of public health information  
• Creates better informed, more connected patients – with impacts both good and bad | 87% of US physicians use social media for personal purposes; 67% use it professionally.  
"If an outbreak occurs, transmission of information about it can occur worldwide in seconds [on social media]. From a public health perspective, that’s an extremely powerful tool.”  
Westby Fisher, M.D., Clinical Associate Professor of Medicine, Pritzker School of Medicine, University of Chicago 72 |  
**Cloud computing** | Provides platform for:  
• Collaboration  
• Participation in health information ecosystems  
• Hosted EHRs  
• Advanced capabilities not possible on local devices (e.g., voice-to-text translation) | One company used the cloud to integrate context-aware voice recognition into its EHR offering, enabling doctors to fill out the patient record by speaking words into a mobile device.  
"The digital world – the internet and the cloud and supercomputing and social networking – is breaking medicine out of its cocoon. It’s a superconvergence we’ve seen in other walks of life but not in the health and medical sphere.”  
Eric J. Topol, M.D. 74 |  
**Big data analytics** | Enables:  
• Better patient-based outcomes using diagnostic decision-support information delivered via mobile devices  
• Personalized medicine  
• Customized medical plans based on patient type of service (e.g., face-to-face, email, remote) | athenahealth, Inc., AT&T and the Massachusetts Institute of Technology’s H@cking Medicine magazine sponsored a "Health 2.0 Code-a-thon” in May 2012 to showcase the potential of big data analytics in health care.  
"You’re going to start to see this sort of big data effort on several [health care] fronts – partly because of supercomputing capabilities that we haven’t had until recently and also because of wireless devices that are increasingly being used to transmit data.”  
David Haussler, Director of the Center for Biomolecular Science and Engineering, UC-Santa Cruz 76 |  

Source: Ernst & Young analysis.
Accelerating the vision

What’s driving physicians to go mobile so fast is less the grand vision outlined in our “Overview” (page 4) and more the direct impact on their practices and their patients of those aspects of the vision that are already possible. Nonetheless, physicians’ rapid adoption could propel the health care industry toward the three underlying goals of that vision – lower cost, increased access and improved outcomes.

**Decision-making insight:** The anecdote provided by Dr. Topol may represent the most important accelerator: the ability for a physician to gain immediate diagnostic insight from a mobile tool, including access to patient record information, whenever and wherever they are. “Mobile access to medical records, test results and real-time vital signs translates into a direct improvement in treatment and outcomes,” says Paul Chabot, Advisory – PI, Ernst & Young. “From what I have seen among our health care clients, physicians are very excited. They are asking for new mobile solutions and are very eager to start using them.”

**Anytime, anywhere collaboration:** Another direct impact is that mobile devices can enable information sharing that eliminates the time-consuming fax-and-phone-call process physicians have traditionally used to collaborate. “As ACOs and other pay-for-performance business models proliferate, the requirement for collaboration among physicians will increase, so the value of mobile technology will increase as well,” says Chabot.

**Managing costs and increasing revenue:** Proliferating pay-for-performance models also are expected to accelerate physicians’ interest in mobile remote monitoring and remote consultation technologies. “When a physician is being paid to keep people well, it’s better to check on patients remotely instead of via a high-overhead office visit,” explains Scott Ponder, Advisory – PI, Health Care, Ernst & Young. “In addition, remote consultation solutions also offer physicians a low-cost revenue opportunity – for example, neurologists already are doing remote consultations called telestroke, which involves the application of telemedicine for stroke victims,” Ponder says.

**The mobile-social connection:** Smart mobile devices tend to enable greater use of social networks, and personal use of both mobile and social networks tends to drive subsequent professional use. Indeed, 87% of approximately 4,000 US physicians surveyed in August 2011 said they used social networking sites for personal purposes and 67% said they used them professionally. The same study said physicians primarily used physician community sites for professional purposes, and tried to avoid patient interaction when using social networks for personal purposes. However, “the genie is out of the bottle,” and two-way doctor-patient communication via social networks is likely to evolve.
Inhibiting the vision

Despite physicians’ rapid adoption of smart mobile devices, several concerns are limiting their use of the most advanced mHealth applications.

**Fear of litigation:** In the August 2011 study mentioned on page 25, 73% of the 4,000 physicians responding listed “concerns about liability” as a top issue holding them back from interacting with patients online (including mobile) — more than any other factor.79

**Security and privacy:** Protecting patient privacy was the second-biggest concern holding back physician interaction with patients online in that August 2011 study, cited by 71% of respondents. Solutions are available, but not in the kind of universal, standardized way that inspires widespread confidence.80

**Payment models must change:** While the Progressions report describes a multitude of experiments involving new incentives and reimbursement methods for remote care, these are still only experiments — often only in rural areas where access is problematic — and haven’t been fully adopted yet.

**Data interoperability:** To be most useful, physicians’ mobile apps must be able to integrate data from multiple disparate sources to support rapid decision-making, and allow clinicians to change the data and reflect those changes back to the source. But much of the needed data is currently stored in multiple incompatible databases. A related issue is interoperability among physicians’ mobile platforms. “If a physician’s mobile software doesn’t support the platforms of all the other doctors he or she is collaborating with, it may not be worth the physician’s investment,” says Ponder.

**Access to aggregated data:** Further, while mobile EMRs make it possible for physicians to access their patient data, it’s not clear how individual practices will gain access to aggregated data or the insights made possible by analysis of such data.

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“Lack of reimbursement, concerns regarding patient privacy and fear of litigation are the three main factors holding back physicians in the US from more rapidly pursuing remote care via mobile devices.”

Dr. Bill Fera
Advisory – PI, Health Care
Ernst & Young
Physician outlook

Given the way physicians are embracing mobile technology, it’s no surprise that at least one research organization believes community-based physicians will be the ones driving hospitals to innovate around mobile HIT, rather than the other way around. 1

Indeed, physicians’ adoption of smart mobile devices and applications for remote monitoring, diagnosis and information access is a critically important first step toward a comprehensive mHealth future. These devices and applications represent the initial infrastructure that makes possible cloud-based information services that promise to empower future physicians with tools to enable personalized medicine that is practiced wherever a patient happens to be. It is not hard to imagine, for example, a physician’s video portal that enables mobile access to Khan Academy-style rapid learning sessions or instantaneous collaborations with a needed expert somewhere else in the world. Such capabilities, taken together, ultimately are what will lead to virtually universal access to health care with lower cost and improved outcomes.

Opportunities for technology companies

- Physicians have demonstrated a natural desire for mobility given their busy schedules and ever-increasing demands on their time. How can we innovate with technology to allow physicians to see more patients, more efficiently; enable data analytics to support them; and yet reduce concern over patient privacy and fear of litigation?

- Physicians are pragmatic – they won’t change easily without seeing tangible value. How can we meet their expectations with demonstrable return on investment and mobile user interfaces that make information intuitive, fast and easy to grasp?

- There aren’t enough doctors in the world. Can we build applications or services that empower remote access, including empowering lower-level clinicians to perform at higher levels through mobile-delivered information or real-time collaborations with experts?

- New pay-for-performance business models anticipate increasing collaboration among physicians. How can we build systems enabling real-time mobile consultations and collaboration (including documentation for subsequent payment)?
Monitoring services will account for 65% of the global mHealth market by 2017.

“Very few technologies have scaled down to even the remotest village in sub-Saharan Africa. Cars haven’t, fridges haven’t, literacy hasn’t. But mobile phones have.”

Joel Selanikio, M.D.
CEO and Co-founder, DataDyne Group LLC
Health care everywhere models challenge providers

New US policies attempt to flip the pay-for-service model, and have already begun introducing value-based payment models that, in part, seek to keep individuals out of expensive hospital facilities. The trade-offs are not lost on hospital administrators, who do not necessarily see their finances improving as a result. Even as hospitals automate processes, pilot mHealth options in their communities and implement EMR systems in the spirit of health care everywhere, “savings from these programs have the potential to be realized mostly by the payer if new financial arrangements are not established,” according to the AHA.85 To the extent that the health care everywhere movement does successfully migrate care beyond the four walls of traditional providers, these providers will be challenged to reimagine how they do business.

Cost is a rising issue

In the meantime, even though lower cost and better outcomes have been urgent US priorities for years, costs are still rising at a faster rate than outcomes are improving.86 The average US hospital stay plus follow-up costs $17,988.87 This, despite the fact that competition is mounting, as the very definition of “health care provider” continues to evolve – ranging from the established hospital, pharmaceutical and medical device companies up to and including more urgent care centers, retail walk-in clinics, drugstore health care wings,88 outpatient surgical centers,89 mobile medical vehicles, boutique (sometimes, physician-owned) hospitals, extended care facilities, community centers and other nongovernmental organizations (NGOs).

While cost is lower in the rest of the world, it is still a major issue for most countries. “In the UK, a national budget crisis makes for difficult choices between the up-front costs of mHealth innovations and their promise of long-term cost reductions,” notes Kenny O’Neill, Advisory – PI, Ernst & Young.

Cost-quality trade-offs are emerging in developing regions

In developing countries, there is yet another set of trade-offs. On the one hand, “Developing countries don’t have the mature hospital infrastructures you find in the US or Western Europe – but they do have mobile technologies and consumers who are actually more savvy using mobile in some ways. They can leapfrog the rest of the world,” says Catherine Zhou, Advisory – Customer Insight & Analytics, Ernst & Young. According to the World Health Organization, however, “Health systems worldwide are under increasing pressure to perform under multiple health challenges, chronic staff shortages and limited budgets, all of which makes choosing interventions difficult.”90
The pressures are mounting in a world in which the sheer numbers of people requiring care are increasing – not only as a function of the epidemic levels of chronic disease, but because the global population is growing and living longer, and whole new groups are now able to buy health care (for instance, Chinese citizens with rising incomes and US citizens under the government’s new policy for universal health coverage).

Numerous mHealth pilots around the world are beginning to demonstrate how hospitals will be able to roll out mobile technologies to make gains in public health. A national UK teleHealth trial has shown reductions of 15% in emergency visits, 20% in emergency admissions, 14% in elective admissions, 14% in bed days and, ultimately, 45% in mortality rates.

Providers’ choice: disrupt or be disrupted
As the vision for health care everywhere unfolds, hospitals must decide whether to harness mobile technologies’ promise of transformative innovation or watch as others disrupt the health system around them. Hospitals are responding with innovation – though sometimes with pushback for more time to revamp structures, systems and procedures already in place – and also with partnerships. These alliances range from working with fitness app providers to joining large health care ecosystems of physicians, hospitals and clinics dedicated to new value-based outcomes, such as ACOs.

Their pilot mHealth implementations include:

- Partners Healthcare, founded by Massachusetts General Hospital and Brigham and Women’s Hospital, has initiatives including Connected Cardiac Care, a TeleStroke Center, Diabetes Connect, Blood Pressure Connect and text messaging for patients who are pregnant or have skin problems. Partners reports a 48% reduction in rehospitalization of cardiac patients, who input vital information from home and are coached and monitored daily by a telemonitoring team.
- In China, kiosks and mobile phones are used for consultations in remote regions. For example, individuals can input information such as blood lipid values into a One Stop Medical Report terminal, which returns reference values and the clinical significance of the patient’s input, along with a health assessment and advice on actions to maintain or improve health. The terminal might indicate high cholesterol or possible diseases, suggest that a hospital diagnosis is required and facilitate appointment booking.
- In the Middle East, Africa and elsewhere, Emirates Telecommunications Corporation (commonly known as Etisalat Group) has been advancing maternal health applications in alliances with various providers. A partnership with D-Tree International, an NGO, has developed a mobile phone app for African midwives to screen pregnant mothers to identify risks, find the closest health center and identify a means of transportation to reach the clinic. In Saudi Arabia, expectant parents receive ultrasound images and videos via multimedia messages to their mobile phones following visits to maternity hospitals in the Dr. Sulaiman Al-Habib Medical Group.

And more is on the way, as providers look to exploit the big data, cloud computing, social and mobile technology megatrends reshaping all industries today. For instance:

- Advocate Health Care, a large Midwestern US health system, will use a cloud solution to integrate its data silos, including administrative and electronic health information, and then apply data analytics to predict patient outcomes before they occur – with a goal of early interventions. Included is a team-based model that manages patients across multiple sites of care.
- The US government recently gave a $1.9 million Health Care Innovation Award to George Washington University Hospital to develop clinical support and monitoring via the web for home kidney dialysis patients.
### Figure 5: Technology innovation and the provider

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<th>Technology enabler</th>
<th>Provider impact</th>
<th>Emerging mHealth use</th>
<th>Quote</th>
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| **Smart mobility** | Ability to expand beyond hospital walls to:  
• Partner with patients in fitness and wellness programs  
• Handle administrative matters  
• Share EMRs  
• Treat patients at home  
• Monitor post-operative patients  
• Monitor and manage chronic disease  
• Reach remote and underserved communities | Monitoring services (e.g., for chronic disease management) will account for 65% of the global mHealth market by 2017.  
Diagnosis services (e.g., telemedicine and health call centers for isolated areas) will account for 15%.  
Treatment services (e.g., adherence to medication schedules) will account for 10%.100 | “When I think about the biggest impacts, I think patient reminders … the supply chain … and then online digital records, where the high payoff will be vaccination coverage. … Of course, because it’s new technology, we should let a thousand ideas blossom.”  
Bill Gates, Co-Chair,  
Bill & Melinda Gates Foundation[101] |
| **Social networking** | Establish real-time interactive communications to:  
• Engage more effectively with patients  
• Share knowledge and experience with peers  
• Market services | Nearly 1,200 hospitals across America have added some form of social media, be it Facebook, Twitter or blogs, to their communications efforts.102 | “Have #lupus? Be sun smart. UV rays can trigger a flare.http://bit.ly/lldEGH  
#ArthritisAction #MayoClinic”  
A tweet from the Mayo Clinic |
| **Cloud computing** | Enables:  
• Delivery of “heavyweight” health care services and information to lightweight mobile devices  
• Networking with other hospitals, physicians, clinics, payers  
• Sharing EMRs with patients | Some 2,000 US hospitals and 41,000 doctors have received $3.1 billion in federal incentive payments for ensuring meaningful use of EHRs.103 | “Health IT is the foundation for a truly 21st century health system where we pay for the right care, not just more care.”  
Kathleen Sebelius, Secretary,  
US Department of Health and Human Services[104] |
| **Big data analytics** | Enables:  
• Establishing patterns of behavior in patient populations  
• Individualizing health care services  
• Developing preventive care  
• Understanding outcomes of various types of interventions | The Seton Healthcare Family hospital system in Texas learned from data analytics last year that a bulging jugular vein is a strong – and easily observed – predictor that someone admitted for congestive heart failure has a higher chance of future readmission.105 | “We don’t want to take the intuition and clinical decision-making out of the process. We want to facilitate it.”  
Nicholas Morrissey, a surgeon at New York-Presbyterian Hospital[106] |

Source: Ernst & Young analysis.
Drug and device providers stand to benefit from mHealth behavioral change

Pharmaceutical and medical device companies are mobilizing cutting-edge information technology in the move toward health care everywhere and encouraging new behaviors in populations where chronic illness is epidemic. As they do, smart mobility and social networking have become key agents of behavioral change, with a demonstrated ability to increase patients’ adherence to treatment. Cloud computing provides an environment in which EMRs and clinical trial data can be shared across the health care system, with big data analytics making sense of the increasing volumes of patient data to help pinpoint new and better treatments.

For medical device companies like Medtronic, Inc., these converging technologies will lead to mobile phones that give patients control over programming and running implanted devices, among other advances, according to Stephen Oesterle, M.D., Medtronic Senior Vice President for Medicine and Technology.107 Already, the company’s CareLink Network connects cardiac device patients, whether at home or away, providing clinicians with 24/7 internet access and a smartphone application for monitoring them.108, 109

Improving adherence to therapeutic regimes through mHealth technology promises a range of benefits for drug companies, including lower probability of adverse events, side effects, reinfections, relapse rates and the emergence of treatment-resistant pathogens.110 In mid-2012 a unit of Johnson & Johnson launched Care4Today Mobile Adherence, a messaging platform, mobile application and website that work in concert to remind patients to take their medicine, refill their prescriptions and see their doctors.111

The embrace of these patient-centric technologies by pharmaceutical and medical device companies has implications for all four key groups analyzed in this report: patients, physicians, providers and payers.

Patients, for instance, are already beginning to use wireless-connected electronic pill bottles and smartphone wellness apps, making it easier to measure their behaviors and providing the context for life sciences and health care companies to launch incentive programs and other behavioral change initiatives.

Physicians are increasingly using their smartphones and tablets to review patients’ vital statistics, which are themselves uploaded from wirelessly connected medical devices to physician/clinician portals. In the same vein, providers such as hospitals are able to release post-operative patients and monitor their progress remotely, rather than keep them in expensive hospital beds. Payers, for their part, see the cost benefit from fewer “heads in beds.”

Still, challenges to realizing these benefits range from potential medical liability to regulatory uncertainty to information security and privacy. In the US, for example, FDA draft guidelines issued in early 2012 for pharmaceutical companies’ interactions in social media raised confusion in the industry.112 The guidance did not address the issue of companies’ liability for comments made by third parties – a concern that led many pharmaceutical companies to shut down their social media pages in August 2011 when their ability to shut off public comments was eliminated.113

“Life sciences and health care companies are increasingly expected to demonstrate to payers how their offerings improve health outcomes and the efficiency of health care delivery. Reducing costs will ultimately require a greater focus on preventing disease and influencing patients to better manage their own health. Successful companies will seek to extend their business models beyond the drug or device to offer payers, providers and ultimately patients more value— all of which will be accelerated by mobile technologies.”

Glen T. Giovannetti
Global Life Sciences Leader
Ernst & Young
Medical device makers face similar regulatory uncertainty. The US FDA is in the process of evaluating feedback to draft guidelines it issued last year that expanded the definition of a regulated medical device to include certain mobile apps that are able to control a medical device, that display data from a device or that can transform a mobile device into a regulated device, such as an electronic stethoscope. "So far, the expectation is that if you’re using any mobile technology to diagnose, prevent, monitor or treat a health condition, then it’s going to be considered to be somewhere in the health care continuum and it will be regulated," says Ed Tomlinson, Advisory – PI, Ernst & Young.

Opportunities for technology companies
The immediate ways in which mHealth technologies stand to benefit pharmaceutical companies are from improved outcomes resulting from better patient adherence to treatment and the potential to accelerate product development while lowering cost.

- How can we build better tracking of drug use compliance without violating patient privacy?
- In what ways can big data analytics be applied to help pharmaceutical companies identify patterns from large volumes of biometric data that suggest not only new treatments, but also the best treatments for patients?
- How can we improve social networks among physicians, clinicians and pharmaceutical companies so that they contribute to identification of new therapeutic regimes, faster product development and lower development costs – all while maintaining individual patient privacy and security?
- Where will consumers perceive the line between encouraging behavioral change and invading privacy?
- Will privacy concerns and competitive interests block the open exchange of big data for medical research?
- How can remote monitoring networks be improved, with more rapid access to patient data, while preserving security and patient privacy?
- What products and services can be developed to help physicians and clinicians manage the potential “information overload” resulting from increasing mobile-device data?
- In what ways can we accelerate testing and consumer feedback loops that lead to improved, simpler device user interfaces?
- How can cloud-based services facilitate patient monitoring or remote device programming?
- Will the consumerization of medical devices create an opportunity for us to leverage mHealth platforms to build products and services that compete with medical device companies?

“We are moving toward a future with smaller implantable sensors, patient-controlled mobile devices, real-time data, remote services that assist patients and caregivers and more.”
Stephen Oesterle, M.D.
Senior Vice President for Medicine and Technology, Medtronic Inc.

“... our vision [is for] enabling secure, real-time access to de-identified patient data across the health care and life sciences ecosystem.”
David A. Krusch, M.D.
Chief Medical Information Officer, University of Rochester Medical Center, and Chairman of PACEr’s Project Leadership Committee

mHealth: mobile technology poised to enable a new era in health care
Accelerating the vision

Factors ranging from strong consumer and physician demand to providers’ own experiences and government incentives are all driving the adoption of mHealth technology.

**Hospitals’ in-house mobility:** Clinicians typically use 6.4 different mobile devices daily within hospitals, by one account – primarily mobile point of care solutions on laptops, tablets and “workstations on wheels.” These will increasingly expand outside the hospital as well.

**Consumer and physician demand:** Easy-to-use mobile apps have improved consumers’ lives in many areas, and they’ve begun to demand the same from health care. The Kauffman Foundation report describes health care frustrations: “Running the gauntlet of specialists, and tests and hospitals and offices, patients feel like mice in a maze of someone else’s (or, worse, no one’s) devising, with little real responsibility for or control over the system of which they are part.” As a result, health care consumers are increasingly turning to social media and a host of new fitness, wellness and health applications on their smartphones and tablets (see page 15, “Perspective on patients”), and hospitals are finding patients’ expectations mounting in these online settings. Likewise, physicians are finding valuable utility in smart mobile devices (see page 23, “Perspective on physicians”). And all of this is creating an environment to enable pharmaceutical and medical device companies to explore new mHealth-related devices and drug compliance regimens.

**Government policy and incentives:** In the US, for example, initiatives such as the Medicare and Medicaid EHR Incentive Programs use rewards (and by 2015, penalties) to advance the meaningful use of EMRs shared across health care settings. The incentives contributed to a 14.2% growth in US sales of EHRs in 2011, to $17.9 billion – and EHRs are increasingly mobile-enabled.

**Competition:** Technology companies are all-too familiar with the importance of first-mover advantage. Competition from early-moving providers as well as from software companies offering mHealth apps is likely to spur more providers to adopt quickly. “An early mover edge might be going to software providers already in such lower-barrier markets as fitness applications, and to telecom operators, internet service providers (ISPs) and cable companies, who can reach into every home and wallet with their networks,” explains Tomlinson.

**Lower drug-development cost:** Big data analytics and cloud collaboration hold the promise of reducing the typical drug development cost, estimated at $1.3 billion and a 10- to 15-year time-to-market.

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**Core health care change drivers:**
- **Cost containment**
- **Increased access**
- **Better outcomes**
Inhibiting the vision

As mHealth adoption pushes providers closer to the health care everywhere vision, everything from business models to workflow processes are in flux. Resistance to changing these well-established practices is an overarching inhibitor.

**Business models:** Hospitals are making big changes, whether merging horizontally or vertically, developing networked niche specialties such as cancer care or otherwise rethinking their current business model in the transitioning health care market – all of which will take time.

**Unknown liability:** Technology changes of the scope imagined by the adoption of mHealth carry risk, and the newness of mHealth means those risks are not yet well understood. Hospitals’ risk-averse nature is only reinforced by the prevalence of malpractice litigation, at least in the US.

**Regulatory uncertainty:** Pharmaceutical companies, medical device makers and technology companies moving into the mHealth app market – for example, as smartphones morph into diagnostic and remote monitoring devices – face uncertainty about which apps and devices will and will not be regulated.

**Workflow and usability:** “For the clinicians, there’s always a question around workload: ‘Is this going to create more work in my daily job?’” says O’Neill. For example, telehealth units have to be integrated into the existing clinical pathways for treating a targeted disease. “Given constrained staffing at many providers, the clinicians’ fear is that technology will add to their workload without delivering any benefit. Mobile devices that don’t complement clinical practice and become business as usual will add to the workload and slow adoption,” O’Neill suggests.

**Data integration issues:** Hospitals typically have disparate and disjointed data silos across departments, and the automated sharing of information across health care providers has been slow to advance. This kind of sharing will be essential to the success of mobile access, transparency of information and data mining in the interest of patient-centric care.

**Lack of transparency:** Hospitals have been slow in easing patient access to information, in part because of these data integration issues and technology limitations – but compounded by the medical practice’s sometimes inaccessible technical and legalistic language and paternalistic posture toward the patient. The AHA stirred significant controversy with an April 2012 letter to the US Department of Health & Human Services asking that pending federal requirements for patient portals be scaled back, if not eliminated.121

**IT department challenges:** Provider IT departments are already overloaded and hard pressed to adapt to new technology megatrends in addition to their many regulatory compliance demands, such as EHRs. Even finding health care-savvy technical staff is a problem (see page 4, “Overview”).

**Device complexity:** On average, consumers give up on new electronics items after only 20 minutes of trying. mHealth devices will need to be simplified for consumer acceptance to scale.122

“Given constrained staffing at many providers, the clinicians’ fear is that technology will add to their workload without delivering any benefit. Mobile devices that don’t complement clinical practice and become business as usual will add to the workload and slow adoption.”

Kenny O’Neill
Advisory – PI
Ernst & Young
mHealth: mobile technology poised to enable a new era in health care
Providers outlook

Health care everywhere remains a future vision. But today we see strides toward enabling the vision everywhere, as in the $14.2 billion (and growing) global market for monitoring devices tracking blood pressure, glucose, EEG and other vital statistics (of which home monitoring accounts for a 38.3% and growing share). Right now, providers across the health care continuum are involved in thinking, planning and bracing for change – and they’re experimenting,” says Zhou.

Adds Dr. Fera, Advisory – PI, Health Care, Ernst & Young, “Providers have to assess where their organization is, find low hanging fruit where they can get real reimbursement and return on investment today, and start putting in place the infrastructure that will support further adoption tomorrow.”

The Kauffman report concludes that the health care system today is in one of two places. First, “It might be forging ahead technologically but mired structurally in the past.” Alternatively, “The system might be at the doorstep of a gradual but eventually decisive transition to improvement and efficiency. It might be at a place where previously undreamt-of analytical tools, sifting through mountains of previously inaccessible information, can give the system the knowledge about effectiveness and the awareness of itself that it has lacked; where paths beyond fee-for-service are clearly visible ahead; and where, in pockets of innovation around the country, change is proving its mettle.”

Opportunities for technology companies

- Provider clinicians need universal access to patient and medical information. How can we help providers accelerate toward the goal of system-wide access to all patient and medical information for all clinicians who need it?
- Providers are re-imagining themselves in the health care everywhere paradigm. How can we leverage technology innovation to help them profitably deliver health care services beyond the four walls of the hospital?
- There’s a serious shortage of talent knowledgeable about both health care and technology. What can we do to extend IT expertise to providers?
In February 2012, the UK’s NHS began encouraging physicians to prescribe smartphone apps to patients.

“A new generation of patients are demanding an increasing understanding of their health needs. Yet despite the billions of dollars spent on health care globally, we continue to fail to exchange information that is mutually beneficial. The ability to connect patients and clinicians with the information that truly improves clinical outcomes is surely one of our greatest challenges.”

Gary Howe
Global Health Care Leader
Ernst & Young
Perspective on payers

mHealth experiments proliferate as payers search for ways to foster behavioral change and improve patient monitoring

Current situation

Health care payers around the world are prodigiously experimenting with mobile devices, applications and programs as they strive to improve the health of their populations, better manage chronic disease, extend health care access and lower cost. This is true whether the payer is a government, a government-backed insurer, a private insurer or an employer. But in general, their use of mHealth technology is just beginning. After all, these are vast and complex systems, many of which are already struggling to reinvent themselves in a “pay-for-performance” paradigm after having optimized their large bureaucracies over the course of many decades for the “pay-for-service” approach. In other words, they’re striving to switch from being treatment-focused to being oriented around prevention, whether preventing a rehospitalization of a chronically ill patient or preventing a healthy individual from ever needing care in the first place.

Pay-for-performance can lead to greater customer engagement — enabled in part by mobile technology

Payers’ emerging prevention orientation means they’re interacting directly with consumers about far more than just paying or denying claims. In this new paradigm, payers have financial incentive to educate health care consumers to help foster healthier lifestyle choices, directly encourage healthy behaviors and better monitor chronically ill patients to avoid costly hospitalizations. And payers are experimenting with smart mobile devices as a key mechanism for such interaction because of their easy usability (which simplifies access), their ubiquity in the developed world and, in developing regions, their ability to reach people beyond the electric grid.

“We have invested heavily in a service-oriented architecture as part of our business model and that has allowed us to bring a lot of things to the web, to mobile and handheld technology. The health care system is difficult to navigate, so we have been building tools that make it easier for customers to interact with the system.”

Mark T. Bertolini
Chairman, CEO and President
Aetna

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“The payers have a real financial stake in keeping you healthy. So they’re taking the lead now ... in order to identify the best behaviors to encourage.”

Scott Ponder
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Mark T. Bertolini
Chairman, CEO and President
Aetna
A cornucopia of mHealth apps
The most comprehensive support of mobile technology we've seen from a payer so far came from the UK government. In February 2012, the UK’s National Health Service (NHS) announced that it was encouraging physicians to “prescribe smartphone apps to patients” (as one UK news service put it).126 The NHS has identified nearly 500 such applications for this purpose, including one that uses barcode scans to determine packaged food ingredients in order to warn allergy sufferers, an app for diabetes management, another that lets patients obtain their medical records from all their clinicians and control who has access to them and the government’s own NHS Choices app, which offers practical advice and helps people find medical services.

US insurers also offer many mobile apps
Also in February 2012, the US Surgeon General ended her “Healthy App Challenge” contest by announcing four winning apps and several additional recommended apps, all of which are free and were judged to make “the health-promoting activity fun.”127 However, in the US, private insurers are prodigious providers of mHealth apps, all with the goal of improving people’s overall health through behavioral change, making health care more cost-efficient through better information dissemination or improving specific health care outcomes through mobile-delivered medical diagnostic information. For example, Humana Inc. offers several mobile apps that use gaming approaches to encourage healthy activities;128 Aetna recently acquired the maker of iTriage, a rapidly growing medical diagnosis app;129 Blue Cross and Blue Shield of Florida offers an app that provides general health care information for any user and detailed plan-specific information to its members;130 and UnitedHealth Group’s Health4Me app lets users store their plan identification card, find a provider, get benefits information and track deductible spending.131 All these US insurers also offer multiple other mobile apps, including various apps encouraging wellness.

Smart card technology lowers Taiwanese health administration costs
A long-running example involving older mobile technology exists in Taiwan, where smart cards have been used since the adoption in 1995 of near-universal health coverage through a national insurance model with one government-run insurer. The smart card is used for billing and to store each person’s medical history. Along with the one-insurer system, the technology is credited with making Taiwan’s health care administrative costs the lowest in the world.132 Many other nations, especially in Europe, also have gained health care efficiencies using smart cards. Today, multiple organizations and alliances have evolved to offer mobile payments and mobile wallet technologies on various smartphone platforms. Once these mobile payment technologies are sufficiently mature, we can envision that integrating them with a payer’s network could provide much of the benefit of the Taiwanese smart card system.

The biggest impact of mHealth technology is yet to be felt
All these examples of mHealth applications and governmental encouragement demonstrate ample experimentation, but the experiments are still generally small – mobile technology has yet to have a game-changing impact on health payers. While the cost, outcome and access benefits of mHealth technology are becoming obvious, payers find their organizational infrastructures still largely focused on the pay-for-service model; instead, they must figure out how to reimburse physicians and providers for keeping people well. And just as pertinently, payers are still building various elements of the information technology infrastructure necessary to integrate data from disparate sources, apply analytics and deliver actionable information to the mobile devices of patients and clinicians. Both these infrastructures – organizational and technological – must change in order for payers to contribute positively to the evolving 24/7 real-time health care everywhere environment that is rapidly evolving.

“The question is, how can payers open up all the information they are always collecting and transform it into an asset for the many third-party health care apps that appear on mobile devices every day?”
Mal Postings
Global CTO – IT Advisory
Ernst & Young
**Technology enabler** | **Payer impact** | **Emerging mHealth use** | **Quote**
---|---|---|---
**Smart mobility** | Enables:  
• Automated, real-time tracking of patient visits to doctors and hospitals  
• Better and lower cost management of chronic disease patients  
• Lifestyle-improving behavioral change messages to reach members anytime, anywhere  
• Lower administrative costs and, potentially, facility costs as well | • The UK's NHS is encouraging physicians to “prescribe smartphone apps to patients” and has compiled a list of nearly 500 such apps for them to recommend.133 | “Whatever your health problem, our interactive online symptom checkers are the fast and easy way to get expert advice on how to look after yourself ... If you prefer your health advice on the move, download our free mobile app.”
NHS Direct134

**Social networking** | Tap into public-domain information to:  
• Accelerate innovation time-to-market  
• Deliver messages encouraging healthy lifestyle choices  
• Identify new treatment approaches  
• Identify potential fraud | • “Aetna’s use of a social media platform to gather and refine ideas helps iterate innovation concepts quickly, uncovering questions and new ideas that could take months through traditional processes. In addition to internal crowdsourcing, Aetna also applies its platform to collecting customer feedback, ensuring ready access to outside-in perspectives.”
Forrester Research135 | “The transformation of health care is going to require behavioral change, primarily by the consumers of health care but also on the part of those who deliver and pay for health care. And I’m convinced that the action of social media over mobile networks will become one of the ‘silver bullets’ for enabling that behavioral change.”
Paul Chabot, Advisory – PI, Ernst & Young

**Cloud computing** | Provides platform for:  
• Health information ecosystems for secure data sharing  
• Applications promoting behavioral change  
• Mobility for claims processing, fraud and duplication identification | • UnitedHealth Group subsidiary Optum announced an open-cloud platform to allow developers to create and host health care applications that enable multiple doctors and hospital networks to coordinate patient care.136 | “We’re going to make collaboration possible in ways it is certainly not possible today.”
Andy Slavitt, Executive Vice President, Optum137

**Big data analytics** | Yields:  
• Predictive modeling of best treatment practices  
• Better identification of providers and practices with best patient outcomes  
• Decision-making insights  
• Personalized treatments  
• Personalized wellness and prevention  
• Improved fraud detection | • Blue Cross Blue Shield Association spun off its data intelligence unit, Blue Health Intelligence, into an independent company in part to help make its data available to more industry stakeholders.138  
• WellPoint said it plans to use IBM’s Watson big data technology to help suggest treatment options and diagnoses to doctors.139 | “On the big data side, there is a big question mark. The major health care stakeholders are struggling with how to deal with the large volumes of data that mHealth is going to create, how to analyze it all and how to share the insights that emerge.”
Dave Nichols, Americas IT Transformation Practice Leader, Ernst & Young

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*Source: Ernst & Young analysis.*
Accelerating the vision

Perhaps nowhere is the “sense of urgency” accelerator felt more strongly than among those paying the health care bills. Whether you’re a nation, a corporation or a private health insurance company, you need to find a way to deflate the escalating cost of health care, while meeting the growing health care demands of developing regions and of the developed world’s aging populations. Besides, you stand to benefit significantly from a healthier workforce/population and better, lower-cost management of chronic diseases – two promises that mHealth technology appears ready to fulfill.

### Core health care change drivers:

- **Cost containment**
- **Increased access**
- **Better outcomes**

**Growth of collaborative care models:** Likewise, the collaborative-care models that emphasize improved outcomes at lower cost tend to embrace mobile applications for real-time collaboration among clinicians. So the growth of such approaches should also accelerate payers’ use of mHealth technology.

**Mobile demand, trials and social networks will also accelerate mHealth use:** Of note, the other core accelerators (mobile demand, successful trials and social networks) are also acting on payers – particularly the demand accelerator. Clinicians and patients all want anytime, anywhere access to medical records and other diagnostic information, and the payers are often the owners or managers of that data. In addition, payers are operating a large number of mobile health technology apps (as described previously), and the results from these experiments are likely to yield better, larger programs to come. And social networking accelerates adoption by providing forums for mobile collaboration, sharing best practices and even rapid product development, as US-based Aetna has done.140 The UK’s NHS announced in May 2012 an organ donor program in partnership with Facebook, Inc.141

**Lower facility costs:** Realizing the health care everywhere vision through mobile and other remote care technologies should lower facility requirements and related costs.

> “It's an aggregation issue. We all feel the increased cost of health care. But companies with large numbers of employees and insurers – those organizations are feeling the sense of urgency quite keenly.”

Ed Tomlinson
Advisory – PI
Ernst & Young
Inhibiting the vision

Because payers generally control so much patient data, the big data challenge described in the “Overview” is of overriding concern. But that challenge – to bring together multiple databases and use analytics to derive useful insights that improve patient outcomes – is only part of the data issue for payers. Payers must also decide whether to share their data with providers, patients or other payers and, if so, how to enable access for each. And however they do so, they must ensure adequate information security and privacy controls to comply with the related regulation in all the jurisdictions where they operate and, especially, to foster confidence from their patient and physician stakeholders.

Figuring out the right approaches to all these issues is likely to slow mHealth adoption. However, this inhibitor has an opposite "potential accelerator": successful approaches to the big data challenges are likely to unlock value that could dramatically accelerate mHealth technology adoption.

To help address the data challenge, insurers have begun to partner with or acquire data analytics technology companies. US-based Humana, for example, acquired 12-year-old health analytics company Anvita Health in December 2011 for an undisclosed amount.142 And three US insurers agreed to partner with analytics company Lumeris, Inc. to acquire claims management software as a service (SaaS) company NaviNet, Inc., in the expectation of enabling deeper analytical insights, including recommendations and alerts for medical clinicians.143 Interestingly, Lumeris is part of a trio of companies started or invested in by renowned technology venture capitalist John Doerr and his brother (a physician) as part of a long-term experiment to apply information technology in a pay-for-performance health care paradigm.144 The others are a US health insurer and a health care software provider.

**IT talent challenge:** As explained in the “Overview,” having IT know-how combined with knowledge of health care process and procedure is critically important to a health care organization's efficiency and, as a result, its costs. The shortage of such savvy talent is likely to hold back mHealth adoption.

**Historically adversarial relationship:** Even though financial incentives are aligning to motivate payers to act to improve the health of their members, past interactions with patients and physicians have often involved claims or reimbursement disputes. Says Aloha McBride, Ernst & Young Advisory – PI, Government & Public Health Sector Leader: “Even though I see insurance companies assigning nurse case managers to support members, whether in just finding a primary care doctor or managing a chronic illness, the patients sometimes find it difficult to develop a trusting, open relationship with their insurer.” Continued lack of trust could slow patients’ and physicians’ adoption of mHealth solutions offered by payers.

**Current incentive/benefits system:** Payers are experimenting with health and wellness apps, but current reimbursement payments for mobile or remote care are largely limited to remote rural areas. The transformation of that system of incentives from pay-for-service to pay-for-performance is likely to take time and, therefore, slow mainstream adoption of mHealth technology. Similarly, benefits explanations that appear arcane to consumers are likely to hold back the speed of adoption; payers would do well to simplify these, thus increasing information transparency.

**Regulatory and liability unknowns:** Likewise, where regulators decide to draw the line about what constitutes a medical device is likely to have a big impact – which, if any, of the many apps being offered by payers will ultimately be regulated? For now, the lack of definitive guidance is an inhibitor. Likewise, barring tort reform or a specific liability moratorium for mHealth technology, uncertainty surrounding legal liabilities involving mHealth technology is an inhibiting concern.

“Most developed countries are spending a disproportionate amount of their GDP on health care – and it’s increasing and it’s not sustainable. In many of those nations, it’s the government that is paying for health care and has the most incentive to manage those costs.”

Ed Tomlinson Advisory – PI Ernst & Young
mHealth: mobile technology poised to enable a new era in health care
Payers outlook

Despite the inhibitors, payers’ adoption of mHealth technology seems inevitable – the only question is how fast or slow it will become mainstream. We believe the inevitability comes from two overarching factors: first, the health care industry’s focus on behavioral change and improved patient monitoring to lower cost, while improving health outcomes; and second, mobile technology’s ability to deliver behavior-changing messages (or transmit patient monitoring information) to or from wherever a person happens to be.

As a result, mobile technology likely will accelerate a trend among payers to become more blended payer-providers, or to collaborate more closely with providers. Payers’ financial interest in the health of their members makes this change likely – even in the US, where insurers and payers have remained more distinctly separate than in other regions despite a few notable exceptions, such as the Kaiser Permanente health system.

“For the most part, insurers have been adopting mHealth technologies in isolation from the provider,” notes Dr. Bill Fera, Advisory – PI, Health Care, Ernst & Young. “The next step is to collaborate with providers to make the services more powerful. Studies show that patients don’t always trust their health plan as much as doctors to provide these kinds of services, so working in conjunction with the provider community should enable a lot more ‘buy-in’ from the patient community,” he notes.

Opportunities for technology companies

- Payers have large databases of patient and medical information. How can we leverage big data analytics capabilities to help payers transform their data into valuable insights?
- Patients have trust issues with payers. Can we leverage technology-enabled innovations to help them overcome those issues?
- Payers are in the midst of transformational business model change from pay-for-service to pay-for-performance. How can we leverage technology innovation to accelerate – and ease – this difficult and complex transition?
- In certain regions, payers and providers have begun vertically integrating. How can our solutions help to better enable these alliances and organizational integrations?
Are you ready?

Don’t underestimate the pace of change

Looking at the scope, complexity and large number of interdependent stakeholders, many people assume that the health care everywhere vision will take decades to unfold. But in the words of cardiologist Eric J. Topol, Co-Founder and Vice Chairman of the West Wireless Health Institute, “I shudder to think about waiting 10 or 20 years for this transformation to occur.”

And he may not have to. With 13,000 apps already available for the iPhone alone, it’s clear that the mobile technology needed for transformative innovation leading to health care everywhere is already here. And as this report has described, the technology industry’s exponential change engine is already focusing on technology innovations that could lead to better health outcomes, broader access and lower cost. It’s doing so not just altruistically, but also for profit — because that’s where value-creation lies. See our “mobile-medical frontier” sidebar (page 47) and consider that, with one notable exception, each of the science-fiction-sounding items described is already here. As for the one exception, we don’t think it will be long before a team claims the $10 million X prize for inventing a real-life version of Star Trek’s tricorder.

And as our Life Sciences colleagues say in their latest Progressions report: “Move quickly. Time is not on your side. Don’t underestimate the pace of change.”

However, culture, governments and institutions generally take much longer to change than technology does to innovate. But after decades of wrestling with escalating costs and increasing demand, they, too, appear ready for change. In fact, they’re already in motion — driven from the top down by stakeholders like governments and from the bottom up by patients. Today, the very sustainability of current models of health care is being challenged by provider and payer alike. Patient-centric health care information ecosystems are beginning to emerge, incentive systems are beginning to change, public-domain genome databases are being established and “collective impact alliances”* are starting to form.

* Collective impact alliances are small ecosystems of health care stakeholders partnering together to drive toward a (relatively) narrowly defined common goal — at least when compared with the monumental task of remaking the entire global health care industry.

“To make the health care everywhere vision of the future work will require many technology megatrends working in concert. It’s not just a cloud thing, or a big data thing, or a social networking thing or even a mobile thing. It is all of these things working together.”

Dave Nichols
Americas IT Transformation Practice Leader
Ernst & Young

“We need a Khan Academy for doctors: captivating 15-minute videos on genomics, on wireless sensors, on advanced imaging, on health information systems. These things can revive the excitement they felt as premeds, when they first decided to go into this field. If we can get practicing physicians up to speed and really inspired, maybe we won’t have to wait a generation. I shudder to think about waiting 10 to 20 years for this transformation to occur.”

Eric J. Topal, M.D.
Co-Founder and Vice Chairman
West Wireless Health Institute

mHealth: mobile technology poised to enable a new era in health care
Within the context of narrower, well-defined goals, mobile health care technology can help give patients the tools to be more accountable, while helping physicians, providers and payers to be more transparent, accessible and interconnected – in turn, helping everyone work together to control and contain cost. And by demonstrating its value in the context of these small ecosystems, mHealth technology illustrates the potency it offers to help resolve the larger challenges facing the global health care industry to increase access and contain costs.

Our mobile technology focus notwithstanding, however, smart mobility cannot enable the health care everywhere vision alone. Technology companies offering other transformative technology megatrends are needed to join these ecosystems as well: clouds to host the “heavyweight” software needed to deliver just the right information experience to the device, social networks to generate crowd-sourced knowledge and help disseminate valuable health care information and big data analytics to mine the large volumes of health care information generated by all patient, physician and provider interactions. Working together in the context of a health care ecosystem, these technologies can help to match a real-time patient requirement with the right clinician at the right place and in the right time.

For technology companies, all this means that a very large window of market opportunity is opening for you to help make the world – and its health care industry – a healthier place.

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**This just in ... from the mobile-medical frontier**

In researching this report we encountered numerous advanced health care examples involving mobile and related technologies that just made us stop and think, “wow.” We compiled the following brief subset.

Research scientists in South Korea have developed a way to use the “capacitive sensitivity” of smart mobile touchscreens (their ability to detect minute electrical current when you touch them) to analyze blood or saliva. Because this technology can detect biomolecules it could theoretically diagnose a range of diseases, from cancer to diabetes.148

Researchers from the University of California, San Diego and University of Illinois at Urbana-Champaign have developed a fetal monitor that is “a wearable patch of circuits, sensors and wireless transmitters that sticks to the skin like a temporary tattoo.” This electronic tattoo will “continuously measure and monitor uterine contractions, fetal heart rate and oxygen, and maternal heart rate and body temperature.”149

Programmers used big data analytics techniques to demonstrate a correlation between poor sleep and increased risk of car accidents. The result won a “Health 2.0 Code-a-thon” that showcased the role of big data in health care and was co-sponsored by athenahealth, Inc., AT&T and the Massachusetts Institute of Technology’s H@cking Medicine magazine.150

In May 2012 the US became the first country to propose reserving wireless spectrum for Medical Body Area Networks (MBANs). As envisioned by the US Federal Communications Commission (FCC), MBANs would deploy multiple sensors to monitor a person’s vital statistics and communicate them wirelessly within a hospital.151

Smart mobile ... horses? This technology is not so advanced: SMS texting. What made us think “wow” was the human ingenuity. Africa’s mountainous Kingdom of Lesotho has the second-highest incidence of tuberculosis. Since 2010, horse riders traveling to otherwise unreachable villages have collected sputum samples for analysis, with the results being texted back to health centers near the villages. To date, they’ve analyzed 4,154 people, 307 of whom tested positive for TB.152

Announced in January 2012, the $10 million Qualcomm Tricorder X Prize will be awarded “to the team that develops a mobile platform that most accurately diagnoses a set of 15 diseases across 30 consumers in 3 days.” Inspired by the handheld device used by the fictional Dr. Leonard McCoy on Star Trek and co-sponsored by the non-profit X Prize Foundation and Qualcomm Inc.’s Qualcomm Foundation, the competition aims to stimulate the imaginations of health technology entrepreneurs.153

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**Considerations**

- Are you moving quickly enough to out-innovate the competition?
- How are you creating value for: Patients? Physicians? Providers? Payers?
- Are you positioned to take full advantage of health care everywhere?
Glossary

**Accountable care organization (ACO)**
Creates incentives for health care providers to work together to treat an individual patient across care settings — including doctors’ offices, hospitals and long-term care facilities. The Medicare Shared Savings Program rewards ACOs that lower growth in health care costs, while meeting performance standards on quality of care and putting patients first.

**American Hospital Association (AHA)**
The national organization that represents and serves all types of hospitals, health care networks and their patients and communities. Close to 5,000 hospitals, health care systems, networks, other providers of care and 40,000 individual members come together to form the AHA.

**American Recovery and Reinvestment Act of 2009 (ARRA)**
An economic stimulus package enacted by the 111th United States Congress and signed into law on February 17, 2009, by President Barack Obama.

**Bring-your-own-device (BYOD)**
Refers to employees’ use of computing devices — such as smartphones, laptops, tablets and personal digital assistants — in the workplace for use and connectivity on the corporate network.

**Cloud computing**
Model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

**Electronic health record (EHR)**
Contains information generated by encounters in any care delivery setting, including patient demographics, progress notes, issues, medications, vital signs, medical history, immunizations, laboratory results and radiology reports.

**Electronic medical record (EMR)**
A digital capture of the paper charts in the clinician’s office, i.e., the medical and treatment history of a patient in a particular practice.

**Food and Drug Administration (FDA or US FDA)**
An agency of the US Department of Health & Human Services, one of the US federal executive departments. The FDA is responsible for protecting and promoting public health through the regulation and supervision of food safety, tobacco products, dietary supplements, prescription and over-the-counter pharmaceutical drugs (medications), vaccines, biopharmaceuticals, blood transfusions, medical devices, electromagnetic radiation emitting devices (ERED), veterinary products and cosmetics.

**Health care clearinghouse**
Organizations that process standard transactions — may serve as an intermediary to plans and providers.

**Health care payer**
Includes HMOs, MCOs, Medicare, Medicaid, CHAMPUS, Workers’ Compensation, COBRA, self-paid, etc. — individual or group plans that provide for or pay for the cost of health care.

**Health care provider**
Includes hospitals, clinics, nursing homes, individual professionals — and any other person or organization that furnishes, bills or is paid for the delivery of health care services in the normal course of business.
Health maintenance organization (HMO)
Provides members with comprehensive health care, allowing members to select a primary care physician who coordinates that member’s care, including referral to specialists in the HMO network. Care is provided to each plan member for a fixed amount, i.e., a capitated rate.

mHealth apps
Application programs that offer health care-related services for smartphones or tablet PCs.

Mobile-enabled health solutions
Encompasses the use of mobile telecommunications and multimedia technologies as they are integrated within increasingly mobile and wireless health care delivery systems.

National Health Service (NHS)
Comprehensive government public-health service in Britain covering virtually the entire population, established in 1948. Financed primarily by general taxes, most services are free. General practitioners and dentists are paid per patient registered with them and may also have private patients. Hospital and specialist services are provided in government hospitals and other facilities by salaried professionals.

Non-governmental organization (NGO)
A nonprofit, voluntary citizens’ group which is organized on a local, national or international level.

Patient-centered medical home (PCMH)
Provides primary health care that is relationship-based with an orientation toward the whole person. Supports patients in learning to manage and organize their own care at the level the patient chooses and includes patients and families as core members of the care team.

Pay-for-performance (P4P)
Offers financial incentives to physicians and other health care providers to meet defined quality, efficiency, transparency and other targets.

Smart card technology
Smart cards allow data and applications to be securely stored and accessed on the chip and enable secure data exchange. Smart card technology provides high levels of security and privacy protection, making it ideal for handling sensitive information such as identity and personal health information.

Telehealth/telemedicine
The use of electronic information and telecommunications technologies to support two-way, long-distance, real-time clinical health care, patient and professional health-related education, public health and health administration.
mHealth: mobile technology poised to enable a new era in health care
mHealth: mobile technology poised to enable a new era in health care

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