Emerging mHealth: Paths for growth



A global research study about the opportunities and challenges of mobile health from the perspective of patients, payers and providers

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David Levy, MD
Global Healthcare Leader

We live in a world that's connected wirelessly with almost as many cellular phone subscriptions as there are people on the planet. According to the International Telecommunication Union, there were almost 6 billion mobile phones in use worldwide in late 2011.[1] The ubiquity of mobile technology offers tremendous opportunities for the healthcare industry to address one of the most pressing global challenges: making healthcare more accessible, faster, better and cheaper.

Unlike many other forms of communication, such as the Internet, mobile health (mHealth) will likely have a greater effect on how care is delivered for three reasons:

- Mobile devices are ubiquitous and personal;
- Competition will continue to drive lower pricing and increase functionality; and
- Mobility by its very nature implies that users are always part of a network, which radically increases the variety, velocity, volume and value of information they send and receive.

Even before the advent of mobile connectivity the distinct lines between traditional health sectors were blurring and new business models were emerging. mHealth is dropping into a 'perfect storm', enabling and accelerating three major global trends already in play in healthcare.

Regulatory reform driven by demographic changes, such as ageing and chronic illness, is redressing the balance between public and private sector participation in healthcare. More and more, the public sector, while seeking to optimise access and quality, is looking towards the private sector for innovation and efficiency. mHealth enables both sectors in this regard, helping to improve access and quality while at the same time providing dramatic innovation and cost reduction opportunities.

Industrialisation of the healthcare sector, already in motion, and driven by technologies such as electronic medical records, remote monitoring and communication platforms, etc. is in many ways the prerequisite for the flourishing of mHealth. Patient-centric, 'care anywhere' is becoming a reality.

Healthcare is moving towards a precision-based model—or 'personalised medicine'. As a result of greater understanding of the human genome, together with other personalised technologies, the industry will likely transform—as have many other industries—to one that is predictive, personalised, participatory, and preventive.[2] mHealth will be a major factor in providing personal toolkits that will ultimately help those manage predicted vulnerabilities, chronic illness, and episodic acute conditions. Enabled by technology, connectivity and data, mass customisation is on the horizon allowing mHealth solutions to flourish.

In recognition of these accelerating factors, PwC commissioned the Economist Intelligence Unit (EIU) to examine the current state and potential of mHealth, barriers to adoption, and opportunities for companies seeking growth in the mHealth space. The result is the following report based on surveys and interviews with key subject matter experts conducted by the EIU.

In addition to the EIU's analysis, PwC provided its own commentary on best practices and strategic considerations for companies active in the mHealth arena noted in the report as 'PwC Perspectives'. We hope that these insights, coupled with the survey findings and interviews summarised in the pages to come, are useful in helping the stakeholders in the industry understand, plan and participate in this inevitable yet exciting new future.

1 Number of mobile phones end of 2011: 5.98bn. International Telecommunication Union (ITU). Key Global Telecom Indicators for the World Telecommunication Service Sector, 2012.

2 Lee Hood, "Vision for Systems Medicine: Predictive, Personalized, Preventive and Participatory (P4)" http://sis.org/cases2007/SIS2007ConferenceHighlights-Hood/docs/HoodLeroy.pdf

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Martin Kopp, Head of Healthcare, SAP

Ian Leslie, Professor of Computer Science, Cambridge University

Jason Mann, Head of China Healthcare, Barclays Capital

Patricia Mechael, Executive Director, mHealth Alliance

Claudius Metze, Business Solutions Architect, Healthcare Unit, SAP

Axel Nemetz, Head of Vodafone mHealth Solutions, Vodafone

Bakul Patel, Policy Adviser, US Food and Drug Administration (FDA)

Steinar Pedersen, Chief Executive Officer, Tromsø Telemedicine Consult

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Sangita Reddy, Executive Director of Operations, Apollo Hospitals (India)

Chris Taylor, Director of the mHealth Innovation Centre, University of Manchester

Ozgur Turgay, Managing Director, Acibadem Mobile

Thierry Zylberberg, Head of Orange Healthcare, Orange

Executive summary

Mobile healthcare (mHealth) is "the biggest technology breakthrough of our time [being used] to address our greatest national challenge", said US Health and Human Services Secretary, Kathleen Sebelius in her keynote address at the 2011 annual mHealth Summit in the Washington, DC area. Worldwide, the technology and its promise have moved up the healthcare agenda.

The interest is understandable. Increasingly ubiquitous and powerful mobile technology holds the potential to address long-standing issues in healthcare provision. However, such effervescence in a field with few proven business models suggests that, yet again, technology-driven hype may lead to expensive failures.

This Economist Intelligence Unit report, commissioned by PwC, examines the current state and potential of mHealth in developed and emerging markets, the ongoing barriers to its adoption and the implications for companies in the field. Based on the research, the key findings include:

Expectations are high for mHealth. Roughly one-half of patients surveyed for this report predict that mHealth will improve the convenience, cost and quality of their healthcare in the next three years (see "About the research"). Meanwhile, six in ten doctors and payers believe that its widespread adoption in their countries is inevitable in the near future. Yet most experts interviewed for this study, while also convinced that mHealth will eventually become an important part of care provision, expect that adoption will take time.

Healthcare's strong resistance to change will slow adoption of innovative mHealth. New technology is not enough. Widespread adoption of mHealth will require changes in behaviour of actors who are trying to protect their interests. The challenge will be even greater for innovators because the improvements that mHealth can bring—such as patient-centred care and a greater focus on prevention—will involve disruption of how healthcare is provided. To succeed, innovators must manoeuvre through culturally conservative, highly regulated and fragmented yet often monopolistic systems that often provide contradictory incentives.

The diversity of interests at play makes an evolving landscape even more complex. Patients want more convenient provision of healthcare, but they also want greater control. For doctors, mHealth can help provide better patient care and ease their administrative headaches, but they are likely to resist the loss of power implicit in greater patient control. Payers already display interest in mHealth, and the economic pressure for more patient-centred, preventive care is likely to drive them further towards the patient's viewpoint.

Emerging markets are the trailblazers in mHealth. Patients in these markets are much more likely to use mHealth applications or services than those in developed countries. Similarly, more emerging-market doctors offer mHealth services than colleagues in developed countries, and more payers cover these costs. The ability of these countries to leap ahead lies in the paucity of existing healthcare: there is greater demand for change and, just as important, there are fewer entrenched interests to impede the adoption of new approaches.

Solutions, not technology, are the key to success. Widespread mHealth adoption requires services and products that appeal to current payers because patients, highly sensitive to price, will provide little income. Consumers' sense of entitlement with regard to healthcare aggravates this price sensitivity. Accordingly, vendors must concentrate on solving payers' problems. Technology is an essential, but not sufficient, tool in this endeavour.

About the research

In developing this report, commissioned by PwC, the Economist Intelligence Unit conducted two surveys in ten countries: Brazil, China, Denmark, Germany, India, South Africa, Spain, Turkey, the UK and the US. The first survey asked 1,027 patients—with a broad distribution of economic backgrounds, ages, levels of education and states of health—about their opinions on various aspects of mHealth. The second survey queried 433 doctors and 345 executives from payer organisations. The respondents in the doctor group were drawn from the public sector (46%) and the private sector (49%) or were independent physicians (5%). The group is more urban (67%) than suburban (24%) or rural (10%), with 45% practicing in primary care, 45% in secondary care and 10% in tertiary care. The executives from payer organisations responding to the survey are roughly evenly divided between the public and the private sector, with 55% C-suite or above.

In addition, the research included extensive desk research and 20 in-depth interviews of senior executives from healthcare providers and payers, technology and telecommunications companies and industry organisations, as well as leading experts from academia, think-tanks and non-governmental organisations.

Finally, the EIU commissioned internal reports on mHealth for nine of the countries covered by the survey from its country experts.

Introduction: Not so fast?



Excitement surrounding mHealth is palpable. A burgeoning calendar of events and exponential growth in web content generated on the topic reflect the rising intensity of interest (see chart 1).

The nature of the discussion is also shifting. "About four years ago [mHealth conferences] were just a few people in jeans meeting occasionally," says Peter Benjamin, Managing Director of Cell-Life, a South African non-governmental organisation (NGO) developing mHealth technology. "Three years ago proper doctors started to show up; about two years ago we had reports on the first randomised controlled trials; and last year the suits got involved so that many mHealth conferences are now dominated by [corporate] executives [discussing return on investment]."

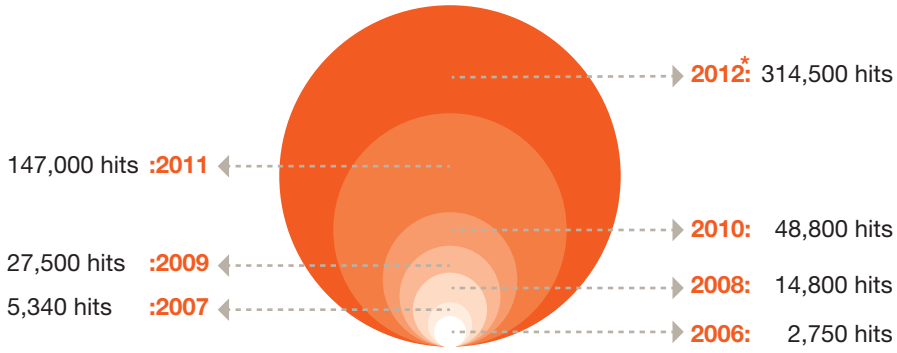
This growing interest rests on the assumption that two phenomena—the ubiquity of wireless technology and the imperative need to transform healthcare provision—will inevitably intersect. The change will be profound.

The current landscape

By late 2011 the world's roughly seven billion people already had just shy of six billion mobile-phone subscriptions, more than one-sixth with mobile broadband, according to the International Telecommunication Union (see chart 2). Connections are likely to outnumber people by 2013. Omnipresent in the developed world, this technology is increasingly widespread in developing countries as well.

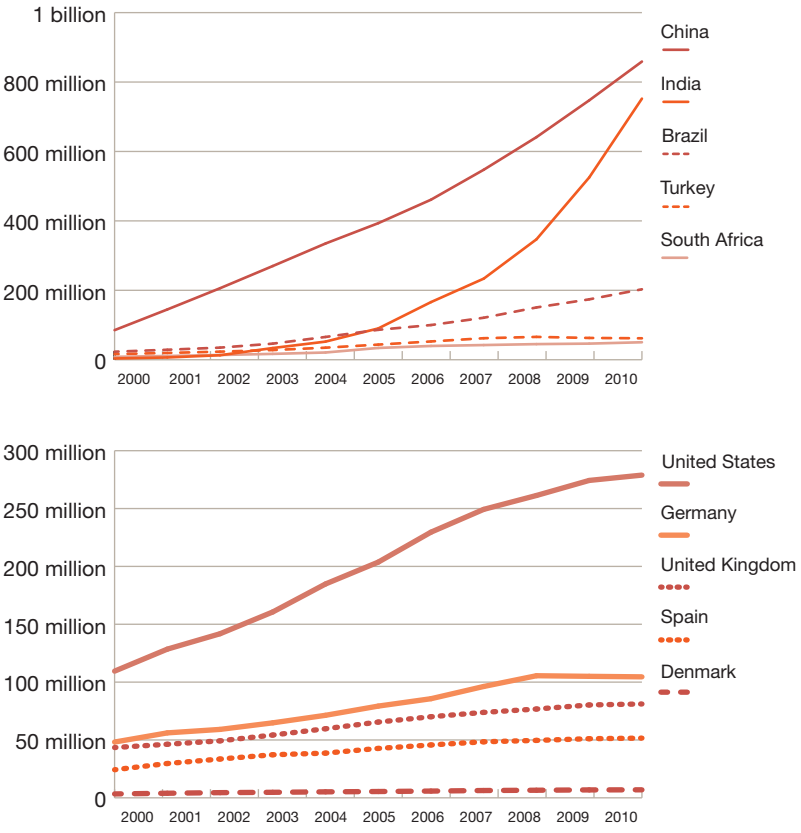
Connectivity is just part of the story. Misha Chellam, Chief Operating Officer of Scanadu, an mHealth device company, explains the value of ubiquitous infrastructure for innovators: in

Chart 1: New mHealth Google hits in year



*Estimate for all of 2012 taken by multiplying pre-March 27 figure by 5

Chart 2: Mobile subscribers for 10 countries



Source: International Telecommunication Union, April 2012

building attachments for the phone, they "are riding on the back of an incredible amount of investment; there is a billing model, connectivity and a user interface people are trained on". So much communication and computing power in so many hands should drive provision of always-on, anywhere service in numerous fields.

Meanwhile, the healthcare sector is ill-suited for modern needs. In developed countries, hospital-centric systems focus largely on acute care even while chronic conditions dominate the disease load. Population ageing will only exacerbate the challenge. Moreover, healthcare services are frequently disjointed and locked into provider-defined silos that ignore wider patient needs.

Economic problems have raised awareness of the high cost of these inadequate systems. Healthcare spending in the OECD has risen in the last decade from an average of 7.8% of the region's GDP to 9.7%. Of this, typically about 70% comes out of increasingly constrained government budgets. Jennifer Dixon, Director of the Nuffield Trust, a UK-based healthcare think-tank, notes that although areas such as telemedicine and eHealth are not new, the focus on such solutions "has had a particular impetus in the last three years because of the economic downturn. More people are looking at change in a way that we haven't seen in the last 10 to 20 years."

In emerging markets, the situation is both worse and more hopeful. Inadequate health infrastructure limits much of the rural population and urban poor to, at best, only the most basic care. However, rapid economic growth is driving citizens to demand more. India's government, for example, faces increasing pressure to raise healthcare spending. Jason Mann, Barclays Capital's Head of China healthcare, says that health is now a hot-button issue for that country's government too. "Its legitimacy is somewhat tied up with its ability to provide broad and inexpensive healthcare across China," he explains.

Expectation versus reality

Expectations are high that mobile technology will help to increase access to care in emerging markets and transform the developed world's costly healthcare behemoths into less expensive, prevention-based and patient-focused systems. The surveys conducted for this research programme found that although patients see relatively modest change so far, large numbers expect that mHealth will have a significant impact on how care is delivered in the next three years (see chart 3). Roughly one-half predict that it will improve the convenience (52%), cost (46%) and quality (48%) of their healthcare (see chart 4). Similarly, 59% of doctors and payers believe that the widespread adoption of mHealth in their countries is inevitable in the near future.

The impact of mHealth on relationships with patients will be about as big as that of the Internet, doctors say.

Pilot projects around the world point to the plethora of possibilities. These range from the Patient Link programme in Tianjin, China, which gives rural patients access to medical professionals, to a host of programmes across Africa that educate the public about AIDS through SMS messages, to SmokefreeTXT in the US, which helps young Americans to give up smoking.

Most experts interviewed for this study, however, are much more cautious. "We all need to come back down to earth," says Patricia Mechael, Executive Director of the mHealth Alliance, a multi-stakeholder group dedicated to advancing mHealth. "My forecast is that in the next year the hype cycle will reach its peak, we will then move into the trough of disillusionment, and then move back up to a happier place." Steinar Pedersen, Chief Executive Officer of Tromsø Telemedicine Consult, adds that currently "you have a research environment that produces papers, a business environment that produces expectations, and a healthcare environment that creates healthcare. So far they have not met. This will happen, but how long it will take I'm not sure."

Such words of caution suggest that change, while certainly desirable

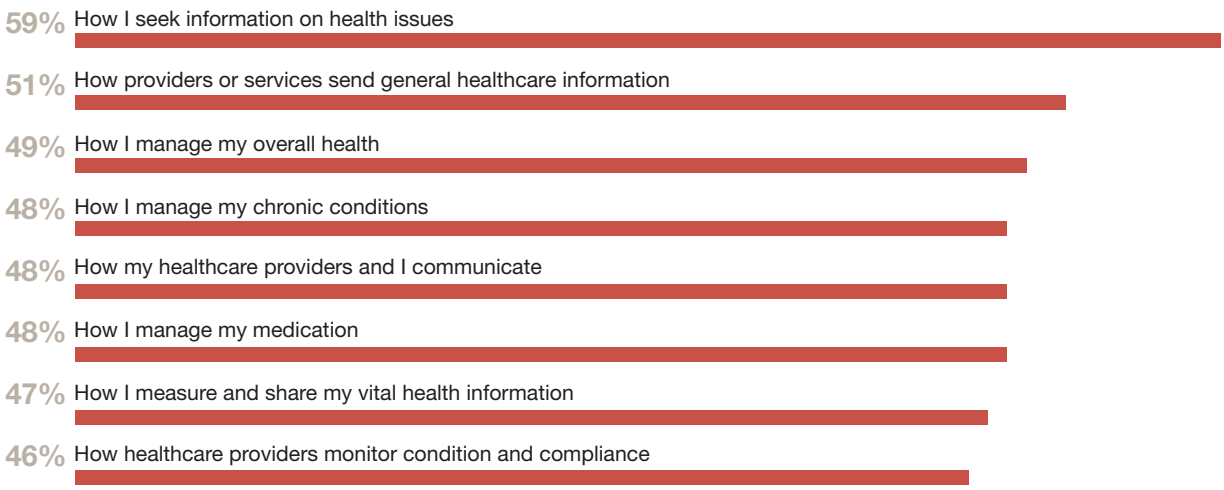
The mHealth universe

In this research programme, mHealth is defined as the provision of healthcare or health-related information through the use of mobile devices (typically mobile phones, but also other specialised medical mobile devices, like wireless monitors). Mobile applications and services can include, among other things, remote patient monitors, video conferencing, online consultations, personal healthcare devices, wireless access to patient records and prescriptions.

A broad variety of stakeholders take part in mHealth. They include patients and patient advocacy groups; healthcare professionals (doctors, nurses, and other professionals who patients see as part of normal healthcare); institutions where care is provided (hospitals, clinics and others); payers (government and private); medical device companies; biopharma companies; technology companies (devices, applications, software, infrastructure, data analytics and others); telecommunication services providers; pharmacies and other healthcare-related retail outlets; NGOs; regulators; policymakers; and a series of new entrants that include entrepreneurs and retailers.

Chart 3: Patients expect mHealth to change their healthcare experience

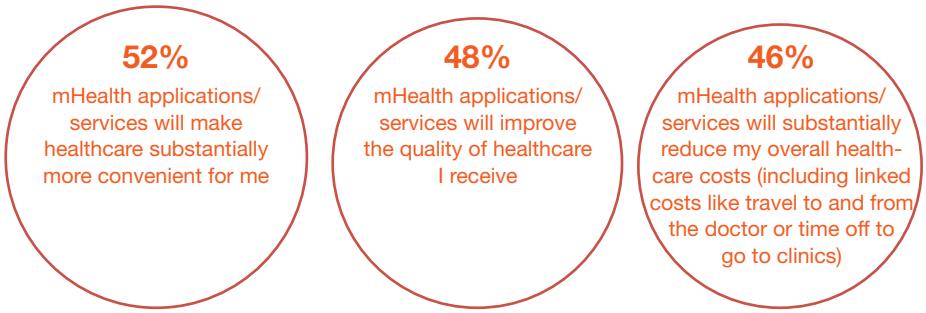
% of respondents who say that, in the next three years, mHealth will significantly change:



Source: Economist Intelligence Unit, 2012

Chart 4: Patients say mHealth will improve convenience, quality and cost of healthcare

In the next three years, patients agree that:



Source: Economist Intelligence Unit, 2012

and likely, is not simple. As with any important new technology, mHealth can enable incremental innovation—improvements to existing practices, or disruptive innovation—fundamental changes that alter healthcare provision. Professor Chris Taylor, Director of the University of Manchester's mHealth Innovation Centre, sees "some quick wins to be had, that will almost certainly come from the simpler, more boring things". For example, the increasingly common practice of texting appointment reminders to patients substantially reduces costs from missed attendance. These innovations have value, but they do not change the way medicine is delivered.

To meet current and future challenges, healthcare systems need disruptive change. For mHealth to enable that, though, it will have to deliver in the teeth of an industry with a long history of effectively resisting disruption. Clayton Christensen, one of the leading scholars on innovation, once described healthcare as perhaps "the most entrenched, change-averse industry in the US".[3] Analyses of other countries are similar.

If mHealth succeeds in delivering such things as a greater focus on prevention, better monitoring of chronic conditions and patient-centred care, its impact will be dramatic. But the scope of the task and the resistance it engenders should not be underestimated. As Eric Dishman, Intel's Director of Health Innovation, puts it: "mHealth is about fundamentally changing the social contract between patients and doctors. It will take time."

3 Clayton Christensen, Richard Bohmer and John Kenagy, "Will disruptive innovations cure healthcare?" *Harvard Business Review*, September-October 2000.

Colliding interests, competing visions

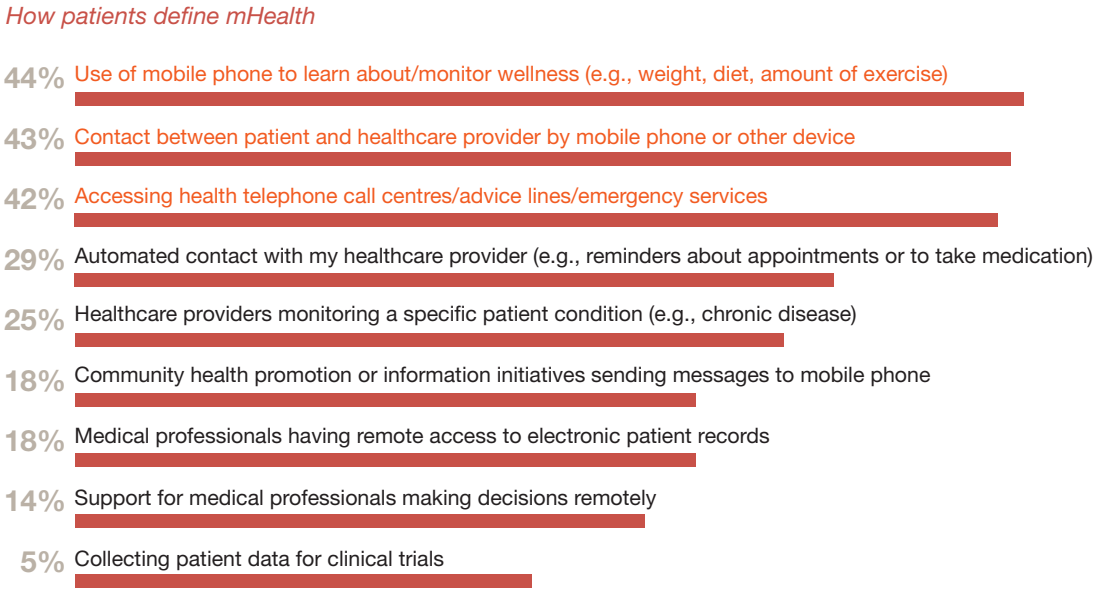


mHealth can be a powerful instrument, potentially altering relationships within the healthcare industry. But Sangita Reddy, Executive Director of Operations at Apollo Hospitals in India, says that mHealth's "greatest uptake will be when it is just another methodology in the healthcare cycle".

Mobile is thus a tool, not a new type of medicine, and its meaning will emerge from how it is applied within existing healthcare systems. This will be determined more by the interests of leading healthcare stakeholders than by the actual technology. That means that the tension among these interests, many of which are highlighted by our surveys, will shape the use of mHealth and the speed of its adoption.

The patient perspective: Patients believe that mHealth offers them easier access to care and more control over their own health (see charts 5 and 6). But this would involve a substantial, disruptive move away from doctor-directed care towards a patient-as-consumer model. Clinicians would remain important, but not always the patient's first option: already, among those who use mHealth services, 59% say these have replaced some visits to doctors or nurses.

Chart 5: Patients define mHealth in terms of access and control



Source: Economist Intelligence Unit, 2012

"Consumers are mobilised under the banner of convenience and, where they pay out of their own pockets, they begin to recognise cost," says George Poste, Regents' Professor and Del E. Webb Chair in Health Innovation at Arizona State University. In this, patients simply expect healthcare to catch up with other service industries.

Nevertheless, it would involve disruptive change. Ozgur Turgay, Managing Director of Acibadem Mobile Health, one of Turkey's largest providers of mHealth services, calls it a revolution. "We are creating a new environment in healthcare," he says.

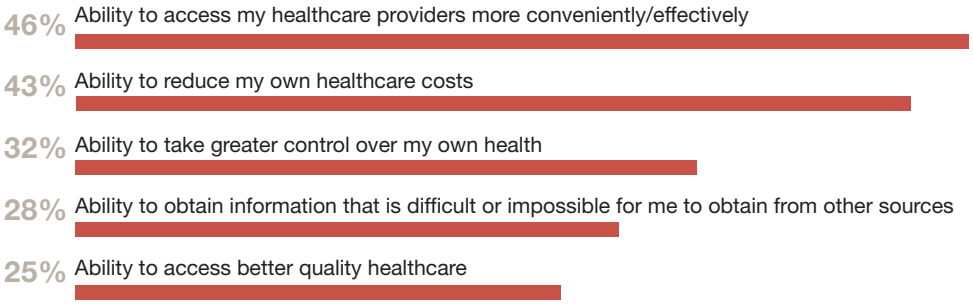
The doctor perspective: While patients are pushing for change in healthcare, our survey reveals doctors' resistance to disruption of their traditional roles. Only 27% encourage patients to use mHealth applications in order to become more active in managing their health; 13% actively discourage this.

Indeed, doctors are averse to a fundamental change to the patient's role (and power): 42% of doctors surveyed worry that mHealth will make patients too independent. A generational divide exists, but it is not what conventional wisdom might predict. Among younger doctors—those with less than five years' experience—53% are worried about the potential for patient independence. Perhaps they are more aware of the depth of change technology has brought in other fields, or their more junior positions makes them more sensitive to how vulnerable they are to disruption. Twenty-four percent of these younger doctors actively discourage patients from using mHealth applications to manage their own health.

Doctors are nevertheless embracing some aspects of mHealth. A 2012 survey of European doctors conducted by Manhattan Research, an organisation that researches medical personnel, found that 26% owned iPads and spent over one-quarter of their professional time using them. Its survey in the US showed that in 2011 30% of surveyed doctors had an iPad, and 28% expected to buy one in the next six months. Uptake in emerging markets has also been strong. Cláudio Giulliano Alves da Costa, President of the Brazilian Health Informatics Association, notes that physicians often resist adopting new information technology but, surprisingly, they have accepted tablets.

Chart 6: Patients will adopt mHealth if it improves access, lowers cost and increases control

Top drivers for patients to consider beginning to use or increasing use of mHealth applications/services



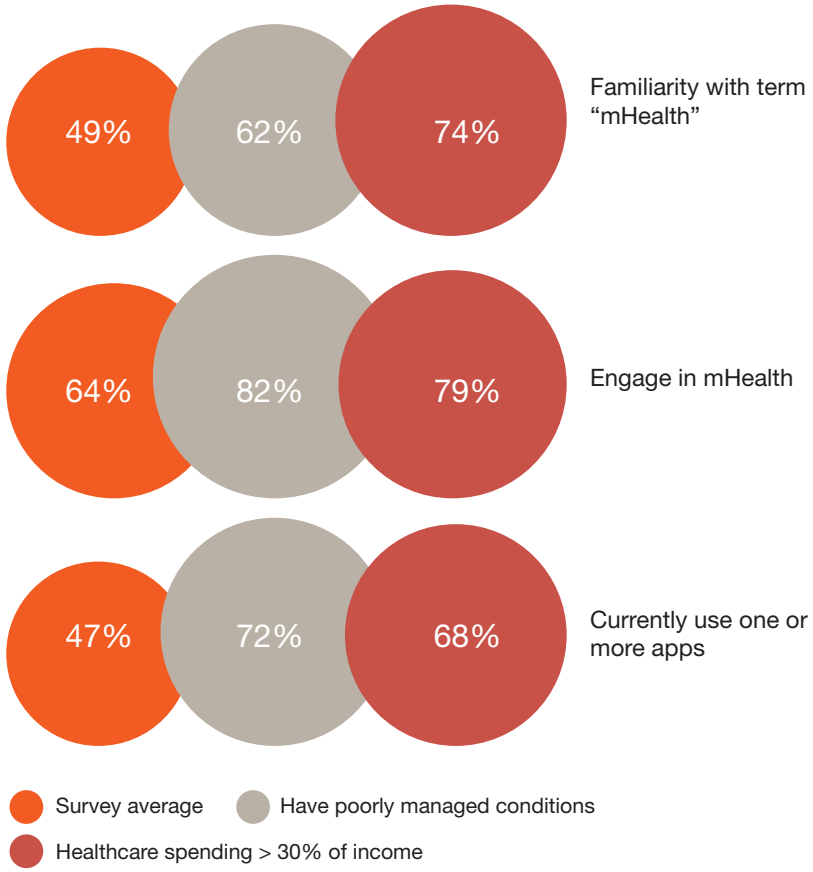
Source: Economist Intelligence Unit, 2012

Early adopters: driven or desperate?

With most disruptive technologies, the early adopters tend to be those who are ill-served by existing provision or not served at all. mHealth is no exception. The two types of patients in the Economist Intelligence Unit's survey most attracted by its products and services are those with poorly managed chronic diseases and those who pay more than 30% of their household income towards healthcare. Both groups are better informed about mHealth, are much more likely to be using such applications and services already, and are noticeably more willing to pay for them (see chart 7). They are, however, also more likely to abandon these applications and services within the first six months. This suggests that greater attention to efficacy data for mHealth is urgently needed—not just to improve return on investment but also to protect the potentially vulnerable from electronic quackery.

Chart 7: Necessity is the mother of adoption in mHealth

Patients with health issues are most likely to use mHealth products and services

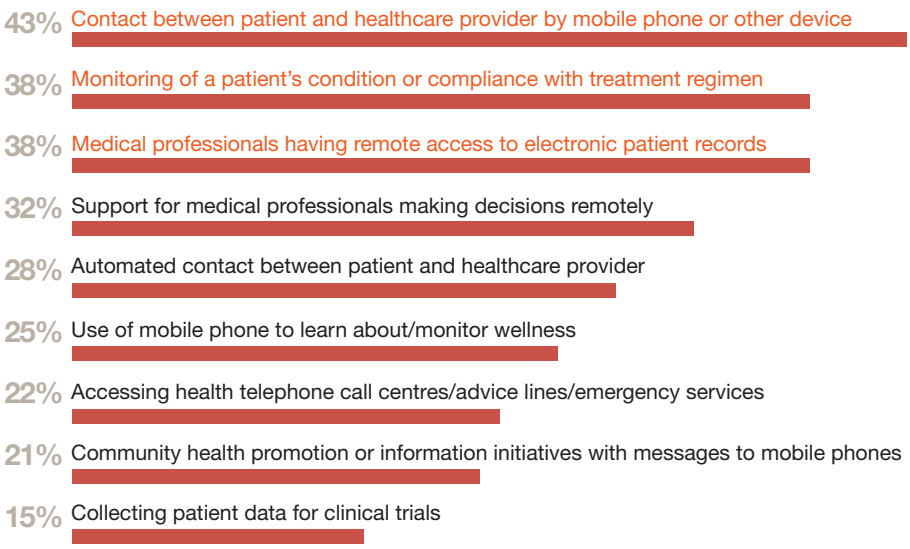


Source: Economist Intelligence Unit, 2012

Doctors are buying into mobile technology because it can help meet some of their needs, such as monitoring patient compliance, accessing records and communicating with colleagues (see charts 8 and 9). One of the most popular medical apps, for example, is Medscape, a free service which provides the latest medical news and information about diseases and drugs. While improvement of care is a bigger driver than simple convenience, doctors hope that it will happen through streamlining, rather than re-inventing, existing systems.

Chart 8: mHealth is about contact with patient, say doctors

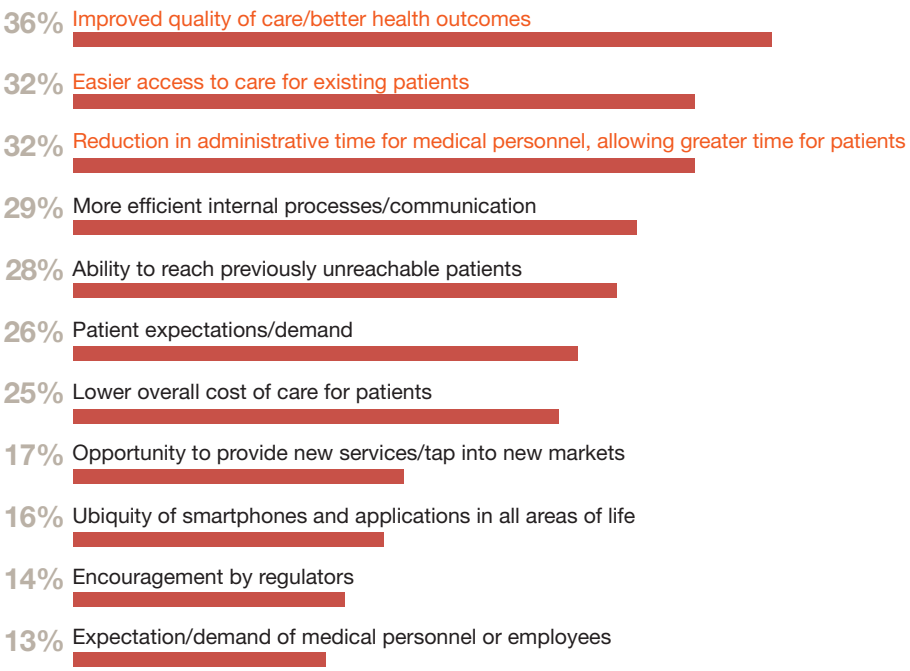
What doctors most associate with the term mobile healthcare (mHealth)



Source: Economist Intelligence Unit, 2012

Chart 9: Search for quality and efficiency are top incentives for doctors to adopt mHealth

What would spur doctor adoption of mHealth



Source: Economist Intelligence Unit, 2012

PwC perspective

Fighting chronic disease through mobile coaching

A recent US trial demonstrated the impact mobile phone-based coaching and online decision support can have on diabetes patients.

Chronic conditions are the leading causes of death and disability globally, putting an enormous and increasing burden on most healthcare systems. Prevention and early intervention are a big step towards the ultimate aim of making populations healthier through better lifestyles and increased compliance with their suggested care regimens. mHealth has the potential to specifically target chronic disease patients, with customised sensors, devices, services and tools to modify behaviour in an engaging and sustainable way.

WellDoc Inc., a healthcare behavioural science and technology company, has created a system of instant and longitudinal feedback and coaching driven by clinical, evidence-based guidelines and behaviour science. A 2009-2010 US trial of the WellDoc system sought to reduce blood glucose levels in 163 patients suffering from diabetes, with each participant receiving a glucose meter and supplies, along with a mobile phone application and access to a web-based portal.

Patients can enter blood glucose levels and other self-care data into their phones—both 'feature' as well as 'smart'—and receive real-time responses from 'virtual patient coach' (in the form of an expert mobile/web-client and cloud-based software system), providing assistance on managing the condition as well as more general tips on diet, exercise and other aspects of their lifestyle. The system can also produce ongoing, evidence-based reports of great use to the patients' clinicians, helping them monitor their conditions more accurately.

The results showed a mean decline in A1c (glycated haemoglobin—the gold-standard measure for diabetes control) by 1.9% in the intervention group (against 0.7% in the usual care group). A clinically significant change in A1c was seen, regardless of whether patients began the trial with a high or low A1c. By comparison, the US Food and Drug Administration considers a new drug that is able to reduce A1c by 0.5% as clinically significant. WellDoc's application has been cleared by the US Food and Drug Administration, works on the vast majority of data-enabled mobile phones and can be integrated into the standard software and electronic health records used by doctors.[4]

With an estimated $218 billion spent annually on diabetes in the US,[5] there is hope that this solution could enable annual cost savings per patient of as much as US$10,000 in reduced healthcare charges and increased worker productivity. [6] [7] [8] In addition, this approach could allow patients to gain more control over their condition and make better decisions on a daily basis, which should enhance the lives of millions of patients who suffer from diabetes. Remote-based coaching of this kind also has considerable potential for other chronic diseases. Diabetes, obesity and hypertension are seen as the three chronic diseases with the highest potential for mobile management through the application of phones and web-based solutions.

4 *The impact of smartphone applications on the mobile health industry (vol. 2)*, Mobile health market, Report 2011-2016, research2guidance, 9 January 2012.

5 Figures for the Centers for Disease Control and Prevention (2010) and the American Diabetes Association, 2009.

6 Milliman, 2011.

7 *Medication adherence leads to lower health care use and costs despite increased drug spending*, Roebuck MC, et al. Health Affairs (Millwood) (1):91-9, Jan 30 2011; *Hospital Stays for Patients with Diabetes*, Fraze T, et al. 2008; Statistical Brief #93. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs [Internet]. Rockville (MD): Agency for Health Care Policy and Research (US); Aug 2006-2010.

8 Testa MA, et al. *Health Economic Benefits and Quality of Life During Improved Glycaemic Control in Patients With Type 2 Diabetes Mellitus*. JAMA 280 (17):1490-6, Nov 1998.

Payers are likely to shift even closer to the patient position because they will bear most of the economic consequences if healthcare systems fail to reform

Payer perspectives: Payers—which in our survey include private insurance companies and government entities which pay for healthcare services that they or others provide—currently occupy a middle ground. They are not so much interested in pure cost reduction as value for money. This includes a reduction in administrative burdens for patients, as well as promoting better health through greater patient involvement in care (see charts 10 and 11). The ultimate aim of improved value for money may differ between private payers, who desire to reduce their spending, and public ones, who may have a fixed budget but seek to provide the best treatment possible within that envelope. mHealth-created efficiencies, however, can appeal to both.

The potential, practical benefits for payers are numerous. Dan Brostek, Head of Member and Consumer Engagement at Aetna, a health insurer, notes that these range from the administrative savings from making commonly requested information easy to download, to improving outcomes through access to personalised information, to making customers—especially those with high deductibles—aware of the actual costs of their treatment choices.

Payers are likely to shift even closer to the patient position because they will bear most of the economic consequences if healthcare systems fail to reform. Disruption is in their interest, and many are trying to redefine their roles within healthcare. This includes a greater emphasis on wellness and prevention—areas where mHealth can help greatly.

Many have launched their own mHealth services. Others have bought popular ones. Aetna, for example, has acquired iTriage, an application with some five million downloads that allows customers to research medical symptoms, locate nearby healthcare providers and schedule appointments. Mr Brostek points out that consumers increasingly expect mHealth solutions. By providing patients with the mobile capabilities they want, insurers can differentiate themselves in a competitive marketplace.



Chart 10: Patient at centre of mHealth, according to payers

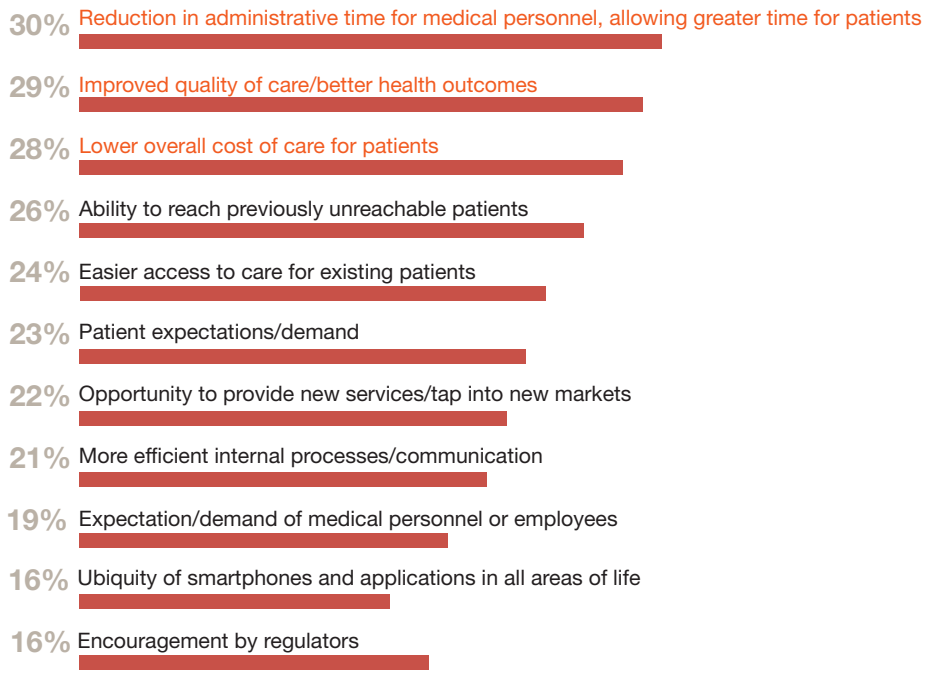
What payers most associate with the term mobile healthcare (mHealth)



Source: Economist Intelligence Unit, 2012

Chart 11: Search for quality and efficiency are top incentives for payers to adopt mHealth

What would spur payer adoption of mHealth



Source: Economist Intelligence Unit, 2012



The centre of the battlefield

The difference between doctors and patients, says Mr Pedersen, "is the centre of the battlefield" over mHealth. Mr Chellam adds that such technology "changes the balance of power. It is not surprising that doctors would be concerned."

Payers, on the other hand, are using their influence more actively to support mHealth: 40% encourage patients to let doctors monitor them through such services, compared with just 25% of doctors. Moreover, although physicians frequently cite existing payment structures as a barrier to their greater deployment of mHealth, in most cases payers are much more likely to cover mHealth-related services than doctors are to provide them (see charts 12 and 13).

Doctor resistance is likely to hold back some aspects of mHealth. This opposition is all the more problematic because mHealth will also have to overcome myriad barriers that typically delay change, especially disruptive innovation in healthcare. Still, most interviewees point to the appearance of the Internet and believe that doctors will be unable to resist—especially as payers join patients in demanding change.

Doctor resistance is likely to hold back some aspects of mHealth…still, most interviewees believe that doctors will be unable to resist—especially as payers join patients in demanding change

Chart 12: Doctors see promise in offering mHealth services

% of doctors who have begun to offer the following types of services via mobile devices, and which they would like to offer

	Have begun to offer	Would like to offer	Have no plans to offer	Offer but intend to stop	Total*
Telephone-based consultations	38%	32%	28%	2%	100%
Administrative communication	38%	45%	16%	1%	100%
Receiving data to monitor patient	21%	51%	26%	1%	100%
Provide patients access to portions of their medical record	17%	38%	44%	2%	100%
Drug adherence and other health-related communication	17%	51%	31%	1%	100%
Use of mobile device to explain/demonstrate during office visits	17%	46%	37%	1%	100%
Text-based consultations	16%	31%	52%	1%	100%
Analysis of general health and wellness data gathered by mobile devices	13%	48%	37%	1%	100%
Video consultations	8%	44%	47%	1%	100%

*Numbers may differ due to rounding

Source: Economist Intelligence Unit, 2012

Chart 13: Payers support diverse mHealth services, and plan to support even more

% of payers who say their organisation has begun to pay for the following types of services provided via mobile devices, and which it intends to pay for in the next three years

	Have begun to pay for	Plan to pay for in next 3 years	Have no plans to pay for	Pay for, but intend to stop	Total*
Telephone-based consultations	37%	31%	29%	4%	100%
Administrative communication	36%	33%	28%	3%	100%
Access by patients to portions of his or her medical record	32%	38%	27%	3%	100%
Drug adherence and other health-related communication	31%	37%	28%	4%	100%
Text-based consultations	30%	34%	31%	4%	100%
Analysis of general health and wellness data gathered by the patient's mobile devices	30%	36%	30%	4%	100%
Medical professionals receiving data as part of patient monitoring	29%	41%	27%	4%	100%
Video consultations	22%	38%	37%	3%	100%

*Numbers may differ due to rounding

Source: Economist Intelligence Unit, 2012

Healthcare innovation: A school of patience



Innovation in healthcare—particularly disruptive reorganisations of processes, care pathways and even job responsibilities—is famously difficult and slow. Although mHealth has a broad range of potential uses and benefits, a common set of powerful barriers also exists. These are both diverse—ranging from technology to culture, from incentive structures to regulations—and mutually reinforcing.

Technology: Technology still presents challenges for mHealth adopters. Both doctors and payers list privacy and security concerns as leading barriers to greater use of mHealth, and only around half of doctors believe that the mobile Internet facilities at their workplace are reasonably secure.

Poor integration also impedes uptake. Just 53% of doctors say that the mHealth applications and services they use work with their organisation's information technology (IT), and even fewer say they are integrated with technology in other parts of the health system (see chart 14).

Chart 14: Poor integration of IT systems impedes uptake of mHealth

% of respondents who say mHealth applications and services they use at their organisation are well integrated with the following



Source: Economist Intelligence Unit, 2012

"It is very easy from the technology point of view to say that this is the future but [those saying so] don't take into account the traditions and the complexity of the healthcare system."

Lack of interoperability between technologies is often to blame. Claudius Metze, Business Solutions Architect in the Healthcare Unit at SAP, Germany-based enterprise software company, notes that almost every healthcare customer has "many disparate systems that are hard to integrate, and where only the vendor knows the secret of how to get data out".

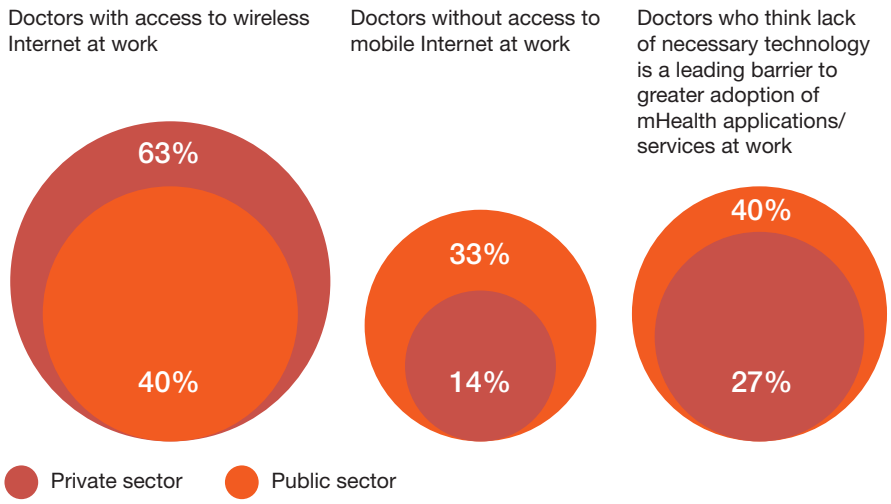
Nor will technological issues ever completely disappear. Mr Brostek explains that one of the biggest challenges in mHealth is the rapid change in consumer technology and adoption behaviours: "When a new operating system comes out, people almost expect within a month that its new capabilities will be layered into your applications. It is complex to move at that speed."

Culture: Technological issues fade next to the complexities of bringing about change in healthcare, however. "It is very easy from the technology point of view to say that this is the future, but [those saying so] don't take into account the traditions and the complexity of the healthcare system," says Mr Pedersen. Electronic health records, for example, have been on the cusp of revolutionising care since 1985, but in most countries they have been unable to break through these broader barriers to change.

In fact, 27% of doctors and 26% of payers cite an inherently conservative culture as a leading barrier to mHealth. Thierry Zylberberg, Head of France Telecom's Orange Healthcare, notes that this is not inevitably a bad thing: the field changes by consensus precisely because if innovation does not work out as planned, the risks to human health can be substantial and difficult to foresee.



Chart 15: A technology gap exists between private and public sectors



Source: Economist Intelligence Unit, 2012

But no matter how understandable the roots of such a cautious approach, it can stand in the way of clearly beneficial change, even one that does not carry much risk.

Size and complexity: Most national health systems are both vast and fragmented. The UK's National Health System (NHS), for example, is the seventh-largest employer worldwide and Europe's biggest, but decision-making powers are diffuse. Ian Leslie, Professor of Computer Science at Cambridge University and an expert in mHealth in China, notes that one strategy for mHealth entrepreneurs is, as much as possible, to "avoid interacting with the humongous thing" that is the health system.

Moreover, figuring out the levers of change in one country is not necessarily helpful elsewhere, because systems vary markedly. They frequently include dominant monopolies, substantial state control and high costs for and regulatory barriers to new entrants, all of which are inimical to entrepreneur-driven innovation.

State control is particularly relevant for mHealth. Ongoing government retrenchment has created a technological gap that will slow adoption. Lack of existing technology is the biggest barrier to greater use of mHealth, according to the public-sector doctors and payers surveyed (see chart 15). One-third of public-sector doctors do not even have mobile Internet at work, compared with 14% in the private sector. Obtaining the economic benefits of mHealth will therefore require governments to invest more to catch up technologically.

Regulation: The highly regulated nature of healthcare also hinders innovation. For rapidly changing technologies, the problem is frequently either a regulatory void—which increases risk for providers—or the application of inappropriate regulations from earlier technologies: 45% of payers and doctors believe that the latter is holding up mHealth.

Bakul Patel, a policy adviser at the US Food and Drug Administration (FDA), notes that his organisation wants to support mHealth and is developing new ways to deal with the attendant

regulatory challenges. For example, to allow faster innovation, the FDA has broken new ground by issuing a description of low-risk mHealth areas, such as patient self-management, that would not be regulated, even if they meet the regulatory definition. Mr Patel acknowledges that regulators continue to face a pressing challenge in seeking to balance patient safety with potential benefits in this fast-changing field: "There is a lot more work in terms of how regulators can add value to this ecosystem. As part of that effort we are developing a new framework for the small subset of high-risk mHealth devices that will be able to accommodate the rapid innovation cycles of these technologies."

Perverse incentives: Perhaps the greatest difficulty for innovation in healthcare is the complex incentive arrangements that have created and continue to reinforce current systems. An mHealth product will only be adopted if a stakeholder sees an advantage in paying for it, but finding such a purchaser is not always straightforward.

One of the best-known mHealth services, run by Ghana-based NGO mPedigree, exemplifies the challenge in finding purely market support for mHealth innovation. The service allows consumers purchasing drugs in certain parts of Africa to text a coded number on the packaging to the service, which will either verify that the product is legitimate or warn that it is counterfeit. The widely praised programme benefits a broad variety of stakeholders—including pharmaceutical firms, pharmacies, purchasers and mobile-phone companies that carry the data traffic. Nevertheless, mPedigree has not found a commercially viable model. Pharmaceutical companies provide some sponsorship, but the programme also relies on prize money, grants and donations of low-cost or pro bono services from a variety of companies.

More daunting still is the ability of insiders to fight innovation that they find disruptive. "With many mHealth solutions you need to understand what is in it for the person who pays your bill and, even more important, you need to understand whose toes you are stepping on, and how to turn it into a situation where everybody wins," says Axel Nemetz, Head of Vodafone mHealth Solutions. He recalls one project that clearly provided superior care for the patient at home and had the support of medical personnel. Hospital administrators, while recognising the benefits, initially sought to block the scheme because they would lose income from the resultant reduction in hospital-based services. In the end, compensation workarounds were developed in the interests of patients and other stakeholders. This is not an isolated incident, but rather traditional behaviour inside the health sector, where actors use diverse economic, regulatory and organisational levers to protect themselves.

PwC perspective

How SMS technology can fight the spread of counterfeit drugs

Due to mobile technology, patients and clinicians in Kenya, Cameroon and Ghana can check whether drugs are fake by sending a single SMS, receiving an instant verification. An example of the many initiatives underway is the one from Orange Healthcare.

It's hard to overestimate the cost of counterfeiting. One expert believes that the global market for fakes could be worth between US$75-$200 billion—a year[9] in lost revenue for pharmaceutical companies. The practice could even jeopardise national and international investment in research manufacturing facilities, marketing and distribution.

However the biggest cost is arguably to society as a whole in the form of additional treatment and especially in lost lives of those who could otherwise have made a productive contribution to a nation's wealth over a lifetime. The 200,000 deaths a year attributed to malaria alone could potentially cost billions to the countries affected. The WHO estimates that malaria can decrease annual gross domestic product (GDP) by as much as 1.3% in countries with high levels of transmission, while in some countries the disease accounts for up to 40% of public health expenditures, 30-50% of inpatient hospital admissions and up to 60% of outpatient health clinic visits.[10]

Given these staggering sums, it's no surprise that there are concerted efforts to help health systems and the pharmaceutical industry secure the global supply chain for drugs. The WHO has been working with government agencies and manufacturers around the world to create a database of products, giving each packet of medicine a unique number. And a new initiative from mobile phone company Orange (part of France Telecom), these markings can now be tracked at any point in the distribution pipeline using widely available and relatively inexpensive technology.

The system is a collaboration between Orange and a non-governmental organisation called m-Pedigree and is simple for users and/or clinicians. Each pack has a batch number and expiry date, along with a one-time code that is only revealed by scratching the covering ink. The code number is sent by SMS to a server, which sends an instant response verifying whether the drug is real or fake.

The code on the packages is a one-off encrypted number that incorporates the batch code and expiry date, so the system is relatively foolproof.

The costs are minimal and initial trials in Kenya have been very successful, with thousands of messages sent to the server, suggesting that such an approach has a huge potential for wider application in both emerging and mature markets. Once trials have been completed, there are plans to develop a sustainable business model with non-profit organisations, government agencies and pharmaceutical companies.

While the many initiatives underway have experienced various levels of success, the results are positive for mHealth overall.

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9 "Poison pills: Counterfeit drugs used to be a problem for poor countries. Now they threaten the rich world, too," *The Economist*, 2 September 2010.

10 WHO estimates http://www.who.int/mediacentre

Emerging markets, emerging solutions



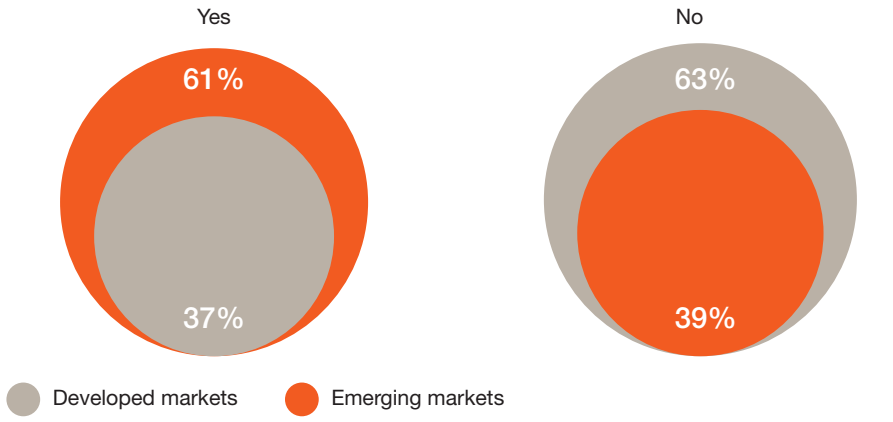
However daunting, the difficulties of innovation in healthcare are neither insurmountable nor universal. Disruptive innovation typically occurs on the fringes of a sector, where consumers have fewer resources and entrenched interests are weaker or non-existent. mHealth is no exception.

Mobile healthcare solutions are being deployed more rapidly in emerging markets than in developed economies. "We see it on the ground in countries we work with. While the US thinks about dealing with fundamental issues like secure electronic health records, in places like India, China and Singapore mHealth is taking place," says Mr Dishman.

In the emerging markets surveyed, patient awareness and expectations of mHealth are, on average, far higher than in developed countries (see charts 16, 17, 18). More important, far more patients are already using mHealth: 59% of emerging-market patients use at least one mHealth application or service, compared with 35% in the developed world, and among those who do not, emerging-market residents are more interested in starting (see chart 19).

Chart 16: Patients are more aware of mHealth in emerging markets

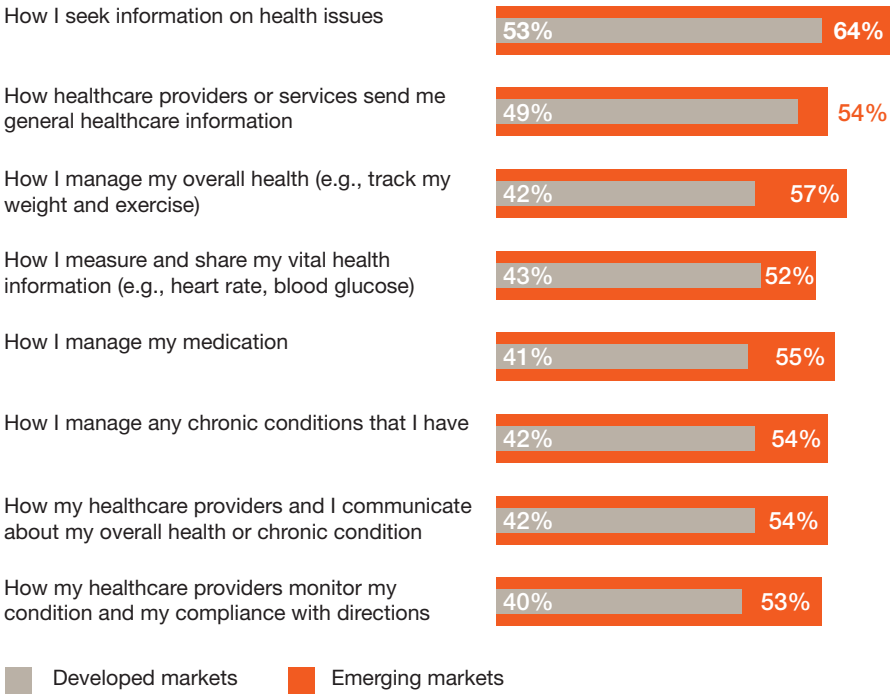
% of patients who are familiar with the terms "mobile health" or "mHealth"



Source: Economist Intelligence Unit, 2012

Chart 17: Emerging market patients have great expectations of mHealth

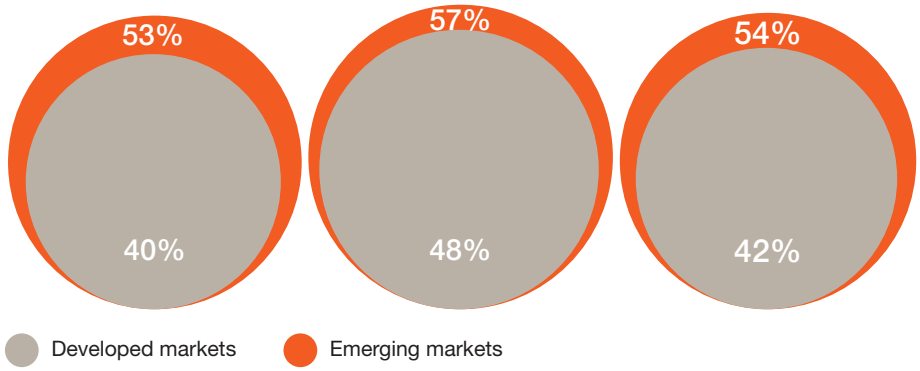
% of respondents who say that in the next three years, mHealth will change:



Source: Economist Intelligence Unit, 2012

Chart 18: Patients in emerging markets are more optimistic of mHealth to their overall care

% of patients who agree with the following statements:



Source: Economist Intelligence Unit, 2012

Chart 19: Interest is high among emerging market patients who do not yet use mHealth

% of patients who would be interested in using the following types of mHealth applications/services



Source: Economist Intelligence Unit, 2012

PwC perspective

Reaching out through mHealth and making healthcare available to masses

Trials in India suggest that remote triage advice and health monitoring via mobile phones can bring healthcare within reach of millions of poorer rural dwellers who couldn't have reached out to tertiary care centres.

Apollo Hospitals Group in India is aware that its private hospitals can only serve a small proportion of India's huge 1.2 billion population. However, with 900 million owning a mobile phone[11], the opportunity for de-monopolising healthcare knowledge from the tertiary care centres and extending the same to rural areas is considerable. Even the first lifecycle state of providing basic education and awareness along with primary care would make quality healthcare reach millions who currently have no access to physicians.

Apollo's first steps into mHealth involved triaged health information and advice via contact centres staffed by paramedics, physiotherapists, nurses, doctors and health advisers, using an IT platform with a structured query database to give an appropriate health response. This service is offered in collaboration with leading telecommunications companies, and has the following track record:

- Over 700,000 calls handled by the triage service since it launched.
- Country-wide coverage, reaching a potential audience of 70 million, 24 hours a day and 7 days per week.
- 2G-based and provisioning for 3G-based video consultations.

As a next step, Apollo is trialling remote analytics through a range of devices monitoring symptoms such as blood glucose count, heart rate, blood pressure and peak flow, all carried out from a patient's own home, creating a 'mobile health system' that also includes lifestyle, diet and educational support.

For example, with their diabetes management program called SUGAR, diabetics may upload their blood sugar count to the clinician through SMS and mobile applications, with an SMS text delivered back to the patient explaining the readings and advising whether further action is required. Further support comes from the contact centre staffed by medical professionals, and customers also have access to customised personal health records. Early signs are encouraging, with the diabetes monitoring in particular raising compliance to an appropriate diet and exercise regime, with plans for further expansion.

Over time the network will become more integrated to link health providers, payers and mobile phone suppliers with new phone customers asked to enter health records at point of purchase as a standard procedure, and a button on the phone to access the telehealth provider at a single touch. And by partnering with health insurance companies, Apollo hopes to make mHealth an integral part of the cure process and not an alternate method of care.

11 Telecom Regulatory Authority of India, 2011

Payers and doctors in emerging markets are also more active in mHealth. More payers currently cover the costs of, or plan to pay for, every mHealth-related service in the survey than do their counterparts in wealthier countries (see chart 20). Doctors in these markets, meanwhile, are more likely to have some form of mobile Internet at work and to have their own applications integrated with local and national healthcare data systems.

mHealth already has brought about substantial change in the doctor-patient relationship for 27% of emerging-market doctors (compared with 16% in developed countries) and a marked internal restructuring of their workplace for 34% (compared with 19%). Collectively, doctors and payers in emerging markets are also much more likely to recommend patients use mHealth either on their own or to let medical personnel monitor their conditions (68% to 59%). In China and India, in particular, this figure rises to eight out of ten.

The scope of mHealth is also broader in emerging markets. Mobile technology has proved particularly effective in public health activities, such as outbreak-tracking in remote areas. The data-gathering programme in Brazil's Amazonas State, for example, provided nearly real-time information on outbreaks of dengue fever that previously took one to two months to collate.

Ms Mechael expects mHealth in many emerging countries to support frontline health workers before it addresses consumer wishes. Our survey reflects this: 29% of public-sector health executives in emerging markets associate the term mHealth with community health promotion or education, the third most common choice for that group.

Finally, while 'pilotitis' remains an ongoing problem in developed countries, the scale of mHealth projects is starting to grow in emerging markets. Brazil's Sistema Tele-Eletro-cardiografia Digital allows ambulances across the country to send cardiograms to the telemedicine unit of a specialist heart hospital in São Paulo. Within five minutes they receive a diagnosis to guide emergency treatment. In Turkey, Acibadem Mobile runs an mHealth nutrition service with 450,000 members, and in less than two years an emergency healthcare service offered in conjunction with Turkish Telecom has grown to 100,000 members. In Mexico, meanwhile, Medicall Home has five million subscribers who pay US$5 a month on their phone bills in order to access medical advice. Finally, South Africa is preparing to launch a national mHealth-enabled programme to increase HIV/AIDS screening. Such projects suggest that mHealth is maturing beyond basic experimentation.

Greater need and fewer options

Overwhelming necessity helps explain the more rapid adoption of mHealth in emerging markets. "In mature markets, [healthcare involves] a luxury problem: am I going to receive first-class treatment in the hospital, in the physician's office or at home? In emerging markets the challenge is completely different," says Mr Nemetz.

The number of doctors per head in the surveyed countries gives some indication of the disparity (see chart 21), but the distribution of medical personnel makes it even starker. Doctors worldwide tend to concentrate in urban areas. This has a particular impact in developing countries where there are so few doctors overall, and is especially relevant in India, China and South Africa, where so much of the population lives in the countryside. In such rural areas, medical care is often provided, if at all, by those with only the most basic of training.

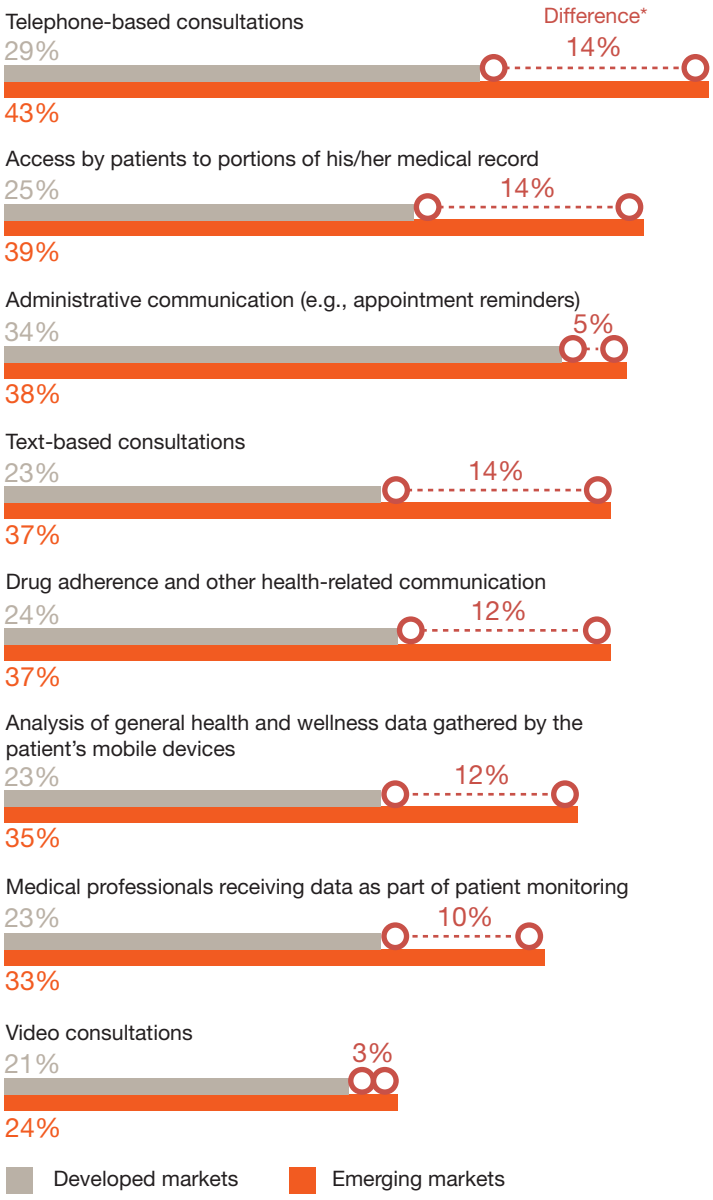
In emerging markets care is also often expensive: 53% of patients there cite cost as a driver of greater use of mHealth, compared with 34% in developed countries. In many cases mobile technology is the only viable tool to reach people. As Dr Benjamin points out: "The cell phone in Europe is a nice gadget, but a substitution for other technology. For a majority of Africa it is not a substitution for anything, but [rather] the only access."

This is also true in much of Asia. Bangladesh's Grameenphone, in co-operation with the Telephone Reference Centre, set up Healthlink to allow its customers (and others using village phone centres) to talk with a doctor any time of day or night. It is not surprising that, in a country with less than one doctor per 4,000 people, the service has fielded 3.5 million calls in the last six years.

The lack of healthcare infrastructure means that emerging markets do not face the challenge of entrenched interests that can impede mHealth in developed countries. Barriers to change remain, of course: China's hospital system is notoriously fragmented, making reforms difficult. Overall, though, Mr Leslie notes: "In the developed world, the problem is this enormous medical infrastructure that is very conservative and resistant to change. In emerging markets, you have a lot of the drivers of innovation without the barriers."

Chart 20: More mHealth services are covered by payers in emerging markets than in developed countries

% of respondents who say their organisation has started to pay for the following types of services provided via mobile devices



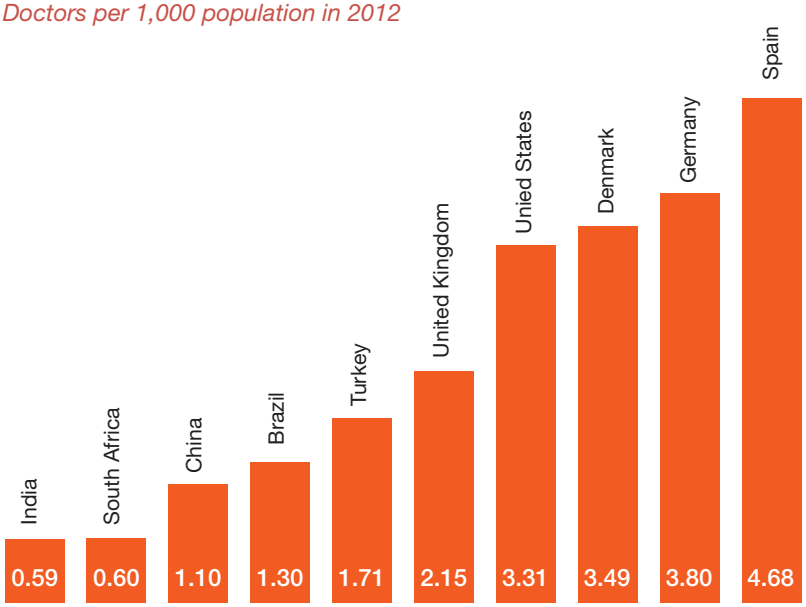
*Numbers may differ due to rounding

Source: Economist Intelligence Unit, 2012

Overwhelming necessity helps explain the more rapid adoption in emerging markets

Chart 21: mHealth adoption may reflect relative need

Doctors per 1,000 population in 2012



Source: Economist Intelligence Unit, 2012

Ms Reddy, who oversaw the growth of Apollo's mHealth business, adds: "When you have no legacy, it is easy to build." She notes that "in emerging markets, higher penetration of mobility is coupled with increasing acceptance of the tool as a medium to interact and exchange information. Healthcare services need to ride this wave to ensure quality healthcare is available to masses irrespective of the patient location."

Finally, these emerging markets are doing well financially, have the technological infrastructure to engage in mHealth, and have populations with expectations of improved care. Looking at all the factors in emerging markets together, Mr Leslie concludes: "In some ways, you can't think of better conditions. Why waste time in the West?"

Emerging solutions

Emerging markets are likely to be the seedbed of innovation—an advantage they can leverage in the global market. Two of the best-known American mHealth services follow emerging-market examples. GlowCaps, a tool that warns patients and their caregivers when the former fail to take prescribed drugs, is very similar in concept to SIMpill, a South African product that appeared several years before. Similarly Text4Baby—a free, multi-stakeholder service sending relevant information to pregnant mothers—is one of the few mHealth programmes to reach substantial scale in the US. Its design drew on Mexico's VidaNet service (for patients with HIV/AIDS) and Kenya's MobileforGood Health Tips. Technology transfer from emerging countries is likely to continue.

More important, the development of mHealth in emerging-market countries can accelerate the development of ecosystems of firms—providers, technology companies, telecoms operators, payers and others—that analysts agree are essential for mHealth's long-term success. Given mHealth's digital nature, an ecosystem will not be restricted by national boundaries. This will eventually allow participants to support disruption in a host of markets. The future of Western healthcare may be developing in emerging markets today.

A tale of two countries—India and the UK

The UK and India reflect the stark differences between developed and emerging markets in mHealth. For the latter, mHealth can address pressing healthcare needs; for the UK, it is simply an added luxury.

The healthcare landscapes of each country create different motives for using mHealth. Indians cover about three-quarters of their medical expenses out of their own pocket, and adequate care is beyond the financial reach of many. The country has only 0.6 doctors per 1,000 people, the vast majority of whom are concentrated in urban areas that encompass just 30% of India's 1.2 billion inhabitants. Rural residents usually receive care from accredited social health activists rather than more trained medical personnel. Given the degree to which specialists concentrate in metropolitan areas and semi-urban towns, "telemedicine and mHealth methods will have to be adopted", according to Sunderrajan Jagannathan, Head of Strategy at Siemens Healthcare India.

The UK, meanwhile, is reasonably well served by the National Health Service (NHS). Life expectancy of 80.4 years is above the developed world average (78) and far above that of India (67.1). Moreover, the NHS's free service at the point of need removes the economic burden of care from most of the population. Instead, the currency British patients tend to pay in is inconvenience, with waiting lists a continuing problem.

The drivers of mHealth in each country are thus different. For Indian respondents, the three biggest attractions are cost reduction (cited by 58%), convenience of access (55%) and ability to obtain otherwise unavailable information (40%). Convenience is the biggest consideration of British patients (49%), but this is followed by a desire to take greater control of their own health (43%). Cost reduction (25%) is far down the list.

Cost is also the leading driver of mHealth for payers and doctors in India, followed by the opportunity to provide new services and to reach previously inaccessible patients. These considerations are much less important in the UK, where reduced administrative time is a leading concern. Indeed, UK payers were twice as likely to say that encouragement by regulators (34%) was a leading impetus for greater use of mHealth than improved outcomes (17%).

Even the people whom mHealth users are seeking to help differ between countries. In the last two years users in India were slightly less likely than British respondents to have acted on their own behalf (74% to 79%), but more than twice as likely to have done so for other family members (54% to 24%) and ten times more likely to have done so for friends and neighbours (29% to 3%).

The barriers to mHealth also reveal a telling difference in perspective. While cultural and medical attitudes are as much a problem in India as elsewhere in the world, the third-biggest barrier for British payers is that other areas need investment first.

The results are predictable. Among patients, 48% of British respondents do not engage in any mHealth-related activity, compared with just 12% of Indian respondents.

A glance at headline projects tells the same story. India has a range of substantial mHealth activities. The Aravind Eye Hospital System's mobile health vans are an often studied use of wireless technology. The Apollo Telemedicine Networking Foundation has over 70 telemedicine centres in the country that allow contracting parties to serve rural areas. The government has announced plans for a variety of national telemedicine networks, including in oncology and disease surveillance. Still, Mr Jagannathan characterises India's progress in telemedicine and mHealth as "baby steps—it has a long way to go, but has big potential."

In Britain, meanwhile, progress is far less steady. Numerous mHealth projects exist, and stakeholders in Manchester are experimenting with the creation of a broadly based ecosystem of organisations to support the field. Nevertheless, after ten years and investment of £6.4 billion (US$10.3 billion), the largest eHealth project—the creation of electronic health records across the country—was abandoned as unfit for modern needs. In order to save money, the largest national telemedicine programme—NHS Direct—is also being replaced by a series of local facilities that will probably have less skilled personnel, potentially a setback in healthcare provision.

From technology to solutions worth buying



Disruption may eventually overcome barriers to change in mature healthcare systems—it is already starting to do so in emerging markets. Yet entrepreneurs worldwide still need to find business models that work in the current environment. This is proving a challenge: 64% of doctors and payers say that today mHealth has exciting possibilities but too few proven business models.

"You can do great things with mHealth," says Mr Nemetz, "but at the end of the day the question is who is willing to pay your bill." Sunderrajan Jagannathan, Head of Strategy and Development for Siemens Healthcare India, agrees: "[For] any business model the revenue chain must be firm. That is where mHealth has a problem."

New technology does not always attract new sources of revenue. mHealth is a case in point. The flood of personal health phone apps notwithstanding, patients are still largely unwilling to buy services. They cite cost as the biggest barrier to greater use of mHealth (49%), not because products are expensive, but because patients are highly price sensitive. Of those using mHealth services or applications, around one-quarter pay more than just US$5 per application. Of those without such services, only about 15% are willing to pay that much. These figures change very little with income.

Patients in emerging markets are more willing to pay than those in developed ones—probably reflecting the higher proportion of all healthcare costs they pay out of their own pocket—but even they demonstrate reluctance. According to Mr Dishman, although they are willing to pay for technology in other areas, such as consumer electronics, "the moment it crosses over into healthcare, [consumers'] entitlement mentality kicks in regardless of social status. For the foreseeable future, we have to show value to [existing healthcare] payers."

Finding and proving a need

To convince payers—or providers interested in cost reduction—to pay for mHealth, companies must focus on solutions that help these stakeholders directly. This is not always straightforward. Lack of imagination is one of the biggest problems facing mHealth, says Mr Dishman, but this is common with new technology: before email became widespread, Intel's surveys showed that most people claimed not to want it.

New entrants from technology industries may find it particularly difficult to understand what potential customers want. As Mr Metze notes: "Technology is nearly nothing as long as you don't know what to do with it. It is only in combination with solutions that you can show real value, but it is very important to find a language that bridges technology people and clinicians, because they tend to think differently."

Working with care providers in creating mHealth solutions is one way to help them be relevant, and it has important additional benefits. Mr Nemetz explains that "when doctors and nurses see that they are in the driver's seat, you don't encounter the behavioural hurdles [to adoption that otherwise occur]".

From incremental to disruptive change

A solution- rather than technology-based approach may seem to lead to merely incremental innovation. Such improvements, however, can be significant. Mr Leslie notes that the ability to book appointments by mobile phone has brought huge efficiency gains in China.

Moreover, solutions themselves often allow or involve broader change. Ms Reddy says that Apollo Hospitals floundered when the focus was on mobile technology. "When we came back to putting the patient in the centre, then everything fell into place."

The company's diabetes programme, she says, has been particularly effective. This has created an integrated loop between doctors and patients that includes voice, text and mobile apps. This integration has improved compliance with care protocols and has helped diabetics manage their condition more effectively. New processes were created along the way, but according to Ms Reddy, mHealth was integrated into existing healthcare rather than standing apart from it. Similarly, Orange Healthcare's project to digitise and store all medical imaging from Paris hospitals in the cloud addresses the problem of the huge storage costs that these institutions face, but also allows easier access and sharing of such data by clinicians.

Ultimately, however, mHealth needs to do more than integrate with existing healthcare systems. As with any disruptive technology, it will need to rely on and act through an ecosystem of actors

PwC perspective

Ingredients for successful mHealth models

The pervasiveness of technology is enabling the emergence of a new, more patient-centric healthcare value chain. As a result, conventional business models, which typically place consumers at the periphery, may soon no longer apply.

To lead, all stakeholders—physicians, hospitals, health insurers, pharmaceuticals, medical device companies and government—will likely shift their practices toward patient/consumer models that will focus on clinical outcomes, value, and patient satisfaction.

One needs to look no further than other industries (e.g., media, retail and travel/tourism) that provide value-add online services—many of which are free of charge—in order to generate a competitive advantage. As in these other industries, business models that will likely get the most traction will be based on payment schemes that leverage retailers, product companies and other business partners to absorb any additional costs with minimal reliance on consumer payments.

PwC research has found that mHealth solutions have begun to embrace the following six principles:

Interoperability – interoperable with sensors and other mobile/non-mobile devices to share vast amounts of data with other applications, such as electronic health records and existing healthcare plans.

Integration – integrated into existing activities and workflows of providers and patients to provide the support needed for new behaviours.

Intelligence – offer problem-solving ability to provide real-time, qualitative solutions based on existing data in order to realise productivity gains.

Socialisation – act as a hub by sharing information across a broad community to provide support, coaching, recommendations and other forms of assistance.

Outcomes – provide a return on investment in terms of cost, access and quality of care based on healthcare objectives.

Engagement – enable patient involvement and the provision of ubiquitous and instant feedback in order to realise new behaviours and/or sustain desired performance.

with a shared concept of how healthcare should be delivered.

It requires "multi-sector, long-term partnerships and critical mass", according to Mr Taylor. On a technological level, this inevitably involves the integration of data and services based around the individual patient. This is not an end in itself, but is instead the key enabler of patient-centred care that involves all aspects of health from prevention to treatment in a holistic way.

Picking up the tab

But, again, who will pay? To increase behaviours that prevent chronic disease, says Martin Kopp, Head of Healthcare at SAP, "you need to find the companies that will benefit from [employees] changing behaviour." The same is true of healthcare reform as a whole.

In the long term, the most common view among those interviewed for this study is that healthcare payers will underwrite mHealth as part of broader changes in healthcare. In Dr Poste's words: "Economically we cannot go on as we are. Pressure will come from payers. We will each have to do a better job of taking personal accountability for our own health. Economic forces will dictate that payers, providers and patients will be in increasing alignment."

As discussed earlier, emerging markets are leading the way in mHealth. But economic pressures will lead to the reconfiguration of healthcare in developed countries as well. When that happens, they will need to catch up.

Does it work? Does that matter?

Perhaps the most visible element of mHealth is the profusion of phone apps, especially ones related to fitness and wellness. Tens of thousands are already available, and different market research firms have issued predictions for global downloads in 2012 that vary widely from just over 40 million to nearly 250 million.

Other data, however, suggest that all will not be clear sailing for the fitness and wellness market. The Pew Internet & American Life Project found that in the year ending August 2011 the increase in the number of adults in the US who had ever downloaded an mHealth app for their phones was insignificant.

More worrying for the industry is the immense drop-out rate. The survey fielded by the Economist Intelligence Unit shows that, discounting respondents who had just started, 67% of respondents who have used an mHealth wellness or fitness app with manual data entry discontinued it in the first six months. For automated apps that took information from other devices, the figure was even higher (74%). This is consistent with the experience of many interviewees.

High drop-out rates highlight two particular weaknesses of these apps. First, on their own they lack value. George Poste, professor at Arizona State University, says that most "are intriguing, but won't have any impact because they are not inter-operable and not actionable." Integration with healthcare systems, however, will be problematic. Prof. Chris Taylor, director of the University of Manchester's mHealth Innovation Centre, notes that "healthcare professionals don't currently treat as credible any data that are being created [through lifestyle apps]".

The second challenge is understanding efficacy. Very few studies have been conducted evaluating the impact of mHealth applications on care, let alone their return on investment. Misha Chellam, Chief Operating Officer of Scanadu, an mHealth device company, explains that while his company is working on finding appropriate measures, "people are ignoring it because it is hard".

Patricia Mechael, executive director of the mHealth Alliance, a multi-stakeholder group seeking to advance mHealth, sees this as one of the biggest barriers in the field. The mHealth Alliance is working with its partners, including the World Health Organisation (WHO) and Johns Hopkins University in Baltimore, Maryland, on the Global mHealth Initiative, to identify and promote the types of mHealth programmes that are, in fact, effective.

There may well be surprises. To date, studies tend to show that remote monitoring can lead to substantial declines in the use of other healthcare assets. The US Veterans Administration, for example, found that overall the practice cut hospitalisation by 30% and admissions for heart failure by 40%, more than paying for the programme. In contrast, a recent major study of telemedicine in the UK found that such services did little or nothing to reduce hospitalisation rates.

But these issues are not confined to health self-management apps. Such products may show some of mHealth's difficulties most clearly, but others suffer similar weaknesses: 61% of patients surveyed by the EIU discontinued using mHealth services that allow better communication with healthcare professionals within the first six months, while 70% stopped using the devices that automatically send data to health providers.

Clear efficacy data could speed mHealth's adoption, but their absence may matter less than one might expect. Jennifer Dixon, Director of the Nuffield Trust, notes that, as with the advent of computers, mHealth "is probably going to happen anyway; there is an inevitability about it, so people aren't looking carefully."

In itself, this may not be bad. She notes that even if banks did not do cost/benefit analyses when introducing online banking, this technology has allowed the restructuring of numerous processes that would have been impossible otherwise. Society may, then, simply expect such change in healthcare, and the issue will be how to use it most effectively. As Bakul Patel, a policy adviser at the US Food and Drug Administration (FDA), says, "Hype or not, it is becoming part of life."

Conclusion



There is good reason to be excited over mHealth. Mobile technology can enable much-needed, thoroughgoing change in healthcare systems worldwide and in turn bring significant social and economic benefits. The scope of the task ahead, though, should temper the current excitement.

The adoption of mHealth, if it is to be meaningful, must be part of a wider disruption of healthcare. But however ripe the sector is for change, the barriers remain substantial. Powerful stakeholders with contradictory incentives will either fail to underwrite change that benefits the system as a whole but not themselves, or use the complexities of systems to block innovation that might harm them.

Disruption is never easy, but is rarely impossible. Already mHealth is being adopted where the need is greatest and the barriers are lowest: among those who pay a large proportion of income for healthcare, among patients who are not getting effective care from existing structures and, most of all, in emerging markets.

To thrive in complex healthcare environments, companies active in mHealth should bear in mind the following guidelines:

- **Find applications and services that bring concrete value to identifiable stakeholders.** Someone needs to be willing to pay for change. This may be a single stakeholder or a combination of several, who come together under cost- and risk-sharing arrangements. The benefits of innovation must be clearly discernible to those who can potentially underwrite its development.
- **Think in global terms.** The main mHealth markets are already, and will continue to be, in the emerging economies. These countries will be sources of substantial innovation that can be transferred to developed markets.
- **Focus on solutions, not technology.** An overemphasis on what mobile devices can do will lead companies to miss chances to solve problems for which people are willing to pay. Businesses outside of healthcare may be the ones to spot those opportunities: many in healthcare have yet to understand the full potential of the new technology. New entrants, on the other hand, must develop a greater understanding of the industry, working with existing providers and payers and co-operating with other companies to build an mHealth ecosystem that supports the long-term use of the technology.
- **Identify possible partners to create a greater impact and find new value.** Any technology relies on an ecosystem of interconnected suppliers, creators and users. The mHealth ecosystem is only beginning to evolve, and profitable new relationships are there to be found. This evolution will also involve co-operation and co-creation between member organisations, including existing healthcare firms, new technology providers, payers, medical professionals and even patients. This will not only identify the best ways to use the new technology, but will also help to smooth its adoption.

Most of all, advocates of the technology, especially those who come from outside the health field, need to avoid the trap of seeing mHealth as something apart from healthcare. Its greatest value will be how it integrates with health systems and allows them to provide better care for patients. In some cases the promise of mHealth will prove illusory: personal contact between patient and provider will always have a place in medicine. In others cases, however, mHealth will revolutionise the way care is provided.

Ultimately, mHealth will probably become so commonplace as to fade from notice. According to Dr Benjamin, in several years “the bits of mHealth that work won’t be called ‘mHealth’: they will be called ‘health’, in the way that nobody talks about ‘electric health’ and no country has a ‘stethoscope society’.” mHealth will have reached its full potential when it becomes ordinary.

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