

The mHealth opportunity

Insights guide: the future for connected healthcare

m2m.vodafone.com

Vodafone
Power to you



Welcome

Welcome to the fourth Vodafone mHealth Solutions Insights Guide, part of our Health Debate publication series.

The Vodafone Health Debate series is part of our continuing commitment to thought leadership in healthcare. It brings together senior pharma, public and private health stakeholders to learn, share and debate on issues and new thinking brought forward by renowned thought leaders and industry experts.

The first in the series examined barriers presented by human behaviour: issues of culture change for healthcare organisations; doctors; and patients.

The second covered “politics and economics” – the need for governments to develop new policies and strategies for healthcare delivery to embrace the new world of flexible, mobile services centred around the patient that is rushing upon them; and the linked need to change funding systems so that doctors and healthcare providers can commission the new types of services – often involving less physical contact with a patient, for example – without losing revenue unfairly and with the right incentives to improve patient health and care.

The third chapter in the series build on the first two by expanding our examination of two major areas that connect human barriers with politics: privacy and security in mHealth systems; and regulation of mHealth systems and devices.

The previous publications in this series have provided an in-depth view of some of the key considerations in adopting mHealth services and technology. This guide extends the discussion in a different direction, by focussing on the numerous opportunities presented by mHealth. There are many different participants who play a role in the successful adoption of connected healthcare and this guide is intended to present a balanced view through the eyes of three of the key beneficiaries: healthcare providers, funders and, perhaps most importantly, patients.

**Jon Lee-Davey, mHealth
Vodafone M2M**



Contents

Section 1

- mHealth: a connected revolution 4
- mHealth opportunities for patients 6
- mHealth opportunities for healthcare providers..... 8
- mHealth opportunities for healthcare funders..... 9

Section 2

- Benefits for patients: a declaration of independence 10
- Case study: communications revolution for home dialysis..... 14

Section 3

- Benefits for healthcare providers and clinicians 16
- Preventative care: the clinician’s view 17
- Computer-Assisted Decision Support: the next level of patient monitoring..... 18
- Case study: three-way boost for vaccination management..... 20
- Case study: Blackpool builds seamless mobile access to patient systems..... 21
- Benefits for healthcare funders: relieving central funding pressure 22
- It saves cash, but needs investment. Who pays? 24
- The elusive business model 26
- Case study: communications revolution for home dialysis..... 30
- Conclusion: looking to the future 32
- Recommendations: six progress points 34
- References 35



Section 1

mHealth: a connected revolution

The “mHealth revolution” – a steady expansion in the use of mobile devices and mobile networks for health and social care (see “What is mHealth?”) – has been a hot topic for almost a decade now in the fields of technology and healthcare. More recently, however, the subject has entered the mainstream.

Digital care is not only healthy for a country's budget. It also improves quality and efficiency, by bringing information together, with satisfied patients in control over their treatment from home.

In part, this is due to a boom in mobile consumer devices. Every day, newspapers, magazines and websites review the latest health and fitness apps; and more and more mobile technologies that monitor health are coming onto the market both as consumer and specialist devices.

The cutting edge topic of “wearable computers” marks just one point on the front line of mobile health monitoring. Now, small monitors can be worn on the body, woven into clothing and connected wirelessly to a smartphone or other internet-enabled device.

But the field of mHealth is much broader than this. With the rise of the “Internet of Things”, we are entering a world of interconnected devices allowing automated “M2M” (machine to machine) communication with extensive applications for healthcare.

The advancement of such techniques, and the data being generated, means we are only just beginning to realise the potential of mobile or remote health monitoring driven by health service providers, for example: home units purchased or lent by the hospital or other healthcare provider, to help with managing a long-term condition.

In a world where the population is ageing, bringing with it a greater prevalence of chronic disease and individuals facing multiple healthcare issues, technological assistance to help more people manage their own conditions and stay out of the expensive hospital system, is no longer a luxury: it is essential.

M2M is revolutionising all sectors of the economy, from smart metering in the energy sector to distribution tracking and logistics in manufacturing: and in healthcare it is no less transformational. Linking together networks of remote healthcare devices and monitors using M2M technologies can boost operational efficiency of healthcare systems, freeing up resources and cutting costs by helping managers and clinicians track accurate, real-time data.

For patients, it also has the power to enhance care quality by extending its reach, making it more personal and bringing it into people's homes and communities.

With miniaturisation, the possibilities for remote networked devices are becoming ever wider. Google[x], the technology company's development lab, recently announced it was working on a “smart contact lens”, for example, which would be able to measure glucose levels in tear fluid¹. The lens would be made from two layers between which is embedded a glucose sensor, with a miniaturised wireless chip to send data to a smartphone or computer to help people with diabetes manage their condition. The company said it is also working on miniaturised LEDs embedded in the lens to alert users when blood sugar levels fluctuate. Whether or not this experiment ever comes to market, it shows the potential of small connected devices to monitor and help manage our health and wellbeing – a major emerging trend.

In a recent BBC radio discussion about wearable computers, the technology analyst Bill Thompson said one of their key aspects would be “forgettability”². Increasingly, we will be carrying computers and digital communications devices that will be so lightweight and unobtrusive that we will forget they are there.

This is a perfect way to keep a constant watch on health problems that are long term but might only flare up into a serious condition intermittently.

But the potential uses and implications of mHealth go far beyond managing long-term conditions into wider areas of treatment and care; wellness and prevention; clinical research; and help for healthcare providers and healthcare funders in targeting resources and ensuring healthcare systems are functioning in the most efficient and effective ways possible.

mHealth techniques can allow patients to access their health information when they are away from home; field workers to access records when they are on home visits or at emergency care sites; and mobile monitors to update records automatically.

And since mHealth is now hitting the mainstream, the opportunities it creates for improving health care and making health services more effective and more efficient are growing all the time. With greater efficiency will come better value for money and potential cash savings as well, a factor that remains central to all public policy thinking as the world emerges slowly from economic crisis.

Quoting figures published by the GSMA (see also Section 4 of this report), Neelie Kroes, European Commissioner for the Digital Agenda, wrote recently that, by 2017, annual savings across Europe made possible by mHealth could reach some €99 billion³. At the same time, the technologies would help place patients at the centre of a healthcare revolution, not the care providers, Kroes said, citing existing examples within the EU including that of Denmark.

“In Denmark, hospital staff can monitor chronic patients at a distance,” she said. “The hospital can check vital statistics like blood pressure, blood samples, body temperature, the heartbeat and sleep rhythms. So the hospital can deliver efficient and personalised care, emergency care and advice on topics such as diet and exercise without people having to leave their home.”

However, she hinted that there is more that governments and healthcare policymakers could be doing to encourage the development of mHealth – a theme we will return to in our conclusion.

“The Ministers responsible can do a lot more with this,” Kroes said. “Digital care is not only healthy for a country’s budget. It also improves quality and efficiency, by bringing information together, with satisfied patients in control over their treatment from home.”

It is clear that mHealth offers a wide range of opportunities for all stakeholders in the healthcare system, including the three key groups of patients, healthcare providers and healthcare funders.

This guide elaborates on the opportunities for better patient care and greater efficiency in healthcare systems arising from mHealth, from the viewpoint of these three key stakeholder groups. It details both the proven and the further potential benefits of a remote model of monitoring and managing care.

We examine each of the three stakeholder groups in turn, looking at the key mHealth opportunities for each in more detail and developing them with reference to recent research and interviews with leading analysts and practitioners.

In our conclusion, we look at possible future developments in the field and ask what more policymakers could be doing to fire up the mHealth revolution, realising as many as possible of the opportunities it creates, as quickly as possible.

What is mHealth?

mHealth can be defined as the application of mobile communications technologies to healthcare, including to transmit health monitoring and treatment data; and to optimise the efficiencies of health organisations’ internal processes.

This includes use of mobile communications technologies and networks alongside devices used within healthcare, some of which can be bought by consumers and some of which will be issued and managed by health care providers and clinicians. It also covers the use of these technologies internally by healthcare bodies, for example to help doctors access patient information for research, or to manage their time more effectively, or to help healthcare funders plan their investments over a region, by looking at a much greater breadth of data.

Together, these technologies form an M2M communications network with a range of elements, on all scales from global to community, namely:

- Medical devices
- Communication devices and services
- Dedicated communications networks, including managed connectivity
- Software platforms to manage service operations, such as devices in the field remotely
- Software platforms to manage devices in the field remotely, and keep the network secure
- Software applications for users, delivering information or insights to patients and engaging them
- Software applications for clinicians and researchers, including data collection and decision support
- Software applications for health service managers, improving workflow and efficiency

mHealth opportunities for patients

mHealth can involve patients in their own care, helping them to feel more than just passive recipients of treatment.

Boost independence

- Allow patients to leave hospital earlier and manage their own treatment at a time and place that is convenient for them, increasing independence and often speeding recovery. It can also allow family and friends to play a greater role in the care process, something desired by many patients and caregivers.
- Allow elderly citizens to live in their own homes as long as possible.
- Ease transitions between healthcare providers by making more data available to the new provider, offering the chance for greater continuity of care. Every patient hates the feeling that they are or may be “falling between the cracks in the system” – being forgotten or worse, ignored.

Improve adherence through monitoring

- Help to improve a patient's adherence to a treatment regime by monitoring treatment and issuing prompts, reminders and education about the benefits of adherence and the risks of discontinuance. Simple medication reminders can do a great deal to maintain a patient's quality of life and avoid potential adverse effects of interrupting or discontinuing treatment.
- Ease the use of complex treatment equipment such as dialysis devices by lessening the amount a patient needs to learn and remember about using the device. This can also increase confidence in therapy as a whole, and so may help patients stay on home treatment courses and avoid crises arising from improper or incomplete use of home equipment.



Increase engagement through participation

- Involve patients in their own care, helping them to feel more than just passive recipients of treatment. Patients are eager to participate in their own healthcare decisions, and want to know that providers respect their own preferences.
- Allow the development of personalised health programmes, again by making use of a larger amount of patient data gathered over time using mHealth devices.
- Transform the relationship between patients and their doctors, nurses and other clinicians. Well-designed mHealth solutions can increase the frequency and quality of communication between the two parties, revealing potential barriers to communication early on.

Enhance patient education

- Offer patients fast access to reliable health advice. Patients are eager for clear information from healthcare providers, delivered in a way that is easy for them to understand.
- Provide patients with useful information and support from others with similar conditions, by offering access to health-focused social networking sites and providing guidance on safe and beneficial participation.

Allow greater access to care records

- Offer patients a flexible means of accessing and controlling their own health information where it is available in the form of electronic health records, enabling them to access information about prescriptions, immunisations, treatment parameters and clinician visits.

Decrease burden on local caregivers

- Decrease the burden on local caregivers including family members and friends by automating many mundane and time-consuming tasks.

Offer better outcomes

- Through an accumulation of all the benefits listed above, mHealth can add up to better patient outcomes – the most important opportunity for all patients.

mHealth provide patients with useful information and support from others with similar conditions, by offering access to health-focused social networking sites and providing guidance on safe and beneficial participation.



mHealth opportunities for healthcare providers

Help clinicians ensure that patients understand their conditions to manage them in the best way possible, driving behavioural change, including dietary and lifestyle.

Expand preventative care

- Help clinicians ensure that patients understand their conditions to manage them in the best way possible, driving behavioural change, including dietary and lifestyle.
- Help clinicians manage chronic conditions in patients, improving patient adherence to their regimes both by reminding patients to take their medications or follow advice, and storing data about their adherence.

Assist in identifying trends, offering care overview

- Make it easier for doctors to analyse clinical and treatment indicators, using tracking and visualisation tools.
- Ensure clinicians spot emerging concerns with treatment and change prescriptions and regimes quicker than under previous systems.
- Generate useful data for clinic and hospital managers, who can use them to identify areas of inefficiency in their treatment systems and improve internal processes.
- Use accumulated data to analyse patient healthcare trends, helping doctors deploy limited resources for prevention and treatment effectively in their community.
- Boost clinical research, again by building up more extensive and cross-compatible data over time for different conditions, treatment methods and patient demographic groups.

Improve data accuracy

- Allow clinicians access to more complete information about the overall health of their patient, to make better decisions, prioritise resources and competing demands, and plan support to enhance care over time based on specific patient requirements.

- Help reduce medical reporting errors, wherever they occur within the system, compared with patient self-reporting.
- Dramatically reduce the bureaucratic burden on clinical staff, who might previously have had to enter treatment information manually into their health record systems.

Co-ordinate care between physicians

- Offer the potential for clinicians to exchange data more easily with other health care organisations who may have seen patients. By feeding health data directly into electronic health records, mHealth solutions can create a central, reliable source of data that will enable all doctors to see what has been happening with a patient's treatment. When a patient passed from one specialist to another, this could enable the clinicians to reference the same data more easily and make decisions jointly.

Enhance patient interactions

- Alert healthcare providers to particular events, offering the chance for a more targeted review and more detailed and meaningful conversation with the patient.
- Allow doctors to enhance patient visits, which are often brief, by improving the frequency, accuracy and visibility of data from the patient. A doctor can then spend more time explaining the course of treatment, rather than gathering information in the visit itself. This leaves more time to listen to patients' concerns and advise them on behavioural changes that may generate more positive outcomes.
- Make it easier for healthcare providers to treat, communicate with and monitor patients in rural, remote or otherwise difficult-to-reach areas.

mHealth opportunities for healthcare funders

Relieve funding pressure

- Relieve central funding pressure, enabling a more distributed model and hence potentially saving money by cutting spending on care in hospitals and clinics, which are expensive to build and run, by increasing care in the home or in less formal clinical settings such as the GP surgery or pharmacy.
- Reduce hospital admission and readmission rates by improving compliance with treatment regimes, again saving money on more expensive central treatment costs, because health issues can be detected earlier and treated locally or in the home.
- Save time and money by allowing service providers to proactively manage and maintain medical devices through remote connectivity.

Improve planning and outcomes

- Support long term planning for healthcare provision including prioritisation of resources, cost analysis, more responsive systems design and better targeted public information campaigns by allowing access to better data about citizens.
- Improve treatment in emergency situations, giving chances of better outcomes before a patient arrives in hospital.
- Reduce the cost burden by limiting the progression of chronic diseases and comorbidities.

mHealth can reduce hospital admission and readmission rates by improving compliance with treatment regimes, again saving money on more expensive central treatment costs.



Section 2

Benefits for patients: a declaration of independence

Ultimately, all health care systems should be designed for the people who need the care: the patients. When it comes to mHealth, the biggest driver for progress, innovation and development is patient independence.

Patients are eager to participate in their own healthcare decisions and want to know that providers respect their own preferences.

Most patients would strongly prefer to be treated or monitored either locally, at a place near to where they lived, or even better, in their own home, or wherever they happen to be at any particular time. In most healthcare systems, it is also no longer the case that patients are seen as passive recipients of expert care, with doctors and clinicians leading the way at all times. These days, patients are encouraged to take a more active role in their own healthcare, making their own voices heard, and relaying their own priorities and desired outcomes of treatment or management of their conditions.

Increased patient engagement in healthcare in the form of shared decision-making is one component of the patient-centred care model being increasingly adopted by health services worldwide. According to one study, the practice results in “increased knowledge, informed choice, participation in decision-making, decision self-efficacy, preference for collaborative decision making and reduced decisional conflict among disadvantaged patients”⁴.

In another study, the consultancy Deloitte segments patients into various groups with different major characteristics, including “online and onboard”⁵, which by last year represented almost one-in-five (17%) of US healthcare users. “Online and onboard” patients are frequent users of online resources to look for information about health problems and treatment options; are the highest users of electronic personal health records; and are the most interested in videoconferencing with doctors. More than half of them (56%) would like to use self-monitoring devices that could send information electronically to doctors, while 42% of them are interested in using health improvement tracking apps.

While 17% of users is still the minority, it is a growing proportion and represents the sharp end of a much larger social movement. In general, most patients are now becoming healthcare consumers, says Deloitte, with a discerning approach to treatment, and clinician relationships.

What do patients want?

Patient feedback suggests that healthcare users are driven by a variety of needs⁶. One of these is speed. For example, they are driven by fast access to reliable health advice.

Another is control. Patients are eager to participate in their own healthcare decisions, and want to know that providers respect their own preferences. They want adequate support for self-care, and hold attention to their physical and social needs as a high priority. That includes a need for independent treatment, preferably at home, or at a facility local to them. It also includes a desire for greater involvement of family and friends in the care process.

Both of these drivers have something in common: communication. Patients are eager for clear information from healthcare providers, delivered in a way that is easy for them to understand. They also value continuity of care and smooth transitions between healthcare providers. Every patient hates the feeling that they are or may be “falling between the cracks in the system” – being forgotten or worse, ignored.

It is in these same areas that mHealth can be a key enabler. Its core features include:

Remote monitoring

Using mHealth to monitor patients at home or wherever they happen to be going about their daily activities can be a huge source of convenience and comfort. It can free up patients from cumbersome data entry procedures and often makes their medical reporting more accurate, if only because it is more immediate, so there is no time to forget what has happened.

It can also be of use for older people or those with dementia, where falls or wandering can be problematic and where automated monitoring might be the only practical way of recording a health indicator.

These monitoring technologies can be either active – initiated by the user – or passive, monitoring health signs continually or sporadically in the background. Moreover, remote technology does not necessarily rely upon use of mobile devices, such as phones: it can entail the use of M2M technology (see opening section of this report) for secure and seamless data transmission from medical devices.

Monitoring devices can collect information from a variety of retail monitors or sensors such as glucose meters or blood pressure monitors, which can then be viewed by both patients and healthcare professionals through web-based portals, making it suitable for people suffering from a variety of conditions.

In some therapy areas, take-up of such techniques is rising fast because there are clear clinical benefits: approximately 22.5% of all patients with cardiac rhythm management implants are already enrolled in remote monitoring programmes, for example, according to research by Berg Insight⁷.

mHealth technologies can also monitor particular types of user for signs of a potential health crisis or emergency situation, making it easier and safer for them to go about their daily routine.

Passive solutions can include small sensors connected to a user that include accelerometers and gyroscopes. They can detect the user's location and movements, and alert caregivers automatically if the data moves outside a predefined range. Other systems have been developed to monitor a user's motion around the house without any wearable device at all, using motion sensors.

Patient adherence

Technologies that help to monitor a patient's adherence to a treatment regime including taking medicines at the prescribed times are often perceived as a clinician benefit, but most patients are also keen to remember when to take their medication. Simple medication reminders can do a great deal to maintain a patient's quality of life and avoid potential adverse effects of interrupting or discontinuing treatment.

Where reminders are also combined with education tailored to the individual's state of mind or treatment stage; and presented in clear visual formats linked to goals, as in a current trial with heart patients in Germany (see Case study: the personalisation revolution, section 4), the results could be even more powerful.

Some mHealth systems will also deliver scripted questions and prompts to users at treatment times. This immediate assistance can be useful to patients, especially if confused about complex treatment procedures, or unsure about how to evaluate potential symptoms.

mHealth is a two-way street. Not only can systems “push” or “pull” information to and from the patient at the behest of the healthcare provider, they can also offer patients a valuable means of accessing and controlling their own health information.

Personalised features such as these can create a variety of outcomes which can be of benefit not only to patients, but also to those around them. These include:

Patient independence

As we have already seen, one of the biggest benefits of mHealth for patients is greater independence. Through the kinds of remote monitoring and communications capabilities described above, visits to outpatient clinics can be minimised, for example. Patients using appropriately designed mHealth systems can manage their own treatment at a time and place convenient for them.

Greater interactivity

The relationship between patients and their doctors and other health care providers can be transformed by mHealth technologies. Properly crafted solutions can increase the frequency and quality of communication between the two parties, revealing important issues early on and allowing patients to feel engaged within their own healthcare. For example, collaborative goal-setting is often seen as a fundamental component of supporting successful patient self-management. Conversely, as clinicians become more adept at using the technology, communication with their patients will become not just more frequent, but also richer in detail, and more accurate.

Enhanced patient education

mHealth can deliver information to the patient exactly when they need it, enabling them to be better informed when talking to clinicians about their treatment plan and make more informed decisions about their own healthcare.

And it is not only about timing: as people respond far more strongly to content that is relevant to them, intelligent education can deliver content on pertinent action to take that is relevant to that individual patient at that specific time, tailored to their behaviour, their condition and even how they are feeling at that moment.

Greater access to health records

mHealth is a two-way street. Not only can systems “push” or “pull” information to and from the patient at the behest of the healthcare provider, they can also offer patients a valuable means of accessing and controlling their own health information. mHealth applications can deliver patient information in the form of electronic health records, enabling them to access information about prescriptions, immunisations, treatment parameters and clinician visits. Health-focused social networking sites are also a form of mHealth, providing patients with useful information and support from others with similar conditions.

Decreased burden on local caregivers (such as family and friends)

Caregivers are important beneficiaries of measures that improve a patient’s wellbeing, but they are often overlooked. In many cases, carers are friends and family members with busy lives and commitments of their own. They can be overstretched and under-resourced while attempting to care for patients at home.

mHealth solutions can reduce the strain on caregivers, automating mundane and time-consuming tasks, while enabling clinicians to spot problems that may otherwise develop into serious conditions that would adversely affect both patient and carer. The strain on caregivers is well recognised, with research from a wide range of US sources repeatedly showing that caregiving can have serious mental and physical health consequences, including symptoms of depression reported in up to 70% of family caregivers⁸. Alleviation of this pressure therefore results in much wider benefits to the healthcare system.

Better health outcomes

In the longer term, all the benefits listed above add up to better patient health outcomes. The ability for patients to live at home with loved ones and enjoy their daily routine; reduced hospital readmissions; and greater patient independence generally mean healthier and happier patients.

Case study: communications revolution for home dialysis

Without treatment, kidney failure is life threatening. Patients have two options: a kidney transplant or dialysis. Dialysis performs the function of the kidney by artificially filtering the blood. There are two clinically effective forms of dialysis treatment: haemodialysis (HD) and peritoneal dialysis (PD). PD patients perform dialysis at home to their own schedule. Currently the default treatment for new patients is centre based haemodialysis. Home treatment including PD however, offers many benefits, not least removing the need for the patient to organise their lives around repeated and sometimes exhausting journeys to a hospital that may be many miles from their home. The home based dialysis patient is able to maintain a more normal and active life routine with continuous access to family and friends, availability for work, travel and other leisure pursuits, all of which have a beneficial impact on personal wellbeing.

Maintaining people at home on dialysis can be challenging for healthcare professionals and isolating for patients. Baxter Healthcare recently joined forces with Vodafone on an mHealth trial to tackle this issue.

Claire Main, Renal Clinical Education Manager at Baxter, says “We thought that there may have been issues due to lack of confidence: patients running into difficulties in their treatment, and not really knowing how to troubleshoot them.

“It’s a demanding time for patients when they first start treatment; coping with a new diagnosis and having to learn a home therapy.”

Patients on Peritoneal Dialysis (PD) are usually trained to fill in paper records to record their daily dialysis treatment. This includes details about their dialysis, blood pressure, and weight. They must also look for signs of infection and changes in their wellbeing.

“If patients aren’t confident, or don’t fully understand their treatment, then some of the early warning signs of problems can be missed. By the time they are reviewed in clinic, they can have serious problems which may require hospitalisation.

“It’s therefore clear that preventative measures could benefit not only the patient, but could also reduce expensive hospital admissions.”

Baxter believed that increasing support for patients in the early days may help them to stay on the therapy, and decided to construct an mHealth solution to test this out. The programme also aimed to increase the level of support that patients received from their specialist hospital staff. Most patients are seen routinely every couple of months and would only report a problem in-between hospital visits if there is a significant issue. By giving the staff access to the patients’ treatment details on a daily basis, they could pick up early warning signs before they grow into bigger problems.

Patients in the mHealth trial have been using an electronic system that enables them to enter their dialysis data on a mobile device or PC. The healthcare professionals are then able to access this data via a web-based application.

A health care professional sets the patient up on the system, registering them with a PIN code, after which patients can use their own mobile phone or PC to access it. Patients use a combination of checkboxes and drop-down menus to enter their dialysis information, which is then sent to the web based application. Hospital clinicians are then able to access their own patients’ data via a secure web site.

Help clinicians ensure that patients understand their conditions to manage them in the best way possible, driving behavioural change, including dietary and lifestyle.



The data can be used in many ways. Primarily, it can prompt clinicians to review the patient's prescription. The clinician can also review the data for a group of patients and look at trends over a period of time. Recording data electronically also overcomes the issue of hand-written data being difficult to read and ensures that it's always accessible. Paper records are often not brought to clinic or not completed fully.

When the patient does attend the clinic, visits are more productive, because clinicians can review the patients clinical records before they arrive and focus on resolving issues rather than discovering them.

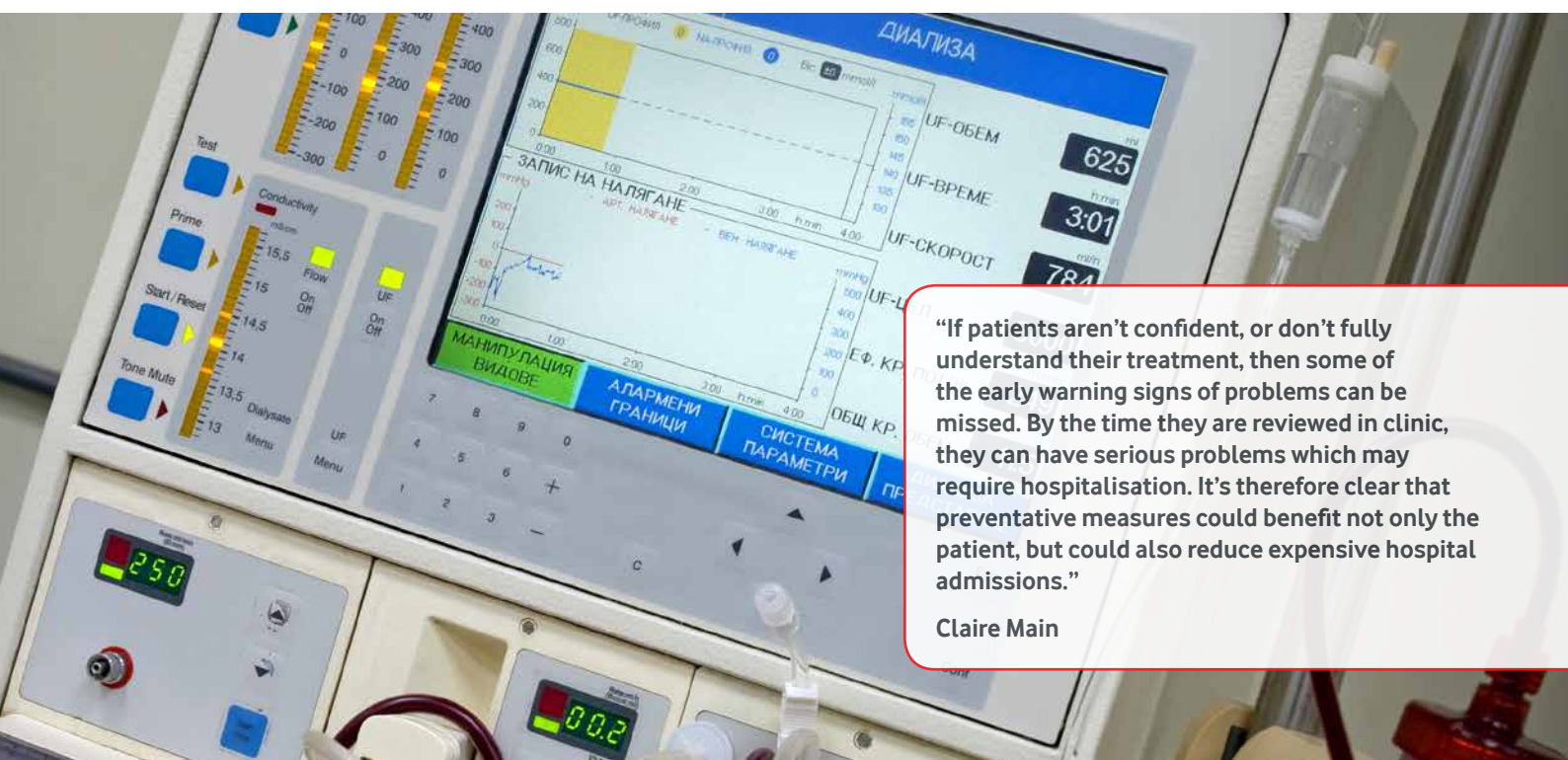
The mHealth system also collects more holistic information such as wellbeing and early signs of infection, and can offer friendly prompts to help troubleshoot common questions.

"It just enhances the training and education that patients are given, and provides an additional level of confidence knowing that someone is watching over them," says Claire.

The pilot project has now completed a 30-day trial, which was well received. All of the patients in the pilot felt that the mHealth system was more convenient than their paper records and gave more clinical monitoring of their condition. They all said that they would be happy to replace their paper records with the system.

The mHealth project is the first step to developing Baxter's strategy to offer innovative services to all patients.

*UK/MG2/14-0019a Date of Preparation
January 2015*



"If patients aren't confident, or don't fully understand their treatment, then some of the early warning signs of problems can be missed. By the time they are reviewed in clinic, they can have serious problems which may require hospitalisation. It's therefore clear that preventative measures could benefit not only the patient, but could also reduce expensive hospital admissions."

Claire Main

Section 3

Benefits for healthcare providers and clinicians

Patient empowerment and convenience are key drivers for mHealth projects, and clinicians share those goals. But clinicians also experience additional pressures that extend beyond treating patients professionally and successfully to issues such as management of their own time and resources; clinical research; and professional development. How can the use of communications networks and mobile devices help them to achieve all of these goals?

Figures suggest that clinicians will value mHealth first and foremost for its ability to drive behavioural change in patients. But beyond that, more than half of all physicians point to another key challenge: patients simply do not understand their conditions well enough to manage them in the best way possible.

The mobile premium for doctors

One thing is clear: doctors believe that mHealth can help them with all aspects of their work. In fact, in a survey of all the main stakeholders in the healthcare system, the GSM Association has found healthcare providers are the biggest believers in the benefits of mHealth⁹. Some 94% of them see benefits in the technology, compared with a still-respectable 67% of patients.

Clinicians are also clear on the challenges that they face when managing chronic conditions in patients, and among the most prevalent issues are those connected with patient adherence. The same survey found that 74% of clinicians said their patients face problems following dietary and lifestyle changes, while 71% often forget to take their medication. Longer-term motivation of patients is a separate but connected issue. Almost two-thirds of healthcare providers (64%) say that patients struggle to achieve their disease goals.

These figures suggest that clinicians value mHealth highly for its ability to drive behavioural change in patients, helping to support a patient's ability to take on new, healthier behaviours and providing ways to steer that individual to become more active in their own care and maintenance.

The mechanisms at work here underpin several key methodologies that are widely proven and valued, such as the transtheoretical model of behaviour change.

More than half of all physicians point out that patients simply do not understand their conditions well enough to manage them in the best way possible.

Clinicians may get an initial, short briefing time to try and explain a patient's situation, but beyond that, face-to-face consultation time is generally extremely limited. One report by the Robert Wood Johnson Foundation linked a lack of patient education to high readmission rates. In what to many patients is an alien and hostile environment, "Fifteen minutes of care instruction and pamphlets about their illness were not enough", the report found¹⁰.

If a patient does not understand an initial message or messages about their condition or its treatment, then repeated messaging, along with patient abilities to retrieve information about their condition, can be invaluable in helping to educate them. This, in turn, can contribute to that overall goal of driving behavioural change in the patient, which is so valued by the clinician.

Preventative care: the clinician's view

Relieve funding pressure

As we have already seen in the previous section of this report, mHealth systems have the ability to enhance patient education and there is a strong link between patient education and preventative care. For example, one study from the 1990s – in the days before mHealth – found that the dissemination of smoking cessation and nutritional advice to prenatal patients reduced the number of preterm births from 6.9% to 1.7%¹¹. Patients diagnosed with minor illnesses who were given self-help materials reduced physician costs by \$36 each. The systematic distribution of targeted educational material to patients can be made far cheaper and easy through the use of mHealth solutions, bringing benefits such as these within the reach of every doctor's practice.

Patient failure to adhere to their treatment regimes risks harming clinicians by increasing unnecessary workload; reducing the effectiveness of their care programmes; and damaging their professional reputations.

Perhaps this is why a recent survey by electronic health records software vendor eClinicalWorks revealed that the use of alerts and reminders for medication adherence topped doctors' wish-lists for mHealth, with 65% citing them as desirable. Just fewer than half (48%) also called for weight management applications. And 52% of clinicians saw potential for mHealth to enhance preventative care¹². These areas overlap: effective weight management can help to reduce the likelihood of chronic disease, making it in many cases a preventative measure that can dramatically reduce healthcare costs.

Applications reminding patients to take their meds or engage in key procedures are an invaluable part of the mHealth landscape. They can target different demographics in their homes and wherever else they happen to be, by using different channels. Mobile video and social media can be particularly attractive to younger patients, for example, as can "gamification": the use of computer game techniques for serious purposes.

For example Jennifer Dyer, a doctor who works with young people who have diabetes, has developed Endogoal [www.endogoal.com], a smartphone app that delivers text messages reminding teenagers to follow their treatment programmes for diabetes. The app includes a virtual pet, a dog named Cooper, who is fed a virtual bone when patients complete their glucose reading, and other game-like rewards. Endogoal also includes educational videos to help remind patients about key procedures.

The serious study of gamification

Academic study of the use of computer gaming techniques in health and social care is in its infancy, but early studies show encouraging signs.

Research by two Birmingham academics published in 2013 in the European Alliance for Innovation journal, *Endorsed Transactions on Serious Games*¹³, found that "creating a process that allows both the young person and the doctor to monitor progress and create incentives for maintaining self-care in a fun way would be advantageous. This could be achieved by implementing the principles of gamification."

Meanwhile a further study by Australian and UK academics with Microsoft Research¹⁴ analysed the use of social media and social network sites for sexual health communication targeting young people. The findings here are relevant to the field of "gamification" as they found that humorous interactive content was the most effective in encouraging young people to share health messages.

"It has been suggested by a number of media scholars that the interactivity of digital media has the potential to stimulate attitudinal change among young people, foster their input and thoughts on the matter at hand, generate action and capture their attention," the study found.

"Sexual health communication that contains humorous content seems to have a higher potential to lead to peer-to-peer discussions, learning, and sharing... The peer-to-peer sharing is important, because studies have indicated that learning information from peers is often more effective than learning from adults."

Computer-Assisted Decision Support: the next level of patient monitoring

Clinicians can move more quickly to spot emerging patient problems in real time, taking an active or pre-emptive approach rather than a reactive one.

Real-time and automated patient monitoring, with data sent to doctors and other health and care professionals, are useful methods for notifying if there is a need for intervention or obviating the need to travel for a face-to-face visit. This results in cost savings and allows for more accurate data to be captured, building up a more comprehensive picture on a patient's needs, in support of decision making.

Where patients have to fill out paperwork to report on their health, the information may not be transferred to the doctor quickly or accurately, particularly if it has to be submitted during a clinical visit or to a visiting nurse. The use of mHealth technology enables reported data to be sent to the physician immediately, so that it can be built into a more frequent analysis of patient healthcare trends. Clinicians can move more quickly to spot emerging patient problems in real time, taking an active or pre-emptive approach rather than a reactive one. Trends could also be highlighted to patients to allow them to take action.

In addition, research published in the Journal of the American Medical Informatics Association shows that Computer-Assisted Decision Support can improve a number of aspects of practitioner performance, including diagnosis, disease management and drug dosing or prescribing, for example in antibiotic prescribing behaviour in primary care¹⁵.

The accumulation of data over time is also set to be a huge boon for both clinicians and clinical researchers. Doctors and nurses working to chart the course of treatment systems as they develop and their effectiveness will gather more and more extensive and cross-compatible data as mHealth develops and more and more data (properly anonymised for privacy) is recorded for different conditions, treatment methods and patient demographic groups.

The collection of data in a standardised electronic format means it can be fed into analytics systems that make it easier for doctors to understand individual cases, and both clinicians and researchers to understand group patterns across an entire cohort or area population. A clearly-presented graph showing trends in vital signs will always be easier to read and understand than reams of handwritten numbers.

The use of mobile technology to collect data in clinical research generates efficiency in a number of ways: firstly, less time and resource is required to transcribe paper records once they have been submitted; secondly, having real-time access at defined points allows decisions on the future course of the trial before having to wait for trial completion. Clinical trials take place across multiple countries, so finding partners that can provide global mobile solutions is often a key consideration.

Improving data accuracy

In many cases, patients being managed at home may make errors in reporting on their own conditions due to a lack of training, low confidence in using equipment or simply by making mistakes. Writing complex diagnostic results from home healthcare machines such as dialysis units can be daunting for patients. Moreover, those results can be difficult and time consuming for doctors to read – if they are trained in how to read diagnostics from that particular machine in the first place.

Making the reporting process electronic can improve the accuracy of data collection. If using a mobile device, patients may find themselves able to enter their results more easily, quickly and with more confidence. Alternatively, medical devices can be enabled with mobile technology (which can either be embedded or enabled using a communication terminal) that allows for automated and secure transmission of data directly from the medical device. This creates a more complete set of statistics for the doctor, who can then produce a more robust analysis.

Better co-ordination between physicians

Another key benefit of mHealth systems is the potential for clinicians to exchange data more easily with other health care organisations who have seen or treated the same patients. By feeding health data directly into electronic health records, mHealth solutions can create a central, reliable source of data that will enable all doctors to see what has been happening with a patient's treatment. When a patient passes from one specialist to another, this could enable the clinicians to refer to the same data more easily and make decisions jointly, boosting continuity of care.

Enhanced patient interactions

Patients with ongoing conditions typically see doctors once every few weeks, or even months, depending on their treatment. When they do, consultations are often short, because doctors' workloads are generally intense. By enhancing the frequency, accuracy and visibility of data from the patient, mHealth provides a way for doctors to enhance these short interactions, making the best possible use out of even a short visit time.

In a properly-implemented mHealth system, much of the data gathering and compilation will already have been done by the time that the patient sits themselves down. A doctor will then simply need to call up easily-digestible charts of results, giving them more time to explain what they mean to patients.

This also leaves more time to listen to patients' concerns and advise them on behavioural changes that may generate more positive outcomes. Although both parties may sometimes express concerns that mHealth can displace the physician/doctor relationship, if implemented properly, the opposite is true: interactions can be richer, and more productive.

Above all, mHealth carries great promise for doctors because it lets them reach patients at the point of care, no matter where they are and at appropriate times. It facilitates automated, two-way communication, enabling physicians not only to inform patients, but also to gather valuable intelligence on their conditions. In a world where everyone seems attached to their phone, it will be a valuable ally in the battle for better outcomes.

Making the reporting process electronic can improve the accuracy of data collection. Medical devices can be enabled with mobile technology that allows for direct, automated and secure data transmission.

Case study: three-way boost for vaccination management



More than 85% of Mozambique's population is covered by GSM networks, one reason why the country was chosen for a pilot "mVacciNation" project, the use of a shared mobile application by vaccination programmes, healthcare workers and caregivers to increase access to immunisation among children under one year old.

The application is being rolled out in the country's Nampula Province by a partnership between Vodafone, pharmaceuticals company GSK and GAVI, a global Vaccination Alliance, with support from Save the Children and the Mozambique Ministry of Health. It aims to establish if mobile technology solutions could increase the proportion of children vaccinated by up to 10% by encouraging mothers to take up vaccination services, supporting health workers and enabling better management of vaccine stock.

In the developing world, the relatively high levels of mobile communications use and coverage, plus the urgent need for healthcare expansion, means mHealth projects can have a major impact.

The application works in three ways:

- Mothers and caregivers are registered on a Mozambique Ministry of Health database either by a mobile health worker or through a self-registration process using the mVacciNation application. Caregivers are then alerted by SMS to the importance of key and their availability, for example at vaccination events. Mothers are able to schedule vaccination appointments by SMS and receive notifications of past and future vaccinations to ensure children complete the full schedule and become fully immunised.
- Health workers are provided with smartphones with software allowing them to contact mothers, view and record vaccination histories, schedule vaccinations and report on follow-up visits.
- Healthcare facilities are prompted by SMS to report regularly on vaccination stock levels, temperature and stocking needs for critical vaccination programmes. This will improve supply chain management and ensure the availability of vaccines when and where they are needed, particularly in rural areas. Reports are aggregated at the district level in real-time and used to generate interactive maps to illustrate vaccination coverage and stock levels.

The pilot is being independently tested in randomised control trials to prove its impact, effectiveness and cost benefits. If successful, it will be replicated throughout the country and across Africa.

Case study: Blackpool builds seamless mobile access to patient systems



In 2010, Blackpool Teaching Hospitals NHS Foundation Trust implemented a patient administration system (PAS), designed to measure performance by documenting waiting times, and appointment attendance. Such systems can generate useful data for managers, who can use them to identify areas of inefficiency in the system and improve internal processes.

However, they have their disadvantages: the data entry burden for staff including doctors and other clinical staff can often be daunting and can eat into valuable face-to-face time with patients.

Initially, clinicians were completing paperwork and entering data at the end of each day, which was found to be taking an hour or more on average. That is the equivalent to one or two extra patient visits a day. Additionally, data entered at the end of the day might not be as accurate as data gathered in the field.

In 2012, the trust worked with Vodafone to use mHealth technology in conjunction with the patient administration system to dramatically reduce the bureaucratic burden on clinical staff, while increasing the level of service to customers.

Under the scheme, the Trust deployed devices that could be used in the field to gather data more quickly, making it easier for staff to document critical metrics throughout the day, and providing the patient administration system with the data it needed for management reports.

The trial originally placed smartphones with field workers, who were able to access email and monthly schedules online. However, the screens proved too small for the display of the specialist clinical data that would enable them to provide even more patient value at the point of care.

The implementation team switched to tablet devices with seven-inch screens, based on the Android operating system, which enabled them to access patient record data with a high level of security. Electronic assessment tools also became a possibility with these devices, as did the delivery of personalised treatment information for patients. Online web resources and clinical knowledge summaries also enabled field clinicians to make informed decisions at the point of care, and this in turn helped to reduce the need for hospital admissions or clinic visits.

Security was a prime consideration for the trust, because as the programme provided access to personal health information, sensitive data had to pass over the network. Vodafone was able to address those security issues, ensuring that patient health data could not be intercepted while being accessed online.

The implementation team had considered using laptops as mHealth devices in the past, but had found them lacking, because of the difficulty in connecting to networks. On a 15-minute patient visit¹⁰, minutes could be spent connecting to a network for access when using those devices, making them prohibitively time consuming. Tablet devices could be configured to connect more easily, accessing Vodafone's cellular network seamlessly.

Blackpool Teaching Hospitals NHS Foundation Trust manages community health services for 469,000 residents in the North of England, and is dealing with a disproportionately elderly population. The Trust is therefore dealing with a wide range of healthcare demands on its limited resources and is under strong pressure to innovate.

Benefits for healthcare funders: relieving central funding pressure

The use of mobile devices by patients and clinicians to access health services offers healthcare funders several opportunities to save precious resources by relieving pressure at the centre of the system, enabling a more distributed model.

In the European Union, it has been predicted that mHealth could save €99 billion in healthcare costs and add €93 billion to member states' GDP in 2017 if its adoption is encouraged.

Put at its simplest, benefits of mHealth include the rare chance to reduce spending on care in hospitals and clinics, which are expensive to build and run, by increasing care in the home or in less formal clinical settings such as the GP surgery or pharmacy.

Empowering patients to gather their own medical data, for example, offers people the ability to reduce their own hospital admission and readmission rates, because health issues can be detected earlier or better tracked. This benefits not only the patient but also the funder who must build, manage and support expensive hospitals and clinics. Other remote patient contacts such as reminders to take medication can increase treatment compliance levels, helping to avoid complications and again reducing the cost of treatment.

Mobile technology can also allow healthcare professionals to access and maintain medical devices remotely, and hence patient data, saving them valuable time and costs in the clinical workplace and boosting productivity. Remote access to the devices also provides an opportunity for service providers to take a proactive stance in remote management of the devices, allowing for provision of more efficient operations, for example through predictive maintenance.

Overall, the potential cost savings from major expansion of mHealth techniques over the next few years are substantial. In the European Union, it has been predicted that mHealth could save €99 billion in healthcare costs and add €93 billion to member states' GDP in 2017 if its adoption is encouraged¹⁶.

Worldwide, the mobile healthcare market is predicted to reach \$58.8 billion by 2020 by reducing the burden on healthcare in nursing homes, hospitals and GP surgeries, according to Allied Market Research¹⁷.

Clearly, these figures are impressive, but the question then arises – exactly who funds which mHealth technologies, so their full potential can be realised? Funding of mHealth initiatives is a complex issue, since most mHealth programmes involve a wide range of stakeholders and hence a range of possible funding sources. To add further complexity, funding in one part of a system might result in savings in another part, so ensuring the right incentives are in place for funders to make the required investments must become a key goal for health policymakers. To put it another way, it will be essential to ensure that everyone who puts money in should receive a share of the savings or benefits that result.

International variation

Healthcare conditions and funding incentives vary widely from country to country. Factors may include:

- a broad national healthcare model;
- regulatory conditions;
- availability of funding;
- patient life expectancy and demographics;
- proportion of rural to urban communities;
- prevalence of disease; and
- availability of mobile hardware and connectivity infrastructure.

One example of the variation of funding issues across national contexts is offered by a PwC survey with Economist Intelligence Unit¹⁸ which found that, in India, the three most important perceived benefits of mHealth programmes are cost reduction (cited by 58% of respondents); convenience (55%); and ability to access information (40%). Both funders and doctors in India also considered cost the greatest motivation.

Results of the same survey conducted among UK respondents offer a stark difference, however. Here, respondents cited convenience as the most important factor (49%), followed by the ability for patients to take greater control over their own health (43%); and then cost reduction (25%). Funders in the UK were twice as likely to say that encouragement by regulators (34%) was a stronger motivating force than better outcomes (17%).

Clearly, these kinds of factors are important to some extent, but for policymakers, it will be vital to frame their mHealth strategies within each national or regional context.

It saves cash, but needs investment. Who pays?

Although there is a clear rationale for funding mHealth, the money still needs to be found for initial investment. So who pays?

“Funding usually comes from a variety of sources,” says Dr Dominic King, Clinical Lecturer in Surgery at Imperial College London and co-founder of mHealth company Digital Stitch. “In the UK, funding is available from academic bodies and charities such as the National Institute for Health Research and Wellcome Trust, alongside government support for start ups for example the Technology Strategy Board. Money is also available from angel investors, venture capital and accelerators.”

King has recently helped to develop “MyGP”, a mobile app launched by specialist developers Digital Stitch, which allows patients of one West London medical centre to store health information, monitor chronic disease data and book appointments and repeat prescription services.

“Most hospitals and GPs want to pay for things where there are obvious cost benefits but that’s the story of medicine where prevention is usually discounted in preference for treatment,” says King. “It’s up to developers to show the benefit.” Strong growth in the sector shows there is clearly a great deal of appetite for investment: a recent survey of digital health companies by US-based digital health accelerator Rock Health found that funding in the sector for the first half of 2014 had already exceeded total funding level for the entire previous year, at some \$2.3 billion¹⁹.

Some reports have cited a risk aversion from potential funders because of a lack of previous examples and proven business models. Some common perceived barriers, and ideas for addressing them, include:

“It takes up too much time”

Any new device takes time to understand in the initial phase. As patients become accustomed to new devices and ways of treating and caring for a condition, they may require healthcare professionals to help first-time users of some devices. However in most cases, the device is designed to be user-friendly and to require minimal input from a GP, pharmacist or clinician. This point highlights the importance of considering the existing care pathway or protocol in which the new device or service is intended to be implemented.

Risk aversion

With relatively few examples up and running, at mass scale some funders may not yet be convinced of the benefits or the business case or be willing to take a perceived risk. According to the PwC/Economist report cited earlier, some 64% of doctors and funders said there were “too few proven business models” in mHealth. The answer to this will include education about the indirect benefits emerging further down the value chain of mHealth.

There may also need to be adjustment of funding and reimbursement mechanisms for healthcare projects, to take account of the restructured value chains made possible by mHealth. This issue has been explored in the previous Vodafone mHealth Insights Guide “Evaluating mHealth Adoption Barriers: Politics and Economics”²⁰.

Under the heading “Funding incentives and disincentives”, PwC/Economist report found: “One prevailing global trend in healthcare over the past few years has been the decentralisation of purchasing organisations, as countries move away from a national single payer/purchaser model. However, this has led to some problems in sustaining a coherent value chain in healthcare, that in turn has a knock-on effect for mHealth projects. In some countries, hospitals face a ‘double whammy’ when implementing telemedicine. Not only can they experience challenges in getting reimbursement for their investment in mHealth, but they can also lose revenues through its implementation, for example through reduced emergency department visits and admissions.

“To fix this problem, some policymakers are now advocating the idea of basing healthcare remuneration in general on outcomes, rather than on a per-patient or a service-fee basis. Reimbursement based on an outcome such as the minimal mortality or readmission rate for the minimal expenditure could also open the door for reimbursements regardless of whether a patient is seen on-site or off-site... For all new incentive ideas to work, however, mHealth projects require a more joined-up approach than healthcare advocates may be used to.”

See also the further section of this report, below – “Sharing the value”.

Perception of who benefits

Some of the mHealth limelight has been taken by programmes that focus on the collection of health information by frontline health workers, government organisations or pharmaceutical companies that do not necessarily directly benefit consumers. However many mHealth programmes focus on self monitoring by patients with treatable conditions of their own vital signs which prevents more serious illness by keeping symptoms in check – or self monitoring where patients are at risk of an illness. Again, education about these broader benefits is the key.

Some policymakers are now advocating the idea of basing healthcare remuneration in general on outcomes, rather than on a per-patient or a service-fee basis. Reimbursement based on an outcome such as the minimal mortality or readmission rate for the minimal expenditure could also open the door for reimbursements regardless of whether a patient is seen on-site or off-site... For all new incentive ideas to work, however, mHealth projects require a more joined-up approach than healthcare advocates may be used to.

The elusive business model

According to one study by Deloitte²¹, successfully monetising mHealth has been a challenge for the healthcare industry and “scant evidence” is available on workable business funding models.

mHealth techniques can add new value to an existing and otherwise potentially outdated product, for example combining existing or longstanding pharmaceutical treatments with reminder apps, as an alternative to funding more expensive new treatments.

A lack of reimbursement mechanism for patients has been cited as a potential barrier to adoption of mHealth initiatives.

The GSMA report on socio-economic impacts of mHealth cited earlier finds there can be conflicting financial incentives for healthcare providers: “Across a few healthcare systems in the EU, healthcare providers are allocated budgets according to the number of patients treated in hospitals. Such financial incentives are in direct conflict with the overall goal of mHealth or other similar technologies that could keep patients away from hospitals,” it says.

Sometimes, savings accrue in unexpected places. For example, mHealth techniques can add new value to an existing and otherwise potentially outdated product, for example combining existing or longstanding pharmaceutical treatments with reminder apps, as an alternative to funding more expensive new treatments. This can work to the benefit of the pharmaceutical company too, by extending a product’s lifespan, as well as ensuring that the medication is being used as intended for maximum benefit.

Patient information can be made more efficient, again saving time and money and improving outcomes as well. A patient who has had a heart attack, for example, instead of being discharged from hospital with an armful of paperwork based on report materials they might receive information in manageable chunks through a smartphone app, along with reminders to take drugs, attend appointments or exercise regularly. Family members may be happy because (with permission) they can access a portal to view the patient’s health information and so no longer need to nag an elderly relative to continue treatment.

Patients picking up the bill?

Another possible business model includes the patient absorbing some or all of the cost.

But the PwC/Economist survey found patients are still largely unwilling to buy services apart from personal health apps. 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 apps, around a quarter pay more than US\$5 per application and of those who do not currently use them, only about 15% would be willing to pay that much. Income has little impact on spend, the report found.

Sharing the value

Ultimately, there is no single proven model for funding mHealth programmes, not least because of the variation in healthcare provision models around the world.

While many early projects will tend to have one direct source of funding from a particular institution or government body to launch them as early adopters, costs are likely in future to be absorbed more broadly as the benefits and savings become clearer. More sophisticated strategies will be designed to share savings between stakeholders, creating incentives across the system.

To ensure this happens however, a shift in thinking is required. The indirect benefits of early detection, including fewer hospital admissions and increased healthcare professional productivity, must be considered when funders weigh up the value of a potential investment.

One model that applies this new mindset is the Accountable Care Organisation (ACO), a term for a group of independent care bodies that come together to improve the quality of patient outcomes over a population and that is rewarded for hitting outcome targets, rather than being paid per treatment or per device used.

The ACO concept was formed in the US. Various types have been identified by a recent King's Fund paper²², including integrated delivery systems such as the well-known US care group Kaiser Permanente. These combine hospital and primary care within a single payment mechanism based on outcomes. Other types put the emphasis on groups of front-line physicians or clinics, working together.

Under all these models, the focus is on improving patient outcomes by any means including mHealth services, rather than reimbursement for specific treatments or devices. Similar approaches are now being tried in the UK, where the Health and Social Care Act 2012 created "clinical commissioning groups" of GP practices working together and integrated care between the NHS, GP practices and local authority-funded social care services to improve outcomes.

However the King's Fund report warns that integrated funding and service management practices must be developed for such approaches to work.

"Much hinges on ensuring that ACOs and their counterparts in the NHS have the capability to manage budgets and services and to establish productive partnerships between networks of providers," the report finds. "Much also depends on creating the right incentives and objectives to stimulate ACOs to deliver the desired improvements in performance. There are no 'off-the-shelf' solutions available from the United States and commitment to testing and learning will be important."

A lack of large-scale research to date on the correlation between mHealth and cost savings in various parts of the health care system has also been a challenge for investors in deciding where the early money should go.

"The mHealth field has been plagued by small pilot-type studies and even the larger studies have focused on one specific device or older versions of technology such as texting," says Cinnamon Bloss, Associate Professor & Director of Social Sciences and Bioethics at Scripps Translational Science Institute (STSI) in California.

But a better understanding of how to develop effective mHealth funding models could emerge later this year when the results of study Bloss is leading are released. The research examines the relationship between medical costs and use of mobile medical devices, with the support of non-profit healthcare system Scripps Health, third party administrators Healthcomp and IT firm Accenture.

The trial includes nearly 200 employees and dependents of The Scripps Research Institute, STSI's parent company, half of whom suffer from at least one of either diabetes, heart arrhythmia or hypertension.

"In the research realm, a targeted sample size of 200 people is not huge but it is larger than you typically see in this field," says Bloss.

Participants are provided with a smartphone to which a glucometer, ECG device or blood pressure monitor can be attached to monitor their own symptoms. Each disease calls for a different protocol – those with arrhythmia use the ECG device only when they experience symptoms, while those with hypertension measure blood pressure regularly.

Participants can log in privately to check their data and access related health information through the HealthyCircles online care team co-ordination portal.

"They take a reading using their device and phone wherever they happen to be," says Bloss. "The aim of the study is about decreasing contact with the healthcare system and helping people to be more self-reliant. Secondary is patient compliance – a big problem. We hope, by giving people these tools, we raise awareness about their conditions and help them to be more compliant with any prescribed medications, doing exercise and so on".

She agrees that there is currently a patchwork approach to funding of mHealth projects. How does she envisage the funding landscape in future?

While the promise of mHealth can often create a surge of optimism in the early stages of a programme, especially in the remote monitoring sphere, publication of results from more large-scale trials is still needed to clinch all the investment arguments, Bloss says.

"I think for these technologies to be widespread, there's going to have to be evidence of cost effectiveness. For things to change, we're going to have to show the return on investment."

In the end, the best approach for funders will be to consider the health care system as a whole, says Jon Lee-Davey, mHealth lead at Vodafone M2M.

"No-one will fund mHealth if one part of the chain is broken, for example if the family doctor is taken out of the equation," he says. "The key is to integrate mHealth into a patient's treatment pathway. It's about not only replicating the normal healthcare path with mHealth, but enhancing it.

"This involves using additional digital means – whether that's through apps, self-monitoring or other means – for enhancing levels of interaction with healthcare professionals".

Lee-Davey describes the current picture of funding globally as complex but believes the momentous pressures on the healthcare environment will drive change, namely "an ageing population and spiralling healthcare costs that will force people to look innovatively at how healthcare is delivered".



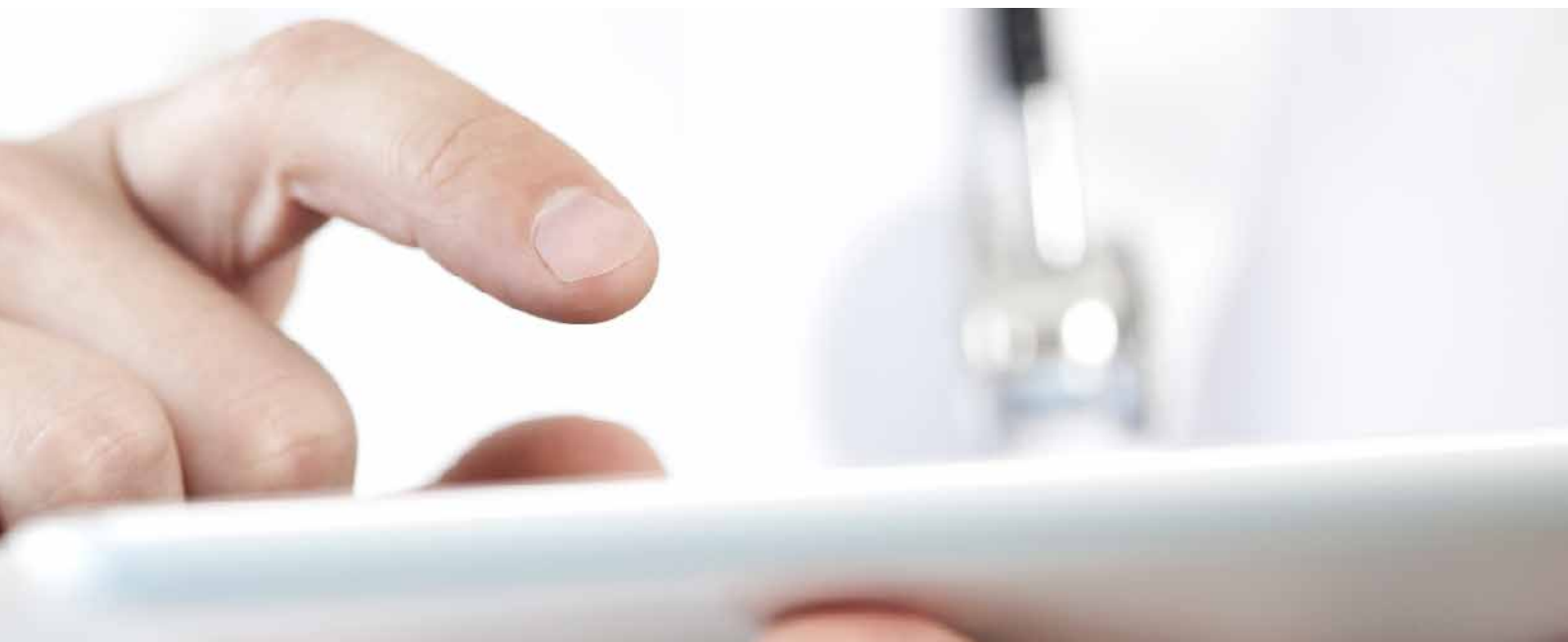
The stakeholder map

Significant collaboration among stakeholders is required to make sure mHealth programmes are delivered successfully, sharing costs, risks and benefits. Policy makers, regulators and funders are all well placed to motivate and involve all the other parties involved with policies, frameworks and initiatives. They need to work together to create incentives that reward healthcare providers for gains achieved through mHealth.

They also need to work together to benefit from each other's experience and respective areas of expertise. No one stakeholder will be able to drive success; this will be achieved through partnerships amongst a range of participants.

Healthcare providers and policy makers may require further evidence of clinical and economic benefits that mHealth can provide to increase its adoption.

Service user	Healthcare professional	Clinical institution	Funder	Technology/ service provider	Regulators	New entrants
Patients	Primary, secondary, tertiary physicians	Hospital	Government organisation	Medical device Pharmaceutical companies	Government policymakers	Entrepreneurs
Patient advocacy groups	Nurses	Clinic	Private healthcare/ insurance companies	Telecommunications provider e.g. mobile network operator	Health institution regulators	Consumer retailers
Informal caregivers	Care home staff	Pharmacy	Medical institutes	Software provider	Medical professional bodies	Consumer technology companies
		GP surgery	Charities/NGOs	Infrastructure provider		



Case study: the personalisation revolution

The trial is run and designed by AstraZeneca's Intelligent Pharmaceuticals group with technology and infrastructure partner Vodafone and leading clinical partners in Germany.

It is blending treatment management – such as reminders to take or restock medication – with lifestyle goal management, presenting simple charts and graphs to the patient on everything from stress levels to how much exercise they have taken. It also acts as a link between patient and healthcare professional through a web portal or by text; can send alerts back to a physician if needed; and includes a module for carers helping friends and family offer vital social support.

Crucially, the system is not just tailored initially but “dynamically individualised” over time, adapting the treatment programme continually to patients' conditions, state of mind and even technical ability depending on their responses to questions in the app or treatment progress.

All data is visualised back to the patient and linked to individual goals to emphasise progress and celebrate achievements, even for patients that are struggling in other areas – a crucial psychological tool to create and maintain new habits.

The potential of mHealth to revolutionise chronic disease management through treatment personalisation is the focus of “Me&MyHeart”, a German trial integrating traditional care methods with digital tools such as apps and sensors.

As an AstraZeneca background paper to the trial points out, not only do new heart patients often end up having to take six or more different medicines, they are also told they need to stop smoking, lose weight and do more exercise – all at once. And currently, much of this critical information is conveyed to them in hospital, when they may still be in shock; when they are back home and more relaxed, on the other hand, as in the new trial, they are much more likely to take it in. The knowledge that their physician and even friends and family can track their progress can also be a motivator.

A nine-month non-clinical pilot trial with about 400 patients is now underway, to be followed by further studies in 2015.

Magnus Jörntén-Karlsson, Intelligent Pharmaceuticals Project Director at AstraZeneca, says the system's power rests in combining individualised medical information with simple, colourful tools allowing a patient to visualise their path back to health.

“The problem with heart disease is that it is often seen by patients as a single event when it is generally a long-term, silent disease, only surfacing with events such as a heart attack,” he says.

“We offer an opportunity for the physician and patient to set parameters together – both long-term and short-term – and then measure and visualise them, so patients can see if they have really managed to do the exercise they set out to do for example, and if they are set to reach their long-term goals.

“Making progress visible and tangible to patients like this helps to motivate them and keep them engaged with the treatment.”



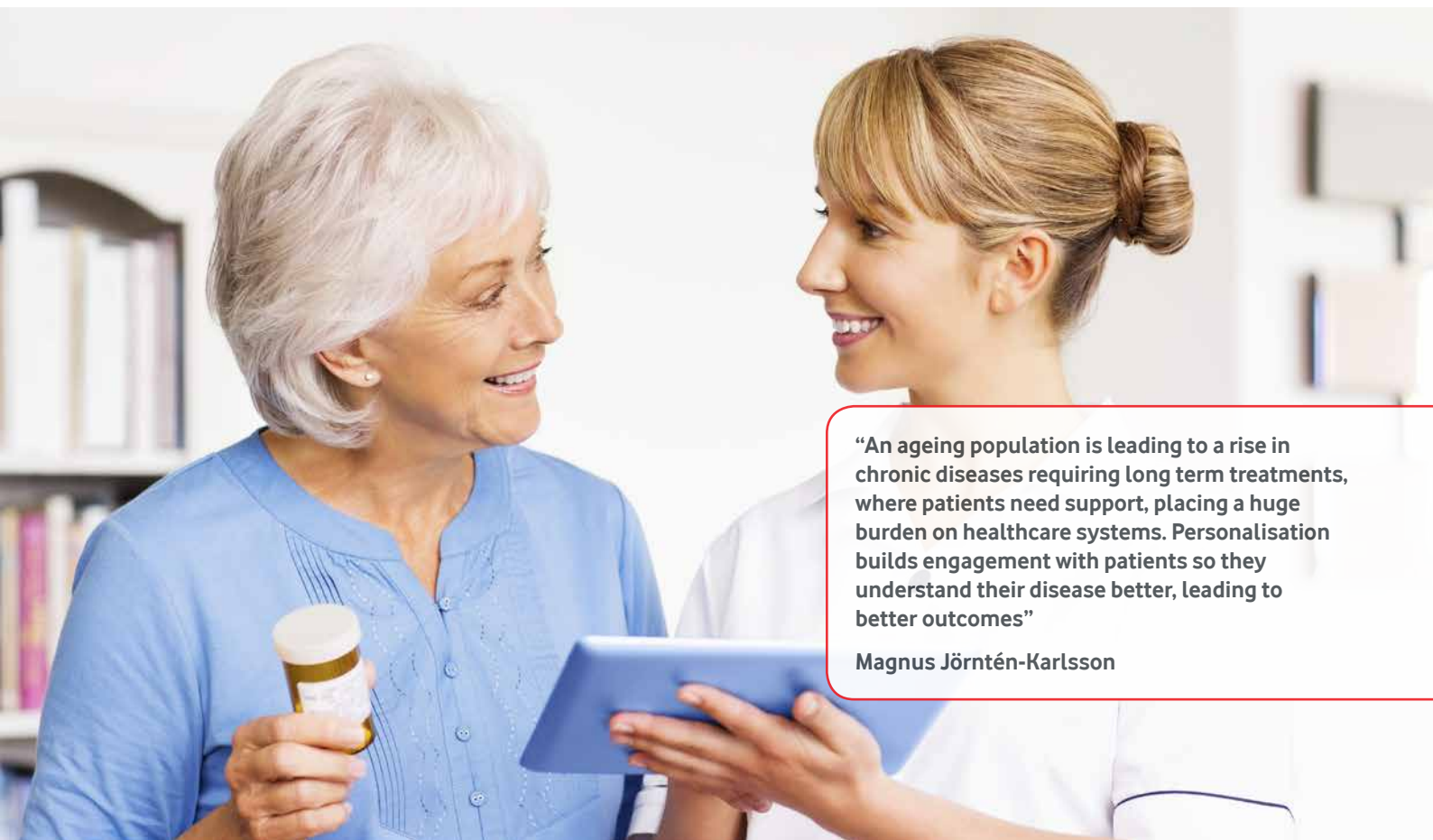
Evidence from the clinical study – focused on improvements in treatment adherence and hence both health and cost gains – will be used to roll out live services in Germany and worldwide, Jörntén-Karlsson says.

Better regime adherence leads to lower cost for the healthcare system through lower levels of hospital readmission, he says, and ultimately there could be a variety of business models developed for different disease applications.

These could range from health services paying for systems as a complement to traditional medication prescriptions, to insurance companies part-funding projects that could improve public health overall and hence reduce claims. In some cases, patients themselves might even choose to pay for additional digital services beyond what the public system can provide.

“An ageing population is leading to a rise in chronic diseases requiring long term treatments, where patients need support, placing a huge burden on healthcare systems,” Jörntén-Karlsson says.

“Personalisation builds engagement with patients so they understand their disease better, leading to better outcomes.”



“An ageing population is leading to a rise in chronic diseases requiring long term treatments, where patients need support, placing a huge burden on healthcare systems. Personalisation builds engagement with patients so they understand their disease better, leading to better outcomes”

Magnus Jörntén-Karlsson

Conclusion: looking to the future

mHealth is set to expand rapidly over the next decade, driven by and building on the successes seen in key therapy areas such as cardiac rhythm management.

Further impetus will be given by the expansion of M2M technologies and the rise of the Internet of Things. As the opportunities mHealth offers to patients, healthcare providers and funders are realised, business cases will strengthen, leading to ever more new projects in a self-reinforcing cycle.

They also need to work together to benefit from each other's experience and respective areas of expertise. No one stakeholder will be able to drive success; this will be achieved through partnerships between a range of participants.

New mobile technologies will continually enhance the potential and possible uses of mHealth, as they emerge.

Networked devices with health applications that are at the forefront of a surge in innovation include monitors of people's vital signs such as temperature and heartbeat, and common health conditions including stress, heart conditions, diabetes, skin conditions and more, from dentistry to psychiatry. With each advance, patients will gain more information on their own conditions, allowing better self-management; clinicians can monitor signs to intervene at the optimum time; and more care can be given in the home. All these trends will save costs by improving care outcomes.

Three further technology trends that are set to have an impact in this field are listed in a recent briefing on Telehealth and Telecare written for British MPs by the Parliamentary Office of Science and Technology²³.

These are:

- Smarter devices, with more interactivity to allow patients to manage long-term conditions better;
- Better sensors, becoming virtually imperceptible to the wearer; and
- Smarter interpretive systems, such as neural networks, to help raise alerts for abnormalities.

As technologies such as these evolve, developed societies will make increasing use of them to help care for the growing number of older people in their populations, says Charles Lowe, President of the Telemedicine and eHealth Section at the Royal Society of Medicine.

"There will be an increasing use of 'machine intelligence' for health stats monitoring," Lowe says. "Regular monitoring of people with long term conditions will be managed by machines and only in exceptional circumstances will people be involved.

"Clinicians will still provide care – the 'laying on of hands' – but diagnosis and treatment plans will be done far better by machines. That will relieve the huge pressure that there is on care staff at present."

Medical apps and other mHealth systems will enable people's health to be monitored much more closely and accurately in the very near future: "So people with long term conditions will be able to go to work, where previously they might have had to stay at home or in hospital," Lowe says.

“I have a vision that a doctor should be able to say to someone with depression: ‘I can offer you two treatments: Prozac or these apps. The evidence for success of Prozac is this and the evidence for apps is that. Let’s discuss it all and decide which method is most appropriate’.”

Charles Lowe

“It will also benefit funders, because these are people who will now be encouraged by their apps to look after themselves better, they will be nudged to improve their exercise, eat more healthily, not to smoke.”

One of the biggest areas where mHealth could help improve outcomes and save money is that of depression, anxiety and other mental health issues that very often accompany long-term conditions and need to be managed in patients at home alongside those conditions, Lowe says.

The stakes are high, he said. According to estimates from The King’s Fund²⁴, mental health problems which exist alongside long-term conditions for many patients raise total health care costs by “at least 45%”, equating to between £8 billion and £13 billion in England each year.

This is where mHealth can help: by combining adherence apps with systems to deliver scripted questions and prompts to users at treatment times and remind patients of key measures that they can take to improve and maintain their own health.

“Mobiles are the perfect way to manage depression and anxiety, because not only can you use them to help diagnose when people are depressed, you can also provide cognitive behavioural therapy over the device – supplemented with talking therapy as well, if desired – to actually start treating people using mobile phones.

“One of big issues currently with therapy is there are not enough therapists around to treat everyone who needs their help, so mobile devices can add considerably to the therapy sessions that are available. And while a long-term change in somebody’s behaviour is difficult to achieve, if you are using a device for treatment that the person has with them all the time, there is a much better chance of changing their behaviour.”

The traditional pre-requisite for the expansion of mHealth into sensitive clinical areas such as these, however, is the need for trials to produce clear evidence about the effectiveness of apps and other mHealth techniques, Lowe says: “I have a vision that a doctor should be able to say to someone with depression: ‘I can offer you two treatments: Prozac or these apps. The evidence for success of Prozac is this and the evidence for apps is that. Let’s discuss it all and decide which method is most appropriate’.”

Currently this is not the case in the UK, because NICE [National Institute for Health and Clinical Excellence – the body that carries out research into the effectiveness of medical treatments on behalf of the NHS in England and Wales] does not yet review the efficacy of mobile apps used for medical treatment, he says.

“We are currently pushing hard for them to start doing so. If and when that happens, it will really open the door to serious use of health apps.”

Recommendations: six progress points

As the mHealth revolution gathers pace, here are the key areas where further work is needed to ensure all potential benefits are realised.

All over the world, similar activity is taking place behind the scenes as the health care sector and the technology industry urge governments, policymakers and regulators to keep up with the pace of mHealth development.

It is not just about improving policy and regulation: there are other barriers to fast progress as well, such as the development of clearer business models at large scale and in different clinical situations, and plenty of work to be done demonstrating how to surmount those barriers.

But piece by piece, as areas such as regulation, large-scale trials and cross-sector funding partnerships develop, the huge range of potential benefits offered by mHealth systems – as summarised in the introduction to this report and explored in its main sections – will begin to be realised.

In the meantime, we would argue that this report and others like it serve to demonstrate that the time for further action by all stakeholders is now.

Although further work is certainly needed to strengthen the case for mHealth and expand its scope, there is no need to wait for the outcome of that work to take your first steps, whether you are a patient, healthcare service provider or healthcare funder.

While all parties need to be flexible and keep abreast of all the latest thinking, news and research: they also need to start now. There is a range of good practice out there already – so no organisation needs to feel it is acting alone. Healthcare providers need to liaise with their peers, talk to suppliers and build their strategies as the mHealth revolution gathers speed.

Evidence

More large-scale research is needed by mHealth system developers to trace and track the links between mHealth and cost savings in various parts of the health care system, to help investors decide where the early money should go.

Funding

Healthcare funders then need to consider how to incentivise healthcare professionals and hospitals in such a way as to reward them for making savings elsewhere in the system through use of mHealth systems. All parties need to develop strategies to share savings between stakeholders, creating incentives across the system. Healthcare providers must consider how to build varied funding partnerships to include academic bodies, charities, government and the private sector, including venture capital.

Partnering

Healthcare providers should look across all their areas of operation to review the possibilities for initiating or joining mHealth projects. Policymakers should ask technology suppliers and their local healthcare partners for ideas about collaboration in this field. A step-by-step approach will ensure providers can move safely from pilots to larger scale implementations, gathering evidence for effectiveness as they go.

Education

More research and pilot projects must be followed by work to educate all stakeholder groups about the benefits of mHealth, including the indirect benefits emerging elsewhere in the healthcare system.

Regulation

Governments must keep relevant regulatory systems – including regulation of medical procedures and devices; data protection; and telecoms regulation – under constant review, to ensure they keep pace with the mHealth revolution.

Accessibility

Finally, all parties in the mHealth chain must be aware of potential accessibility problems posed by some types of mobile interface or device, such as smartphones which can feature small screens, small controls and touch controls. People with impaired vision, for example, often have specific requirements when it comes to using mobile applications, which must be usable enough and flexible enough to be accessed by as many people as possible. All interfaces must be clear, simple and usable. Here, automated data transmission through the use of M2M technology can play a role, limiting the need for patients to interact with technology in order to enable remote data collection or message receipt.

References

1. Google Official Blog (2014). Introducing our smart contact lens project. <http://googleblog.blogspot.co.uk/2014/01/introducing-our-smart-contact-lens.html>
2. BBC World Service (2014). Click, Wearable technologies, 26 February 2014. <http://www.bbc.co.uk/programmes/p01sq4f4>
3. "European Commission (2013). Let's get rid of the waiting room". Blog post by Neelie Kroes. <https://ec.europa.eu/digital-agenda/en/news/lets-get-rid-waiting-room-blog-post-neelie-kroes>
4. "Do Interventions Designed to Support Shared Decision-Making Reduce Health Inequalities? A Systematic Review and Meta-Analysis". Marie-Anne Durand, Lewis Carpenter, Hayley Dolan, Paulina Bravo, Mala Mann, Frances Bunn, Glyn Elwyn. 15 April 2014. <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0094670>
5. The U.S. Health Care Market: A Strategic View of Consumer Segmentation. Deloitte Center for Health Solutions (2012). https://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_chs_InfoBrief_2012HealthCareConsumerSeqments_011813.pdf
6. BMJ (2005). What do patients and the public want from primary care? <http://dx.doi.org/10.1136/bmj.331.7526.1199>
7. mHealth and Home Monitoring M2M Research Series 2014. Berg Insight (2014). www.berginsight.com
8. Study referenced at Mental and Emotional Effects of Caregiving Experienced by Caregivers. Family Caregiver Alliance (2012). <https://caregiver.org/selected-caregiver-statistics>
9. "mHealth US end-user research: Beliefs, barriers, success factors and recommendations". GSMA/IPSONS Healthcare (2012). http://www.gsma.com/connectedliving/wp-content/uploads/2012/12/cl_mh_user_study_12_12_FINAL.pdf
10. The Revolving Door: A Report on U.S. Hospital Readmissions. Robert Wood Johnson Foundation (February 2013). <http://www.rwjf.org/en/research-publications/find-rwjf-research/2013/02/the-revolving-door--a-report-on-u-s-hospital-readmissions.html>
11. "Cost-benefit analysis of patient education". Edward Bartlett, Georgetown University (1995). [http://www.pec-journal.com/article/0738-3991\(95\)00723-D/abstract](http://www.pec-journal.com/article/0738-3991(95)00723-D/abstract)
12. Physician survey: mHealth applications. eClinicalWorks (2013). <http://www.slideshare.net/eclinicalworks/eclinicalworks-patient-engagement-survey>
13. "A gamification model to encourage positive healthcare behaviours in young people with long term conditions". Andrew S Wilson, Birmingham City University and Janet E McDonagh of University of Birmingham. Endorsed Transactions on Serious Games, Volume 1, May 2014. <http://www.eud.eu/doi/10.4108/sq.1.2.e3>
14. "Young people, social media, social network sites and sexual health communication in Australia: 'This is funny, you should watch It'." Clifton Westly Evers, University of Nottingham Ningbo, China, Kath Albury and Paul Byron, University of New South Wales and Kate Crawford of Microsoft Research. International Journal of Communication 7 (2013). <http://ijoc.org>
15. "Effects of Computerized Clinical Decision Support Systems on Practitioner Performance and Patient Outcomes: A Systematic Review". Amit X. Garg, MD, Neill K. J. Adhikari, MD, Heather McDonald, MSc, M. Patricia Rosas-Arellano, MD, PhD P. J. Devereaux, MD, Joseph Beyene, PhD, Justina Sam, BHSc, R. Brian Haynes, MD, PhD. American Medical Association. 2005. <http://jama.jamanetwork.com/article.aspx?articleid=200503>
16. GSMA (2013). The socio-economic impact of mhealth. http://www.gsma.com/connectedliving/wp-content/uploads/2013/06/Socio-economic_impact-of-mHealth_EU_14062013V2.pdf
17. mHealth Market (Devices, Applications, Services & Therapeutics) - Global Mobile Healthcare Industry Size, Analysis, Share, Growth, Trends and Forecast, 2012 – 2020. Allied Market Research (2013). <http://www.alliedmarketresearch.com/mobile-health-market>
18. "Emerging mhealth – paths for growth". PwC with Economist Intelligence Unit (2012). http://www.pwc.com/en_GX/gx/healthcare/mhealth/assets/pwc-emerging-mhealth-full.pdf
19. Digital health funding: mid year review 2014. Rock Health (2014). <http://www.slideshare.net/RockHealth/digital-36395071>
20. "Evaluating mHealth Adoption Barriers: Politics and Economics". Vodafone (2012). <http://enterprise.vodafone.com/insight/news/2012-05-04-evaluating-politics-and-economics-as-an-adoption-barrier-to-mhealth-services.jsp>
21. "mHealth in an mWorld: How mobile technology is transforming health care". Deloitte (2012). http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_chs_2012_mHealth
22. "Accountable care organisations in the United States and England: Testing, evaluating and learning what works". King's Fund (2014). <http://www.kingsfund.org.uk/publications/accountable-care-organisations-united-states-and-england>
23. POSTnote 456: Telehealth and Telecare. Parliamentary Office of Science and Technology (2014). <http://www.parliament.uk/business/publications/research/briefing-papers/POST-PN-456/telehealth-and-telecare>
24. "Long-term conditions and mental health: The cost of comorbidities". King's Fund (2012). http://www.kingsfund.org.uk/sites/files/kf/field/field_publication_file/long-term-conditions-mental-health-cost-comorbidities-naylor-feb12.pdf

m2m.vodafone.com

Vodafone Group 2015. This document is issued by Vodafone in confidence and is not to be reproduced in whole or in part without the prior written permission of Vodafone. Vodafone and the Vodafone logos are trademarks of the Vodafone Group. Other product and company names mentioned herein may be the trademarks of their respective owners. The information contained in this publication is correct at time of going to print. Such information may be subject to change, and services may be modified supplemented or withdrawn by Vodafone without prior notice. All services are subject to terms and conditions, copies of which may be obtained on request.

