CHAPTER 1.9

Connected Healthcare: Extending the Benefits of Growth

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It is well established that good health and economic growth go hand in hand.[1] But inclusive growth, with its emphasis on concepts such as equality of opportunity, goes much further. For true inclusivity, the benefits of growth must themselves be inclusive. This is why extending access to healthcare and the ability to lead a healthy life are fundamentally important for both developed and developing economies.

Seen another way, this kind of inclusive growth addresses the natural human desire—shared by people across the globe—to access the best possible care for themselves and their loved ones. The question is: How can this ambition be fulfilled at a time when healthcare systems everywhere are under unsustainable strain? Demand for healthcare is increasing worldwide, but limited healthcare budgets mean that expertise and specialist resources tend to be either centralized or spread thin over a wide geographical area. Access to good care is becoming harder, making inclusivity an increasingly challenging goal for all economies.

EXPANDING ACCESS, EMPOWERING PEOPLE, INCREASING EFFICIENCY

Although the pressure is enormous, connected information and communication technologies (ICTs) are now sufficiently mature to enable radical new solutions. The world is on the cusp of a transformation in which data, devices, and applications will connect patients and caregivers seamlessly and securely. This transformation will empower people to maintain their health and manage chronic illness through continuous, unobtrusive monitoring. It will increase efficiency across the care continuum and enable the collection and integration of health data in meaningful ways that go beyond episodic notes collected on occasional visits to the doctor for an urgent need. Most significantly for inclusive growth, it will allow healthcare providers to reach out to millions of people who are currently excluded from care because of their location or economic circumstances.

Drivers of change

The momentum behind this transformation is powerful and global. No economy—developed or developing—is immune from evolving patient needs and financial imperatives. In 2014, the United States is likely to spend more than US$3 trillion on healthcare (almost the equivalent of Germany's entire gross domestic product, or GDP); this figure could rise to around US$4.5 trillion by 2020.[2] In the Organisation for Economic Co-operation and Development (OECD) countries, combined public health and long-term care expenditure was around 6 percent of GDP on average in 2013. This is projected to reach 9.5 percent in 2060, assuming countries take cost containment measures. With no action on spending, the figure could reach 14 percent of GDP. For some of the BRIICS countries,[3] the OECD estimates that costs will increase, on average, from the current 2.5 percent to

between 5.3 percent and 9.8 percent of GDP, depending on the scenario.[4]

Many of these costs relate to the massive global rise of chronic disease as mortality from diseases falls and lifespans increase. Driven by changing lifestyles and aging populations, chronic disease currently accounts for around 75 percent of healthcare costs. And effective treatment requires patient support and engagement across the continuum of care: from prevention to diagnosis, treatment, and recovery.

By 2020, the World Health Organization projects that chronic diseases will account for almost three-quarters of all deaths worldwide. This problem does not affect the developed world alone. Sixty percent of the burden of chronic diseases and 70 to 75 percent of deaths caused by ischemic heart disease, stroke, and diabetes will occur in developing countries. Cardiovascular diseases are already more numerous in India and China than in all the economically developed economies in the world put together. The number of people in the developing world with diabetes will increase over 2.5-fold, from 84 million in 1995 to 228 million in 2025. In addition, overweight and obesity are at unprecedented levels and rising substantially.[5] The implications of these conditions for inclusive growth and access to care are huge.

Transformation has begun

Confronted with these soaring demands, care providers worldwide are seeking to optimize the use of costly infrastructure and technologies typically found in hospital environments, and to leverage the skills of highly trained professionals to deliver the best possible care to the largest number of patients. Meanwhile, in emerging economies, mobile and connected technologies are starting to extend inclusivity by filling critical gaps in primary care such as diagnostic and screening services.

Antenatal and obstetric care is one such gap. Women in semi-urban and rural areas in emerging economies often die from preventable complications during childbirth. Many of these deaths could be avoided with basic imaging technology, but such technology is frequently unavailable. In Nairobi, Kenya, for example, out of a total population of 3.7 million, an estimated 5 percent (185,000) are pregnant at any given time.[6] However, no ultrasound services (critical in routine pregnancy monitoring and clinical diagnosis) are offered in any public primary healthcare facilities in Nairobi.

Although conventional healthcare infrastructures may be lacking, many of the countries concerned have well-developed mobile phone networks. These networks are now providing a way to reach previously excluded populations. Initiatives such as Imaging the World and Mashavu in East Africa have built innovative mHealth services based on telecommunications networks.[7] In Indonesia, Philips is running a pilot project in Mobile Obstetrical Monitoring (MOM).[8] This is a prototype scalable telehealth solution for early high-risk pregnancy detection where maternal mortality is a concern. Using a mobile phone application, midwives can collect data from physical examinations and tests performed at local nursing clinics or even at the soon-to-be-mother's home. They then send these data to obstetricians or gynecologists in a different location, who can determine whether a pregnancy might be high risk. If so, women can be referred to appropriate medical services for immediate and adequate help.

In projects such as MOM, mobile networks connect patients and frontline health workers in rural areas to experts in urban locations. Technological developments are also enabling rural clinics and community medicine programs to perform sophisticated imaging in the field, such as a mobile ultrasound transducer that connects to a standard tablet through a USB connector.[9] This means that local care providers can provide imaging services and rapid diagnostics with readily available computing devices and easy-to-use software, even in poorly resourced semi-urban and rural areas.

Indeed, governments, nongovernmental organizations, and large "hub-and-spoke" hospital chains are increasingly recognizing the need to move primary healthcare into the communities where people live. Lack of primary healthcare facilities is particularly acute in many parts of Africa for reasons that range from the unavailability of qualified healthcare workers to the lack of electricity, water, and basic healthcare technology. Public-private partnerships, such as the recently established Community Life Center in Kenya,[10] demonstrate one approach to addressing these challenges. The center has its own purified water supply, is powered by solar energy, and uses LED lighting, which provides greater security for patients and staff and enables longer opening hours. Its healthcare equipment allows for monitoring, diagnosis, and triage. Mothers-to-be can have antenatal testing, and the availability of refrigeration prevents vaccines from spoiling. Importantly, this partnership was developed in consultation with the local community and continues to foster community involvement as well as offering additional services such as access to clean water and solar lighting products.

THE ROLE OF ICTS

Integrating ICTs is a key part of expanding primary healthcare through initiatives such as the Community Life Center. For instance, China has designated information sharing and electronic health records as part of its Healthy China 2020 strategy, which aims to provide healthcare access to every resident, rural and urban, by 2020. Regional healthcare information networks (RHINs) will enhance sharing and facilitate information technology (IT) operations among China's community health centers, primary care facilities, and top hospitals. And an RHIN IT platform will provide clinical decision support,

cloud-based imaging services, and tele–intensive care unit (ICU) monitoring.[11]

Worldwide, solutions such as tele-ICU monitoring offer an answer to another of the world's global health challenges—the shortage of skilled staff. By implementing sophisticated algorithms that alert clinicians to changes or trends in patients' conditions, tele-ICU monitoring allows a single specialist to monitor a large number of ICU patients, even over multiple physical locations. Hospitals benefit from a reduction in staffing requirements; patients benefit from more timely interventions and higher survival rates.

Remote diagnosis and screening are as applicable in the developed world as in emerging economies when it comes to extending access to care. They allow people living in any far-flung rural area to have access to specialist expertise that would otherwise be unavailable locally. Care providers can then offer treatment in dedicated urban centers that can handle large numbers of patients cost-effectively.

Of course, although technology can reduce the need for specialists it will never replace all medical professionals. Indeed, it can be a valuable tool in training them. World Economic Forum figures show that Africa is particularly hard hit by staff shortages. The continent faces 28 percent of the global disease burden but has only 3 percent of the world's healthcare workforce. With a challenge of this size, the vast reach of the Internet can make a major difference. For instance, in Kenya, e-learning has taught 12,000 nurses how to treat major diseases such as HIV and malaria, a far greater number than the 100 nurses a year who can be taught in a classroom.[12]

Connected care

The examples presented above are just the start. As payers (both public and private health insurers) and patients continue to push for better outcomes and more personalized care at lower cost, the connected healthcare transformation will widen and deepen.

Imagine a specialist doctor such as a cardiologist who has a software application on a phone that delivers notifications about critical patients. This process is similar to the way Facebook sends notifications of friends' updates, but with more serious intent.

The cardiologist might receive an ECG chart and patient parameters, so she can quickly issue instructions. Or a patient equipped with wearable sensors might send data on worrying symptoms—such as a racing heartbeat—as they actually occur. In an acute situation, cardiovascular imaging and informatics at the hospital might reveal that the patient needs a stent fitting. Once the patient leaves hospital, mobile monitoring devices and applications will continue to monitor vital signs and will provide support for a good recovery and coaching in maintaining a healthy lifestyle—from managing food, alcohol, and cholesterol intake to exercising and understanding early warnings of deterioration in the patient's condition.

Specially designed user interfaces will ensure a seamless patient experience, not just in the hospital but across everything patients touch in their daily lives. If they do need to come back to the hospital, patients will have collected more and more useful data about their health. They can also continue to track themselves as treatment progresses.

Similarly, technology built on the Internet of Things will improve the quality of life for the growing numbers of elderly people. Worldwide, older people are often excluded from active participation in society because they are not well or are no longer able to live in their own homes. By integrating a variety of ICT systems, millions of people will be enabled to stay independent for longer and to continue to contribute to economic activity.

For example, an application on a tablet could manage a treatment plan to make sure seniors take their medicines on time. It could help them perform simple tasks such as taking their weight and blood pressure, or checking their heartbeat and respiration via a wearable device. In the longer term, other devices around the home could be integrated. Home cookers might help manage the nutritional value of food, and digitally connected lamps could blink red or green to indicate when certain pills need to be taken.

Data from these telecare/telehealth services will be uploaded to a dedicated center where a single healthcare professional can manage hundreds of patients simultaneously. As in tele-ICU monitoring, advanced algorithms will evaluate and prioritize the data that should be presented, so there is no information overload. The system will identify any patient whose condition gives cause for concern and alert the healthcare professional to take action—whether this takes the form of simply requesting an additional measurement, notifying the doctor and the patient's family, or calling the emergency services.

Empowering people

One of the biggest transformations will go beyond the diagnosis, treatment, and support of people when they are sick. Connected healthcare holds the key to continuous personal healthcare—preventing disease by enabling everyone to looking after themselves and their loved ones better. The boom in smartphone applications, wearable electronics, and mobile devices that track activity, fitness, and performance reflects a growing interest in managing wellness. People want motivating ways to stay fit. And if the data produced are stored securely in the cloud, they can be integrated with medical records to provide a lifelong record of our health rather than the episodic snapshots of today.

With access to coaching and support around the clock, individuals are reassured and empowered to manage their own health. And when people do fall ill,

they are helped to keep to treatment regimens (such as taking medicine in the right doses and at the right times). Patients gain a sense of responsibility—and they and their caregivers can work as a team to prevent, improve, and reverse health challenges.

For care providers and payers (public and private health insurers), all this means a reduction in acute episodes and hospital re-admissions. Clinical trials demonstrate that more involved patients have better outcomes, are more satisfied, and cost healthcare systems less than patients who are less engaged in their healthcare experience. Research bears this out in cardiac patients with heart arrhythmia (who often also get strokes).[13] This research shows that such patients fare better when they are reminded to take their medicine routinely and their vital signs are observed. As predicted, monitoring reduces acute episodes and anxiety, and patients need to come back to hospital less often.

Ultimately, empowerment will lead to increasing "consumerization" in healthcare and greater inclusion for patients in decision-making. More and more people will have the freedom and responsibility that come with choice and will be able to make well-informed decisions on spending their discretionary income on health effectively.

Effective and efficient healthcare systems

Along with this empowerment, connected healthcare will enable all stakeholders in the care continuum to work together more effectively and efficiently. As data are shared seamlessly across systems, clinicians will be coordinated and informed about patients flowing through the system. Information will be integrated throughout the hospital environment, so that admissions, records, nursing, diagnostic imaging, transitional care, rehabilitation, and home care are all part of a whole. This information will be shared with patients and families through patient portals and websites, with clinical data presented in formats easily accessible to patients and families.

Within the decade, we expect barriers to pooling and sharing clinical information will be overcome as hospital administrators, clinicians, and researchers apply Big Data principles within and beyond the borders of their own institutions. Patients will be able to manage the confidentiality of their personal data, and aggregated data will be anonymized for use in population health management studies. This step will offer further opportunities to extend care for individuals and entire patient populations. Smart algorithms will trawl through integrated data from hospital records and personal data, providing new insights into the impact of lifestyles, treatments, and outcomes. This learning will enable improved clinical decision support and personalized medicine based on a complete picture of factors that includes a patient's past history, sensitivities to medications, activity levels, and nutritional intake. Genomic data will be applied to entire patient populations based on geography, ethnicity, and health status, or used to extend understanding of an individual's genomic profile to help develop unique prevention or treatment plans. In the long term, we may see web-based patient profiles that aggregate genomic data with other data pools to produce risk maps with mobile applications that people can download to a smartphone—with customized advice for maintaining good health.

MAKING IT HAPPEN

Bringing about this vision of connected healthcare calls for change in many areas. It requires integrated and interoperable IT systems, mobile and data analytics that can apply new care models with better coordination, stronger patient engagement, and end-to-end solutions. Health consumers of the future will demand new levels of experience and service in the care they receive. Giving people access to their personal data and to healthcare provider cost and quality data will be a vital part of this transformation, freeing them to move between care providers and to make informed decisions about their care.

Certainly few people have their health details at their fingertips today. The episodic nature of care means the patient journey across the continuum of care is comprised of fragmented experiences and incomplete data. Healthcare providers frequently operate without the right tools and without incentives to help them collaborate on proactive patient care management. This leads to waste and inefficiency, which costs US$750 billion per year in the United States alone. The lack of tools and incentives is often compounded by a lack of infrastructure, staff shortages, and the absence of insurers—particularly in emerging economies.

However, pressure from public and private insurers to cut costs and reengineer processes is having an impact. The rise of value-based healthcare models shows that even entrenched business models—such as reimbursement for individual interventions or bundled payments—can be replaced by models based on quality and desired outcomes for entire patient populations. And technologically, the building blocks for connected healthcare—from sensors and actuators to connectivity and wearable electronics—are readily available. Furthermore, as examples from Africa and Asia demonstrate, connectivity does not necessarily require Internet access. Emerging economies are leapfrogging ahead through innovative solutions based on wide-reaching mobile phone networks such as telemedicine, phone-based medication compliance programs, and health awareness campaigns. A single phone in a village is enough to provide a point of contact for a local nurse to send data to specialist doctors in an urban health

center, as has been clearly demonstrated in the MOM pilot project in Indonesia mentioned earlier.

The interoperability requirement

The fundamental requirement for change is the ability to share data from any source. This means more than software systems talking to each other, and more than data entered into a patient health record system and interacting with a tablet. The necessary change must include all data across the continuum of care, whether those data come from devices that patients carry in hospitals, from imaging systems and patient monitors, from connected technology in the home, or from wearable devices and applications that check vital signs.

This is a big task. Interoperability is a challenge. But, as experience from industries such as travel and banking and financial services demonstrates, the challenge is not insurmountable. We live in a world where we can get money out of automated teller machines wherever we go, make secure international payments online, and, in some countries, even scan paper checks with our smartphones as proof of deposit. With sufficient incentive, solutions will be found. And despite its fragmentary nature, foundations are being built for the exchange of health data. The Digital Imaging and Communications in Medicine (DICOM) standard has been enabling the free flow of imaging and related data since 1993. Today organizations such as the CommonWell Health Alliance (in the United States) and the international Continua Health Alliance are bringing together industry players to develop standards and interoperability for conventional and connected personal healthcare.

Privacy is naturally of paramount importance, and ways to ensure it must be implemented to meet an array of local regulatory requirements and cultural norms. Confidential patient records will be encrypted and stored in dedicated data clouds that fit the need of individual markets. Personal freedoms can be respected by giving people control over whether their data are stored in the cloud, and when and how healthcare applications collect such data. No one should risk exclusion from care because data stored in the cloud indicates a pre-existing condition or a pre-disposition to developing a particular illness.

Reliability, harmonization of the user experience (such as similar user interfaces for home and hospital applications), and openness of platforms also present challenges. Connected healthcare depends on making solutions that are scalable to a size that includes millions of users, as well as being secure and adaptable. With huge quantities of data coming from a multitude of devices, it will be vital to develop techniques to assess which data are truly meaningful and useful, and to identify from which patients those data come. Implementation will require a deep understanding of the regulatory environment, clinical workflows, healthcare informatics, and safety nets put in place to protect customer and patient data.

Compelling digital propositions

The key challenge is not technical, however. It is a matter of mindsets: how governments, insurers, medical professionals, patients, caregivers, and all of us think about healthcare. Although fragmented, the healthcare industry is highly conservative—often with good reason, because people's lives are at stake and so novel, untested systems and processes are not easily adopted. Nonetheless, the new generation of professionals consists of digital natives. They want and expect connected systems. And throughout the world, it is crystal clear: if a digital experience is compelling enough, people will integrate it into their daily lives and ways of working, which in turn will drive adoption and standards—just as it has with Facebook, Google, Sina Weibo, M-PESA, and many more applications.

The lesson for the healthcare industry is that digital propositions must be rewarding to use. Fulfilling the potential of connected healthcare starts with connecting devices and data, but its success lies in convincing people to use these devices and to stick to fitness plans and treatment regimens. Clinicians and patients interact with data very differently. Thus personal health applications need to be attractive and useable by everyone—from an 80-year-old person with multiple chronic diseases to a teenager with a sports injury; from a doctor, a nurse in a telehealth center, and a general practitioner to a health coach and a caregiver.

With relentless pressures on resources and finances, healthcare worldwide is approaching a tipping point at which radical change must come. Connected healthcare offers a way to improve outcomes, expand access, and give millions more people the opportunity to live healthy lives—all this based on sustainable business models. Just as the cloud and the Internet have disrupted other industries, they will transform healthcare. Digital solutions will connect all the elements of the care continuum, empower stakeholders, and facilitate collaboration. Responsibility and incentives will shift as people are enabled to manage their own health. And as good healthcare reaches ever more people through mobile and connected technologies, it will help bring inclusive growth and better health to entire populations at a lower cost of care.

NOTES

1 See, for example, Frenk (the Mexican Minister of Health and Chair of the 2004 meeting of OECD Health Ministers) who notes that "… economic evidence confirms that a 10% improvement in life expectancy at birth is associated with a rise in economic growth of some 0.3–0.4 percentage points a year" (Frenk 2004).

2 Munro 2014; CMS.gov 2012; Deloitte 2014.

3 The BRIICS countries are Brazil, Russia, India, Indonesia, China, and South Africa.

4 de la Maisonneuve and Olivereia Martins 2013.

5 WHO 2007.

6 Philips 2014a.

7 For details about these initiatives, see Imaging the World at http://imagingtheworld.org/ and Mashavu: Networked Health Solutions at http://mashavukenya.wordpress.com/.

8 Philips 2014b.

9 Philips 2014c.

10 Philips 2014d.

11 KGMP 2010; Frost & Sullivan 2014; Huawei 2014.

12 World Economic Forum 2014.

13 The webcast on strategic alliance Philips and Salesforce.com is available at http://www.media-server.com/m/p/vwkvvgb7.

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