

PricewaterhouseCoopers'
Health Research Institute

HealthCast

The customisation of diagnosis, care and cure



Table of contents

The heart of the matter	2
--------------------------------	---

Health leaders will become agile caretakers of interdependent networks that grow smarter as they get to know and support each individual

An in-depth discussion	4
-------------------------------	---

Health will be customised around a framework of six vectors that personalise diagnosis, care and cure for individuals

Three key issues will force a change in today's health model	8
--	---

- Rising chronic diseases among young and old
- Technology-enabled mass customisation
- Understanding of genetic, behavioural and socio-economic factors on health

Six vectors are moulding a new customised framework to activate individuals and health systems	16
--	----

- Incentives that encourage partnerships
 - Regulatory reforms
 - Funding that redistributes spending
 - Patient communication that supports choice
 - Information technology that eases collaboration
 - Flexible workforce models
-

What this means for your business	34
--	----

Health systems will use five touchpoints to engage individuals

A toolkit for change	35
----------------------	----

- Coordinated care teams
- Fluent navigators
- Patient experience benchmarks
- Medical proving grounds
- Care-anywhere networks

Recommendations for industry stakeholders	48
---	----

Conclusion	50
------------	----

The heart of the matter

Health leaders will become agile caretakers of interdependent networks that grow smarter as they get to know and support each individual

Three trends were predicted in PricewaterhouseCoopers' 1999 report, HealthCast 2010: consumerism, genomics and the Internet. We said all three would radically alter how health is defined and delivered, and that has happened. Between now and 2020, healthcare's vital signs will be under pressure. Health systems will turn from reactive medicine to proactively understanding and supporting individuals in managing their own health. Many health systems say they deliver patient-centred care, but PwC's research found only pockets in which this is true. Health organisations remain focused on their own organisations, not necessarily what is best for the patient.

The customisation of diagnosis, care and cure engages patients before, during and after they are ill or injured. Customising care to the individual takes health systems out of their comfort zones, forcing them to integrate people, technologies and organisations that are not part of their current routines. "In an integrated world, no one provider owns chronic disease care. The patient owns the chronic disease," said Gary Belfield, who leads commissioning for National Health Service's (NHS) Department of Health in England.

What is happening to healthcare is no different from other industries—the power of the individual is increasingly influencing how healthcare is directed and delivered, enabled by the technological and the virtual world we live in. And this is by no means a western phenomenon.

On the way to researching this shift toward a system of patient-centred health, we watched governments and businesses react to a frightening global recession. While economies eroded throughout 2009, healthcare was noticeably resilient. In fact, both the world's largest economy and the most populous country, the United States and China, chose to spend even more on healthcare as part of billion-dollar economic stimulus packages. As the recession wore on, PwC interviewed more than 200 health leaders, including 11 federal and state ministers of health from seven countries. Ever mindful of how the recession was affecting their economies, these officials talked about the need to wring value from rising health costs. In addition, these officials realise that engaging patients and customising care to their needs can be more effective and efficient.

In 2020, individuals will access a newly networked model of care, research and financing.

Rather than architects of health systems, health leaders will become agile caretakers of interdependent networks that get smarter as they get to know and support each individual.

An in-depth discussion

Health will be
customised around
a framework of six
vectors that personalise
diagnosis, care and
cure for individuals

Executive summary

- Care in the future will be customised to the individual as performance metrics, payment, outcomes, incentives, services and treatments address differences in the needs and preferences of individuals.
- Incumbent models of care are struggling to keep up as healthcare volumes become more unmanageable. A burning platform for change is being driven by three key issues:
 - **Chronic disease.** Both young and old consumers are developing chronic diseases in record numbers, leading to explosive growth in the consumption of resources that is driving up spending and creating liabilities for future generations.
 - **Digitisation.** Technology is leading healthcare into a new era of “mass customisation,” following other industries such as auto manufacturing, media and entertainment. PwC research shows that consumer attitudes on healthcare vary widely, depending on gender and age, and that’s just the leading edge of the mass customisation.
 - **Broader view of converged health influences.** It is widely accepted that chronic diseases are associated with behavioural, socio-economic, and genetic factors that are not within the control of today’s medical delivery system.
- Health will be customised around a framework of **six vectors** that customise diagnosis, care and cure for individuals.
 - **Incentive-based payment.** Public and private payers are ending volume- and budget-based payment and moving toward payment based on patient outcomes. This could result in a major redistribution and prioritisation of health spending. Three-quarters of health leaders surveyed by PwC favoured more incentives for physicians to follow best practice guidelines. More than 80% of health leaders surveyed said there needs to be more incentives for patients to be compliant with their medications.
 - **Broad-based regulatory reforms.** Many of the world’s largest economies are tackling major regulatory reforms that will alter how behavioural, genetic and medical delivery components drive personal health spending.
 - **Funding.** Payment and financing are redistributing funding from sickness to wellness. Eighty percent of global health leaders surveyed by PwC agreed that providers should be reimbursed on quality outcomes.
 - **Patient communication.** When PwC surveyed global health leaders about the most effective strategies to engage individuals in their own health, the top two answers were health education and greater awareness. The third was increased patient responsibility, but the ordering shows that health leaders know there is a lot of communication needed to support patients.
 - **Electronic medical records (EMRs) and IT.** By 2020, health systems will move from predominantly paper records controlled by the industry to predominantly digital ones controlled by individuals. Ninety percent of health leaders surveyed said making EMRs available to clinicians and patients would make their systems more efficient and effective. But effective implementation will be difficult and expensive.
 - **Workforce.** Seventy percent of health leaders interviewed by PwC said their systems would be more efficient if they had more primary care physicians and 79% said they needed more nurses. Systems must redesign care models to meet the expected workforce shortages amid demands for customised care.

- Individuals' relationships with health delivery models are changing and will be shaped by **five touchpoints** that make care more personalised and efficient. Health systems can use these touchpoints as a toolkit to activate a change in the patient's role in healthcare.
 - **Coordinated care teams.** Consumers want better coordination of care, and payment methodologies are being altered to enable packages of care that better serve the needs and preferences of patients. Two-thirds of global consumers surveyed by PwC said coordinated clinical teams are important to them. Yet, 40% of health leaders surveyed by PwC said hand-offs among clinicians are difficult or very difficult.
 - **Fluent navigators.** Regardless of whether they live on \$1 a day or in the richest cities of the world, chronically ill patients need help to navigate the health system on their own. While nearly half of global consumers said it was easy or very easy to understand their medical condition, consumers also said it was much harder to access a specialist than a primary care physician.
 - **Patient experience benchmarks.** Access to care was the top attribute that defines quality care, according to PwC's survey of global consumers. Many governments are responding to this by setting access targets, such as wait times for primary care, emergency care, and surgery. Such mandates have been shown to increase productivity by causing providers to re-engineer their processes and rethink workforce definitions.
 - **Medical proving grounds.** Research and delivery systems are converging to slash the time it takes for innovation to reach patients. "Centres of excellence" interested in global recognition, such as an effort in Luxembourg, are on the forefront. In PwC's survey of global health leaders, almost half said they thought medical tourism would increase in the next five years. The medical tourism industry will split between those shopping for low-cost and those searching for new science and value.
 - **Care-anywhere networks.** The definition of access is being redefined by the ubiquity of wireless mobile devices. One-third of consumers surveyed said they would consider healthcare that is delivered over the phone or Internet. Half of health leaders surveyed said they are expanding access to care in patients' homes, which are increasingly wired with networked devices.
- Health leaders will work together to achieve solutions for customised diagnosis, care and cure. Following are **recommendations** for health stakeholders:
- Develop incentives that encourage partnership
 - Work on regulatory reforms that reward competition and innovation
 - Plan for redistribution of funding from sickness to wellness
 - Provide individuals with better information to support shared decision-making, concordance and choice
 - Explore workforce models that allow greater flexibility and effectiveness
 - Prepare for complexity of agile, interoperable IT framework for realtime, customer-driven market

About the research

PricewaterhouseCoopers Health Research Institute (HRI) conducted more than 200 in-depth interviews with global thought leaders and executives representing government, hospitals, pharmaceutical companies, insurance companies, clinicians, academics, and the business community to gather insights on current challenges and best practices. These interviews were conducted in more than 25 countries around the world. HRI also surveyed 3,500 consumers in seven countries (the U.K., Germany, the Netherlands, Norway, U.S., Canada, and Australia) and 590 leaders of health plans, providers, government, employers, physician groups, and pharmaceutical/life science firms in 20 countries (the U.K., Germany, the Netherlands, U.S., Canada, South Africa, Australia, New Zealand, Argentina, Brazil, China, India, as well as multi-territory geographies including central Europe, Scandinavia, the Middle East and Asia).

About the series

This report is the latest in a series of HealthCast reports published by PricewaterhouseCoopers' Health Research Institute. Each relied on the expertise of our global network of practitioners as well as in-depth research through proprietary surveys and one-on-one interviews. The goal has been to help global health industry leaders determine the future direction of industry trends. The first report, HealthCast 2010: Smaller World, Bigger Expectations, was published in 1999. It was followed by HealthCast Tactics: A Blueprint for the Future, in 2002, and HealthCast 2020: Creating a Sustainable Future, in 2005.

Readers also would benefit from other PricewaterhouseCoopers reports that focus on future trends in our industry. Those reports include four papers published on the future of the pharmaceutical industry: Pharma 2020: The vision; Pharma 2020: Virtual R&D; Pharma 2020: Marketing the future; and Pharma 2020: Challenging business models. Three other PwC reports that provide a deeper look at topics in this HealthCast include: Jammed Access: Widening the front door to healthcare; Diagnostics 2009: Moving towards personalised medicine; and The new science of personalised medicine: Translating the promise into practice.

All of these reports are available on www.pwc.com/healthindustries.

How will the business model of healthcare change between 2010 and 2020? Scientific and technological developments will enable individuals to play an active role in care.

Healthcare is being shaped by a customisation of products and delivery to many varied and disparate points—from patients’ self-monitoring at home, to Internet patient communities, to a new layer of “navigators” shepherding patients through the increasingly time- and money-strapped healthcare systems.

Three key issues that are forcing a change in today’s healthcare model:

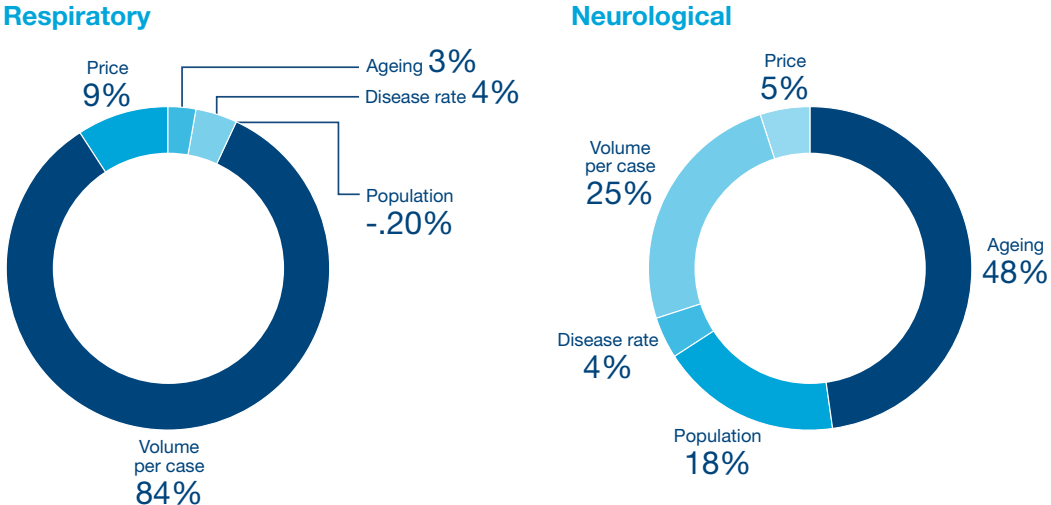
1. Both young and old consumers are developing chronic diseases in record numbers, leading to an explosive consumption of resources that is driving up spending and creating liabilities for future generations.

Diseases that were once fatal are now chronic, which has brought extended life, but also extended spending. Most countries have not analysed health spending by disease because of the siloed

way in which they disperse funding and collect data. However, the rise in chronic disease is spurring health leaders to look across sectors at causal relationships of spending. For example, the World Health Organisation’s Global Burden of Disease collects data that compares the impact of disease by country. While aging is often cited as a key driver of health spending, there is a growing concern that spending is increasingly spurred by generations of children facing costly chronic disease. For example, in Australia, respiratory diseases are the second highest driver of health spending. More than one-fifth of Australian children under 16 years of age have been diagnosed with asthma. On the other end of the age spectrum, neurological diseases, such as Alzheimer’s, show the fastest growth rate in Australia, estimated to increase more than 50% between 2003 and 2023. (See Figure 1.)

Aging is causing other problems. As more individuals retire, nations face a shrinking

Figure 1: Drivers of change in health expenditure between 2002/03 and 2032/33: Components of change (%)



Source: Australian Institute of Health and Welfare Disease Expenditure Projection Model

productive workforce to finance their health needs. In the Netherlands, the elderly dependency ratio (ratio of elderly to productive adults) will increase from 22% in 2008 to 30% in 2020, and 46% in 2040. China, which adopted a one-child policy in 1979, has a similar problem.

The concern is that escalating demands for health services are consuming an unsustainable share of resources. Nearly every nation is clamouring for more and more clinicians. Seventy percent of health leaders interviewed by PwC said their systems would be more efficient if they had more primary care physicians and 79% said they needed more nurses. The PwC global consumer survey revealed the need for more specialists: nearly one-third said it was difficult or very difficult to access a specialist. Yet, the supply of clinical specialists has grown dramatically: specialists per capita in Organisation for Economic Co-Operation and Development (OECD) countries increased by 20% between 1995 and 2005. Paying for more and more resources is unsustainable. “People tell me all the time—in 20 years you will no longer be able to finance your health care system. And they are right,” says Mars di Bartolomeo, Luxembourg’s minister of health. “They are right unless we keep the status quo and no development takes place.”

2. Technology is leading healthcare into a new era of “mass customisation,” following other industries such as car manufacturing, media and entertainment.

Mass customisation is enabled by technology and the convergence of multiple devices such as smart phones, EMR databases, home health monitoring and treatment architectures. Patient, research and provider communities are operating new online interoperable communities that merge previously unconnected people and data streams. “Cellular phone technology and Internet innovation are the two most commonly used innovations outside the healthcare industry that are effective in engaging and changing individual behaviour,” said Anton Rijnen, CEO and principal officer of Medihelp Medical Scheme in South Africa. As mass customisation relates to healthcare, the patient becomes the end-user, with industry players focusing on providing care and treatment options best-suited to an end-user’s needs and preferences.

Unfortunately, some health systems have been so focused on internal challenges that they are just beginning to understand consumer preferences. For example, PwC research confirms that consumer attitudes

on healthcare vary widely, depending on gender and age. As part of PwC’s consumer survey, we asked respondents to rank more than 15 health system attributes in order of preference. We then conducted a principle components analysis to group these attributes into five high-level categories. The categories included: high quality, low cost, access, personal attention, and education. The averages for each category by demographic variable (e.g., age, sex, income) were then calculated and plotted to see how preferences varied depending on population characteristics.

The results clearly demonstrate global trends in valuations of health systems’ attributes based on age and sex. The population aged 50 and over value high quality and personal attention, whereas

younger populations value low cost and health education and wellness. Variations in valuations by sex were even more significant—men ranked high quality and personal attention above women, and women vastly preferred low cost and access compared to men. Response patterns by individuals also indicate a recognition that trade-offs between attributes occur, e.g., high quality over access, low cost over personal attention. (See Figures 2 and 3.)

Many health systems are already experimenting with segmentation of consumers by health status or disease group. Our analysis demonstrates that as health systems evolve, they will need to become more adept at customising health solutions according to more consumer-centric attributes. As the choice agenda

Figure 2. Valuation of health system attributes by age

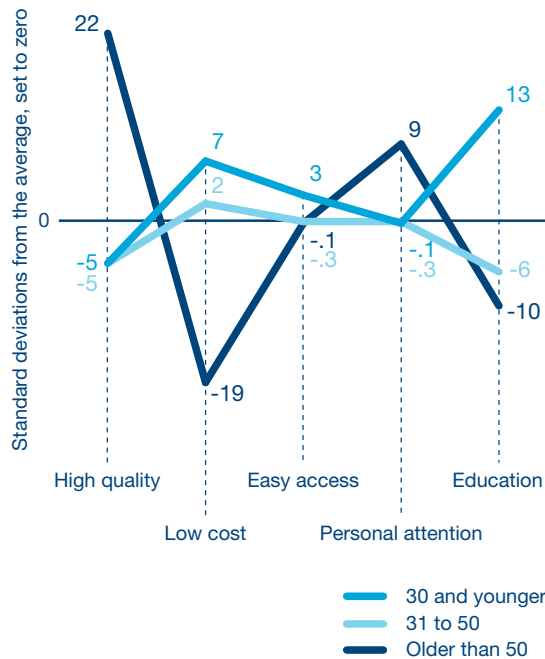
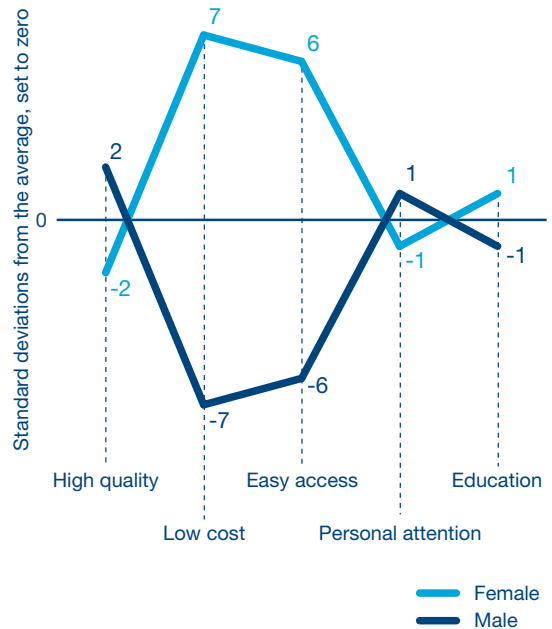


Figure 3. Valuation of health system attributes by sex



forges ahead, public sector providers, which are less akin to this kind of market analysis, will be faced with responding to customer preferences or face stronger competition from the private market.

Jonathan Broomberg, M.D., Deputy CEO of Discovery Health in South Africa, said data-driven segmentation allows it to connect with and manage high-risk members who have multiple chronic conditions. “We know we have a defined number of people with multiple chronic conditions—they pose high risks to our Funds, and also have significant needs. We segment them accordingly and personalise interventions for them.” The South African company has a rewards system that connects to health claims so members do not have to self-report. Providing varied and individualised service and healthcare delivery options tailored to the behaviours and situations common to individuals in each segment will lift healthcare to a truly mass-customisation level. Payers, then, need to borrow from other industries’ marketing approaches and likewise make a paradigm shift

from “marketing to one” to personalised marketing to many, across varied segments.

This leap in mass customisation will be fuelled by the phenomenal potential of genomic medicine and biotechnological innovations. Care will move from centralised models to new, post-mass-production- and mass-customisation-based models, triggered to a large extent by revolutionary new DNA sequencing technologies as well as the increased application of bioinformatics and tailored diagnostics and therapeutics.

“We’re on this massive technology leap right now,” said Richard M. Myers, Ph.D., president, director and faculty investigator at the HudsonAlpha Institute for Biotechnology in Huntsville, Ala. “We are able to sequence DNA thousands of times faster than in 1990 when the Human Genome project started. Genetic and genome analysis is working really well in cancer, and it is being applied to metabolic, neurodegenerative, and autoimmune diseases. Ultimately, all diseases will benefit.”

3. Chronic diseases are associated with social, economic, genetic and behavioural factors that are largely unaddressed by today’s medical delivery system. The delivery system must interface more effectively across society and with individuals regarding these factors to prevent, detect and manage diseases.

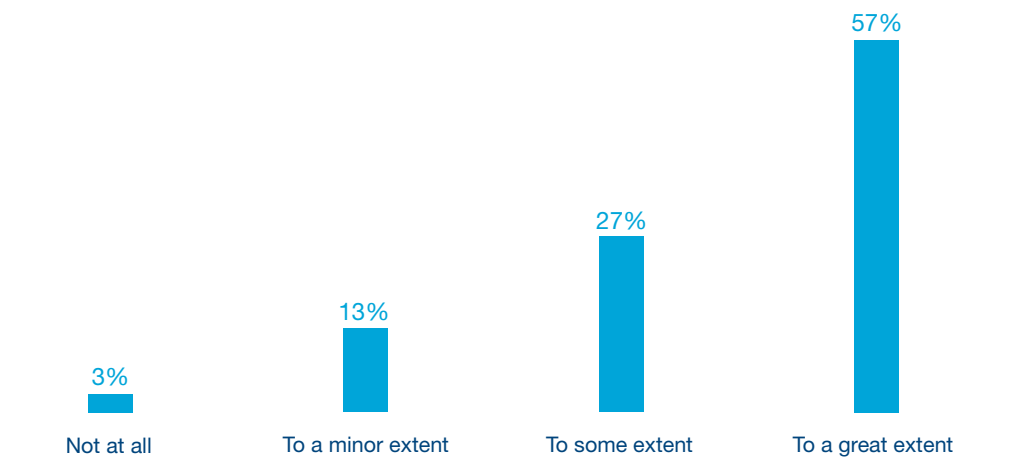
New diagnostics and pharmacogenomics are enabling treatment to focus more on what fits each individual. “If we have a drug that works in 30% of patients with breast cancer, and if we can specifically target these 30%, then we can avoid wasting a very expensive medicine on the other 70% of patients who will not respond,” said Professor Klaus Lindpaintner, of bio-banks.com in Switzerland. Further, health systems recognise that supporting the individual, particularly in chronic care, means addressing their behaviours before and after they leave the hospital or clinic. Yet, “genomics should not be overestimated. A healthy lifestyle can often be much more effective in achieving a good health standard

than actually testing and determining a predisposition for a disease,” noted Nick Lench, CEO, London Genetics Limited.

As Figure 4 shows, health leaders believe that individuals should play a larger role in managing their health. But they also believe that individuals need support and tools to do so: “The main responsibility for the prevention of disease falls on the citizens, with clear directives and adequate assistance from government agencies,” said Karam Karam, M.D., the former Lebanese minister of health.

Three spheres of influence—behavioural, genetic and medical system—affect how much is spent on an individual’s health. (See Figure 5.) Within each sphere are hundreds of variables that affect whether an individual gets sick, gets treated, and gets better. Rapidly developing medical knowledge about the effectiveness of these variables and how they interact with each other will radically alter business models. For example, physicians practice differently in different parts of the world, even within the same city. The care of a patient with a

Figure 4: To what extent should the patient be responsible for managing chronic care?



Source: PricewaterhouseCoopers’ Health Research Institute Global Health Leaders Survey

backache will vary depending on when they seek treatment, what physician they select, how involved they are in the treatment plan, where the treatment takes place, what medications are prescribed, where they recover and how soon they return to work. Within each of those decisions are innumerable options.

The complexity of these variables and how they affect an individual's health means it is impossible to trace simple lines between cause and effect in health outcomes. The old model was built on a linear pathway: get sick, visit the doctor, get a pill or procedure, get better. Now we know an individual's pathway to health knowledge and treatment is complicated by hundreds of interactions that are not linear. And, today's patients may never be cured. However, thanks to discoveries about behaviour, genetics and medical practice, the individual's pathway to health is becoming more predictable and manageable. Marc Miller, director of strategy and corporate

development for McKesson AsiaPacific, explains that, "Population-based predictive modelling can assist in identifying those at risk of developing chronic disease, in addition to assessing the potential to impact their trajectory. Tailored prevention programmes can then be targeted at those at risk, thereby reducing the prevalence and intensity of the condition and its associated costs."

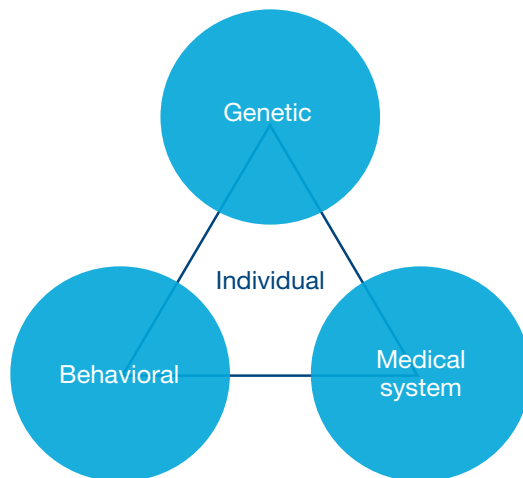
A convergence of knowledge is occurring that will enable stakeholders to better understand, or in some cases, predict which individuals will acquire which diseases, which drugs will work best, and which incentives will drive behavioural change on the part of patients and clinicians. For the delivery system, the greatest near-term impacts will take place within their own sphere. But, even larger impacts await as the spheres themselves converge.

Genetic sphere: The archaeology digs of the future

Just as archaeologists have used fragments from the past to understand the human race, scientists today are embarking on the greatest biological dig of all time. Researchers throughout the globe are rushing to decipher what U.S. National Institutes of Health Director Francis Collins has called the "language of God." The human genome is central to research funding in the world's largest economies; but emerging economies, such as Mexico, India, Thailand, South Africa, Kuwait, China and Iran, are funding their own genomic projects or institutes. "In 10 years' time, we will have billions of data points on every individual," said Leroy Hood, M.D., Ph.D., who created the gene sequencer and now is president of the Institute for Systems Biology in the U.S. "We will develop very powerful tools in analyzing individuals; from a drop of blood, we will get measurements of over 2,500

Figure 5: Spheres of influence

Variables of individual health: three spheres of influence affect each individual's health



proteins. This will let us scan organ systems. Are they healthy or are they diseased and can we understand future medical status? We can match particular types of patients to particular types of drugs.”

An integral element of this sphere is the continued advancement of biologics—large complex molecules biotechnologically produced or isolated from living sources that have highly specific targeting properties. The biologics, which include monoclonal antibodies, therapeutic proteins and nucleic acids, and, eventually, generic biologics (biosimilars), place the patient’s genetic make-up at the core of treatment. Biologics hold great promise for pharmaceutical companies striving to fill drug-sapped pipelines as “patent cliffs” of blockbuster drugs near. At least 600 biologics are in clinical trials, including 250 targeting various cancers.¹

In the decades ahead, researchers may determine which genes make people sick—and which keep them healthy. For example, the “Welllderly” study hopes to find what genes protect individuals from disease. Scripps genomic medicine researchers are looking at the DNA of healthy individuals age 80 and older with no history of chronic disease to help find the genetic mystery behind living a long and healthy life.² Initial results of the Welllderly study have surprised many experts, showing that “healthy individuals have the same ‘bad’ genes that are linked to illnesses such as heart disease, cancer, and Alzheimer’s,” according to research published in the *Journal of Life Sciences*. However, researchers find that many people have genes that protect them from heart attack, cancer and other diseases.³

Behavioural sphere: habits and patterns

Behaviour affects nearly every medical decision. It is more than preferences; consumers make medical decisions based on social and economic determinants in their environment. The type of housing or transportation that individuals depend on impacts their access to care. Their educational background can have a huge influence as well. For example, only three-quarters of global consumers surveyed by PwC said they always pick up their prescriptions. Even fewer—as few as half—take all of their medications as prescribed, according to other research. In the meantime, lack of adherence costs pharma companies billions in sales each year because patients are not taking their medicines.⁴ What makes people behave the way they do when it comes to their own health? It is well known that heart disease and cancer are associated with smoking and lack of exercise. Yet, people continue to smoke and avoid physical activity. For certain decisions, patients need coaching and the right incentives.

However, behavioural decisions become even more complicated when genetic information is part of the equation. For example, how does a woman react when she is told that she carries a gene that is likely to cause breast cancer? How can the medical system help her make choices about her care? In California, the Scripps Genomic Health Initiative is investigating whether genetic test results encourage people to improve health behaviours, such as diet and exercise. As part of this research, they are also working with patients’ doctors to prevent future health

1 Pharmaceutical Research and Manufacturers of America, “Medicines in Development,” *Biotechnology* (2008)

2 Daniel S. Levine, “Lost in Translation,” *Journal of Life Sciences* (Fall of 2009): 40-48.

3 Daniel S. Levine, “Lost in Translation,” *Journal of Life Sciences* (Fall of 2009): 40-48.

4 *Pharma 2020: The vision. Which path will you take*, PricewaterhouseCoopers, 2007.

issues to which they may be genetically susceptible. The collaboration enables individuals to take a genetic test for about one-fifth the normal price. Affymetrix conducts the genomic scan, Navigenics interprets it, and Microsoft's Health Vault provides participants with personal health records to manage their care. Individuals who have a genetic predisposition for one of 20 diseases will be monitored over the next two decades to detect how their behaviour changes after they find out their genetic susceptibility to disease. Individuals are advised by genetic counsellors on recommended lifestyle changes and ways to work with their physician to improve their health outcomes. "We suspect that genetics will be an initial gateway to drive awareness, but there needs to be a mechanism that will continue to drive awareness such as genetic counsellors or health coaches," said Vance Vanier, M.D., chief medical officer of Navigenics, a genomics technology company in the U.S.

Medical system sphere: Convergence brings new relationships, organisational models

During the past decade, many European systems have responded to demands from consumers for more choice. Rather than assign individuals to a particular physician, clinic or hospital, individuals have the option to choose among providers within

their regions. Increasingly, consumers are empowered with more information based on patient satisfaction, waiting times, and even cost effectiveness data.

In addition, systems are collecting and combining new data in an effort to link delivery practices to health outcomes. In England, QPACT links clinical outcomes data derived from general practices' Quality and Outcomes Framework (QOF) with Electronic Prescribing Analysis and Cost (ePACT), a prescribing practice database. This allows primary care trusts (PCTs), the local public sector payers, to track the relationship between prescribing and outcomes. The ability to demonstrate that generics produce similar outcomes to more popular, more expensive alternatives has enabled PCTs to build a strong case for clinicians to change their behaviours and reduce costs.

Combining prescribing and treatment data to look at the whole individual changes how relationships revolve around the individual. For example, "If obesity is a disease, we should tailor our treatment to this disease," said Peter van der Meer, member of board of directors at the Onze Lieve Vrouwe Hospital in Amsterdam. "Healthcare is not organised this way at the moment. Doctors cure the knees of patients with knee injuries, but if the cause of these injuries is obesity we should pay more attention to healing obesity."

A customised care framework will activate individuals and health systems toward new business and care models.

Healthcare systems are, essentially, playing catch-up to adopt innovations and trends in consumerism from other service industries. This is an enormous undertaking. Given that the healthcare industry is a vast, highly regulated and highly change-resistant infrastructure that has taken decades to build...it will likely take decades to modernise. Transforming the internal focus of the health system will mean re-engineering virtually all components of this infrastructure—communications systems, doctor-patient roles and responsibilities and, perhaps even most challenging, hard-wired habits and traditions. The overarching challenge is to carry out a shift from an old bureaucratic healthcare infrastructure to a new, smart healthcare infrastructure.

Building a smart healthcare infrastructure

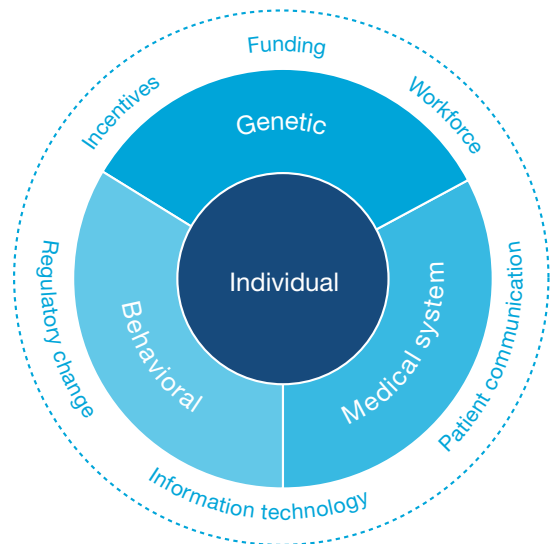
It is well accepted that digitisation is an essential component of rewiring the complex array of interactions and interdependent parts of the health system to accelerate the personalisation of healthcare. There are lessons from other industries that have faced digitisation of outmoded, lagging (and massive) infrastructure to become modernised. For example, just as electronic health records will lay the foundation for change in healthcare, so, too, the deployment power grids will interface smart meters that help consumers measure their own energy consumption. It is estimated that, globally, 250 million smart meters will be deployed by 2015, up from 46 million in 2008.⁵

The European Union has set as a climate change mitigation initiative an 80% penetration rate of smart meters. In a very similar way that electronic health records and other advances will promote two-way communications between patient and healthcare, smart grids will usher in an age of two-way communication between consumer and utility—supplanting the decades-old one-way communication model.

In a similar fashion, making the healthcare infrastructure “smart” will require a profound investment—and, as the currency of this infrastructure is health, not electrons—its build-out represents an even more daunting and significant challenge.

The customised care infrastructure is circled by six vectors that are enclosing care around individuals. (See Figure 6.)

Figure 6: Framework for customised care



⁵ Environmental Leader Popular Topics. “Global Smart-Meter Installations to Reach 250 Million Units,” Environmental Leader (November 2, 2009), <http://www.environmentalleader.com/2009/11/02/global-smart-meter-installations-to-reach-250-million-units/?graph=full>.

Incentives: Incentives are being tailored toward transparent, patient-centred goals that encourage partnership.

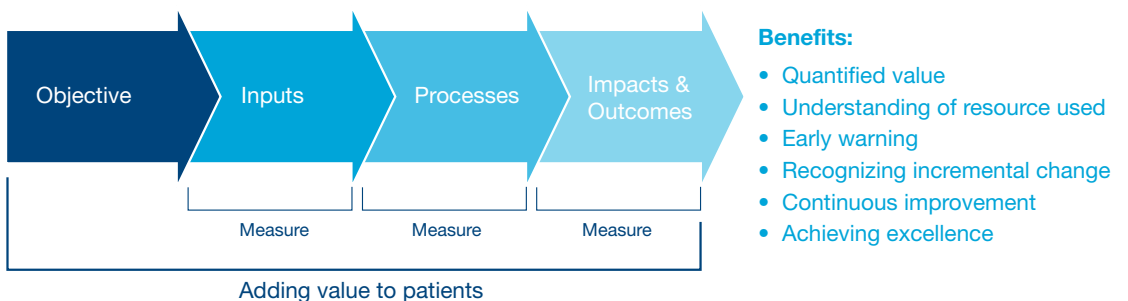
Health leaders surveyed by PwC overwhelmingly believe that funding methodologies need to adopt new and better incentives. As Jan Coolen, senior representative of the National Healthcare Patients Organisation in the Netherlands states: “The single-most important factor that will make change happen is the transition from compensation for production capacity units of health providers towards rewarding patient outcomes.” Three-quarters of health leaders surveyed favoured more incentives for physicians to follow clinical best practice guidelines. “Physicians are paid based on their treatment of the patient rather than on health outcomes. If physicians were paid instead, based on patients meeting goals, like weight loss and smoking cessation, they would more likely engage patients in order to achieve these outcomes,” said Eric Peterson, M.D., the director of cardiovascular research at the Duke Clinical Research Institute in North Carolina.

For example, “Some doctors treat too much, some do not treat enough. We need more monitoring. If you operate a lot this correlates

directly with hospital revenues. The system gives wrong incentives,” said Juha Teperi, Ministry of Social Affairs and Health in Finland. In the same vein, some hospitals are discharging patients too soon, and others too late. As much as one-quarter of heart failure patients are readmitted to U.S. hospitals within 30 days, according to a new U.S. study.⁶ When patients are discharged too soon without the right care coordination, they return to the hospital unnecessarily, driving up costs. On the other hand, when there is insufficient home care and skilled nursing capacity, patients are not discharged soon enough. That was the case in Scottish Highlands, where the NHS found that some patients waited more than six weeks to be discharged from the hospital because of funding or inavailability of a care home.

But, what incentives will best support making the care delivery serve the needs and preferences of the patient? Several public payers are moving toward payment structures that pool funding for care and enable flexibility in the model of care. Some countries are developing funding models that enable the patient to direct the use of pooled funds. Such a move measures inputs and outputs to create value for the patient. (See Figure 7.)

Figure 7: Managing performance means measuring inputs and outputs



⁶ Joseph S. Ross, et al., “Recent National Trends in Readmission Rates after Heart Failure Hospitalization.” *Circulation: Heart Failure, Journal of the American Heart Association* (November 10, 2009), <http://circheartfailure.ahajournals.org/cgi/content/abstract/CIRCHEARTFAILURE.109.885210v1>.

In 2010, the Netherlands will move to bundled physician-hospital payments in four diseases: diabetic, cardiovascular, chronic obstructive pulmonary disease (COPD) and heart failure. Currently, about one-third of hospital payment in the Netherlands is bundled through Diagnosis/Treatment Combinations (DBC), which cover all activities from the first specialist visit through to the final outpatient appointment. “We introduced a ‘keten-DBC’ for diabetes. It enables an evidence-based clinical pathway and reduces complications (like amputations, blindness),” said Robbin Thieme Groen, chief medical officer of Isala Klinieken, the largest private hospital group in the Netherlands. “The programme directs the total chain, from family doctor through interventions by the hospital. As the hospital, we ‘own’ this DBC, but we may want to have the family doctor run this ‘keten-DBC’ of diabetes care. This would enable an even more patient-focused and cost-efficient programme.”

Funding models that are based on performance change the financial assumptions for every sector and their relationships to other sectors. For example, hospital leaders have been incentivised to

“This has great potential for making delivery of healthcare more affordable, effective, and safer. While pharmaceutical companies have not fully embraced this concept, I predict that they will be compelled to do so in the next few years because the biological discoveries, many of which are useful immediately for their diagnostic or prognostic value, are coming at an ever increasing pace and will be hard to ignore.”

To date, pharma has focused on its piece of the spending pie, which ranges between 10% and 25%, depending on the country. However, many companies are starting to think about diseases differently by partnering with other organisations on products and services to achieve health outcomes. In the U.S., accountable care organisations (ACOs) are being developed as pilots for Medicare under a financial structure of shared bonuses. Physicians and hospitals would be accountable jointly for the cost and quality of care to a set population.

Creating incentives for patients is another problem for health leaders. More than 60% of health leaders surveyed said there needs to be more incentives for patients to be compliant with their medications. And, when asked what is the single greatest obstacle

“Without engaging the users of healthcare as responsible partners in the design and consumption of services, our system will fail,” said noted British economist Julian Le Grand.

show efficient use of their hospitals. What happens when they are incentivised to keep patients away? The same is true for drug makers that are incentivised to sell more product. “The rapid pace of genomic technologies is making almost daily advances in identifying the set of genetic determinants that contribute to disease and differential response to treatments on a personalised, individual basis,” said Richard M. Myers, Ph.D., president, director and faculty investigator of the HudsonAlpha Institute for Biotechnology, Huntsville, Ala.

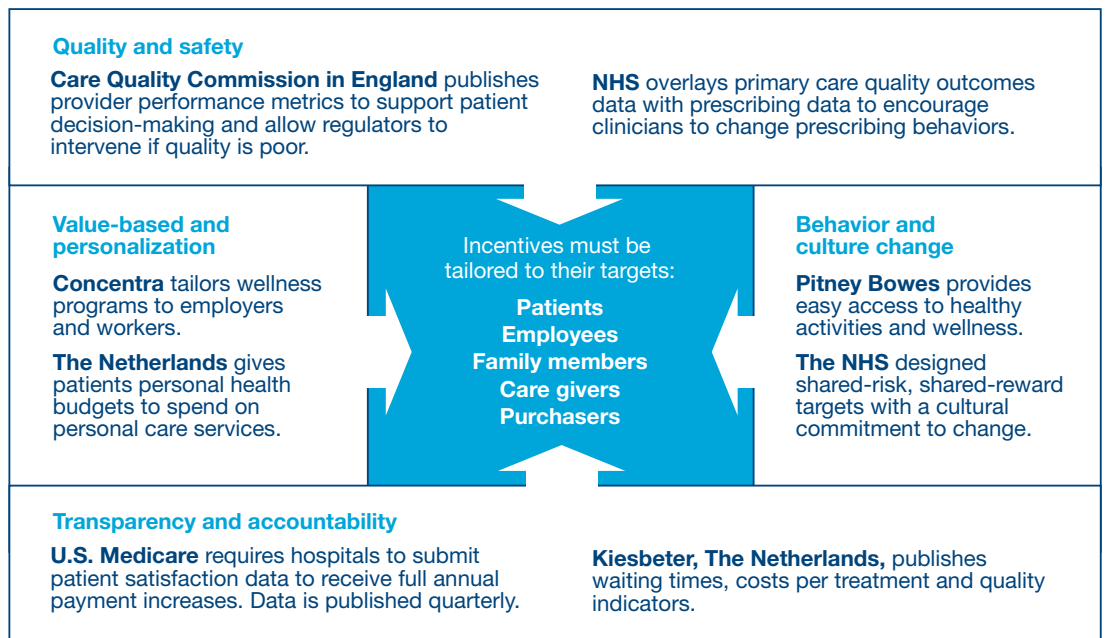
to individuals managing their care, the top answer was “lack of willpower.” One emerging practice that could shift the current incentive structure is the personal health budget. In retailing and banking, customers have a direct financial relationship with the service provider. In healthcare, they do not. But, many think they should. “The greater the number of agents, no matter how apparently benevolent, between the user/patient and the service deliverer, the less likely services are to be truly user-focused and responsive,” said Julian Le Grand,

professor of health economics at the London School of Economics and former senior health policy advisor to Prime Minister Tony Blair. “Without voice or choice, the user is disenfranchised from the whole debate about the quality and nature of services they must use.” Both insurance and tax-based systems introduce proximity barriers, which limit individual influence on how and what services are financed and delivered. “Without engaging the users of healthcare as responsible partners in the design and consumption of services, our system will fail,” he added.

The concept of personal health budgets is under way in the Netherlands and being piloted in England. In the Netherlands, an insurer determines how much an ill or disabled person will need for various personal care, nursing, and support services. The individual is offered 75% of that amount to spend as they wish rather

than using the government-provided services. The government believes that individuals will make wise choices when they are spending the money themselves. A majority of individuals who have used the budgets say the quality of care purchased by them was good to very good and 90% would rather purchase their own care than go through the government for it.⁷ The programme has been so popular that the government has budgeted \$4.3 billion by 2011, up from \$1.2 billion in 2006.⁸ In England, the Department of Health and the NHS launched a three-year pilot in 2009, testing different methods and applications for personalised budgets. The pilot will test notional budgets, third-party budget holders and direct payment to see which is most effective. It will also examine whether Primary Care Trusts can monitor and regulate personal budgets to maintain quality standards, while relinquishing ultimate choice and control to individuals.

Figure 8: Incentives are multi-dimensional... ..and so are the targets of incentives



⁷ Per Saldo News on the PGB, “NZa evaluation of the PGB in the Insurance Act,” Per Saldo, <http://www.pgb.nl/persaldo?waxtrapp=tteqeJsHcwOhcPjBC>
⁸ Dutch Health Care Performance Report 2008, June 24, 2008, from the RIVM website, <http://www.rivm.nl/vtr/root/o33.html>.

Regulatory reforms: Government officials are balancing the need for societal requirements, market reforms and cost control.

Governments write the regulatory frameworks for industries, and too often those rules do not keep up with the changing requirements of the market. Many countries believe their health systems need to remain innovative and that competition can help accelerate the transformation to being patient-centric. “Commercialisation, free market and competition can be a good solution,” said Davout Yean, general manager of TaiKang Life Insurance in China. “Government should encourage investment from private sectors in healthcare and give private hospitals a fair environment to compete with public hospitals.”

Many of the world’s largest economies are tackling major regulatory reforms that will alter how medical delivery organisational structures and funding mechanisms can drive personal behaviours that impact health costs. Because governments spend so much of their budgets on healthcare, regulatory reform is a constant process. Health leaders in Europe surveyed by PwC were evenly split on whether the industry needed more or less regulation. In the U.S., where a major debate on health reform enveloped the Congress in 2009, only 30% of health leaders said regulation needs to increase some or a lot; 36% said it needs to decrease some or a lot. The remainder was neutral.

One of the key contours of the reform debate focuses on whether governments or markets do a better job on health improvement. Both sides argue that their methods benefit the individual. In practice, a blend of the two is most effective, and many are pursuing public-private partnerships to accelerate improvements. “The social movements aimed at individual

and community behaviour towards health are only partially successful; there is a need for newer models of participation from government, society and the corporate world,” said Nael Zaidan, M.D., vice chairman, of Private Hospitals Association in Jordan. Experience with liberalisation in different countries and from other industries shows how crucial it is to explicitly and carefully determine and define the public interests associated with care provision that need to be safeguarded, as well as the design of the regulation of the markets. The Netherlands’ ambitious reform demonstrates the delicate balance between the flexibility of the regulation to adjust and accommodate to the events that occur along the way, and the stability to stick to the principles.

Trying to emerge from the recession, governments are taking this opportunity to make long-term investments in healthcare. The biggest investment is being made by China, home to one-fifth of the world’s population. In late 2008, the government announced an economic stimulus in which more than one-quarter—850 billion yuan (124 billion USD)—would be spent on healthcare over three years. For a country that spends only 5% of GDP on healthcare, the investment represents a doubling of health spending, making China a key laboratory for health reform.

Reform discussions are increasingly wrapped around metrics that are patient-centric, but population-based. For example, the U.K.’s National Institute for Health and Clinical Excellence (NICE) publishes clinical appraisals about which treatments should be paid for, with one consideration being the range of acceptable cost effectiveness in quality-adjusted life years (QALYs). The Netherlands also uses QALYs to make some coverage determinations. In 2009, the U.S. devoted \$1 billion of the stimulus funding to comparative effectiveness research, although it is unclear whether that

will be tied to QALYs. At the same time, policy makers worry that personalisation is evolving beyond population-based metrics because what works for the majority does not work for all.

Regulatory reform is addressing behavioural, genetic and medical system influencers:

Behavioural: Change is public-private sandwich

As obesity rates grow across the globe, governments are issuing and enforcing new rules about food labelling, product placement and food preparation.

However, governments increasingly understand that behavioural change depends on partnerships with private industry. When PwC surveyed global health leaders about outside influences that were having a positive or negative effect on population health, the most negative response was to grocery stores and supermarkets. One answer to this is tighter regulation; another is partnerships with the business community. In the Netherlands, the government has declared a goal of having their youth be the healthiest in Europe in five years. To accomplish this, they have partnered with the food industry, the business community and retailers to achieve common health goals. In England, the NHS launched Change4Life, which encourages families to adopt healthy eating and exercise practices. A cornerstone of this initiative has been partnering with companies like the British Heart Foundation, ASDA and Tesco (two of the largest supermarket chains), British Gas, the Food Standards Agency and Kellogg's. All are using Change4Life brand assets and tools to help them create their own health promotion activities. Sub-brands have spun off, such as Dance4Life, Cook4Life and Bike4Life. As a result, organisations that were previously on the

peripheries of the health industry, or indeed, at odds with them (like supermarkets and food manufacturers), are being united under a common health promotion banner.

Genetic: Getting regulators on the same page

Unfortunately, regulatory reforms suffer from the same silos as the industry itself. Hospital regulators regulate hospitals, drug regulators regulate drugs. Few look at the system as a whole. In a converged, customisable world, regulators must look at how different aspects of the system can work together to improve patient health. "There is no single door at the FDA for bringing in both a drug and a diagnostic to guide its use. Diagnostic tests and drugs are reviewed in two entirely different centres and under very different rules," noted Raymond Woosley, M.D., Ph.D., president and CEO, Critical Path Institute (C-Path) in the U.S.

Globally, more health leaders are talking about a common regulatory regime for all healthcare products and services, rather than separate regimes for pharmaceuticals, medical devices, diagnostics and the like (as is presently the case in most countries). The next step would be a single global system, administered by national or federal agencies responsible for ensuring that new treatments meet the needs of patients within their respective domains.

Given the financial sustainability challenges in health systems around the world, public and private payers are exerting pressure on the academic community as well as pharmaceutical and life science companies to achieve higher returns on investments in research. Venture philanthropy, spearheaded by specific disease foundations, is directing research as patient advocacy groups become disenchanted with the slow progress on cures.

Medical system: Integrated sums are greater than their parts

Regulators are looking at how to make the parts of the health system work better together through information technology exchange standards and payment reform. “Collaboration between ministries is also important. Health and education agencies need to coordinate better to decrease obesity,” said David Levine, president of the Montreal health agency in Canada.

For example, Australia is moving toward a \$43-billion National Broadband Network on which it is estimated one-fourth of the bandwidth would be dedicated to the health sector. Australian leaders see the network as crucial for a citizen-centric health system. The Australian National Health and Hospitals Commission stated, “Making the patient the locus around which health information flows is critical and will require a major investment in the broader e-health environment. Electronic health information and healthcare advice will increasingly be delivered over the Internet. Broadband and telecommunication networks must be available for all Australians if we are to fulfil

the real promise of e-health.” In the U.S., the federal government committed to invest \$36-billion in EMRs with a notable string attached: they must be interoperable.

In addition, regulators continually face balancing regulation that protects incumbent health organisations with new entrants that offer competition and innovation.

In Jordan, critics say there is no organised effort to support R&D and innovation in the pharmaceutical industry. As Hanan Sboul, the Secretary General of the Jordanian Association for Pharmaceutical Manufacturers explains, “There are currently around 80 pharmaceutical patents owned by Jordanian pharmaceutical companies, yet very few, if any, were commercialised or succeeded in hitting the market mainly because pharmaceutical companies do not have the leads or the experience to commercialise their patents. There should be an organised effort to assist them in identifying and linking with venture capitalists; success in commercialising some of these markets will be attractive for other inventors to follow.”

Funding: Payment and financing are redistributing funding from sickness to wellness services.

The move to coordinated care pathways is the beginning of a shift of funding from treating sick patients to keeping them well. However, to succeed in these models, stakeholders must be familiar with how they can work seamlessly together. For example, when the NHS asked for bids for its integrated care pilots, stakeholders had to show that they already “had a proven track record of working together, therefore a better chance of succeeding,” said Gary Belfield, the acting director general of commissioning and system management for NHS’ Department of Health. “We did not want the first year of the pilot spent building relationships, only to figure out they did not work.”

When the NHS asked for bids for its integrated care pilots, stakeholders had to show that they already “had a proven track record of working together, therefore a better chance of succeeding,” said Gary Belfield, the acting director general of commissioning and system management for NHS’ Department of Health.

The traditionally iconic symbol of the health system in a community is the hospital, which is built for acute care, not chronic disease. While technology allows more services to move from hospitals to outpatient, home and clinic setting, hospitals and communities are often reluctant to abandon their capital-intensive structures. “Home care service will need to ramp up; we have spent far too little in recent years on home care. We have spent way too much on hospitals and doctors; these are very expensive forms of delivery. Home care funding has increased 17% over the past two to three years, but this is still far short of where it should be,” said Linda Miller, Deputy Minister of Health, Alberta, Canada.

However, with limited funding, the spending pie will have to be reallocated. “It is essential to have an incentive model to assist providers in promoting prevention,” said Zaid Al Siksek, CEO of the Health Authority Abu Dhabi. In some cases, this means expanding the traditional physician team to include nurses, nutritionists and others.

The Australian Commonwealth and State Governments conducted coordinated care trials, which aimed to improve care for people with chronic and complex health care needs. These trials involved the pooling of commonwealth and state funds to local management using a methodology to estimate the cost of caring for these individuals. The Funds Pool was intended to be the single budget from which the health and community care expenditure of all trial

participants would be funded, including the costs associated with their care planning and service coordination.

Employers are increasingly recognising their healthcare costs (private insurance premiums, absenteeism, workers’ compensation) as more than a cost centre, but rather an investment that can be a differentiator in competing for talent. One leader is the U.S.-based corporation Pitney Bowes, where its onsite cafeterias provide reduced-cost ‘fresh and healthy’ items that meet caloric, saturated fat and sodium criteria. The manufacturing company also started a ‘walkstation programme’ that enables employees to walk on a treadmill while working. The

station is in a private room, equipped with a laptop docking station and telephone. Pitney Bowes' approach is focused on encouraging its employees to engage in healthy behaviours that yield greater long-term benefits versus short-term fixes. For example, the company's insurance recently stopped covering bariatric surgery because of associated complications, and workers who had the surgery were not keeping the weight off. As an alternative, the company contracted with a residential weight loss centre to help obese employees take control of their own health.

Eligible employees can volunteer to go on short-term disability and live at the residential weight loss centre for four weeks. A representative from Pitney Bowes said, "We see the results of the residential programme after they return; it is a catalyst to healthy behaviours and commitment to a healthy lifestyle." Pitney Bowes also started 'Change One,' a weight management programme that targets individuals with a Body Mass Index (BMI) > 27.⁹ At the start of the 2009 Change One programme, 19% of participants met the U.S. Centres for Disease Control guidelines for physical activity. By the end, 42% met the guidelines and only 2% were not exercising.

What constitutes a healthy work environment varies, depending on the needs and wants of each employer group and their employees. "The culture and workforce of each company is unique, and their health needs can vary substantially from one employer to another," said Kris Covey, vice president of Concentra, a U.S.-based company that operates more than 500 community-based medical centres and worksite clinics. "For example, the communication and support tactics for a trucking company may likely differ compared to a high-tech company like Cisco. We typically see employers taking an evolutionary approach versus a revolutionary approach toward programming. What this means, is most frequently employers start their programmes through an awareness campaign, which includes a 'Know Your Numbers' component, then add support and health intervention strategies over time. As a programme matures, employers are in a better position to drive participation and ramp up the intensity of campaigns with more backing from their employees."

⁹ Brent Pawlecki, "The Culture of Health" (PowerPoint presented at the Obesity Conference, September 2009).

Patient communication: Individuals benefit from better information, education and communication materials that support shared decision-making, concordance and choice.

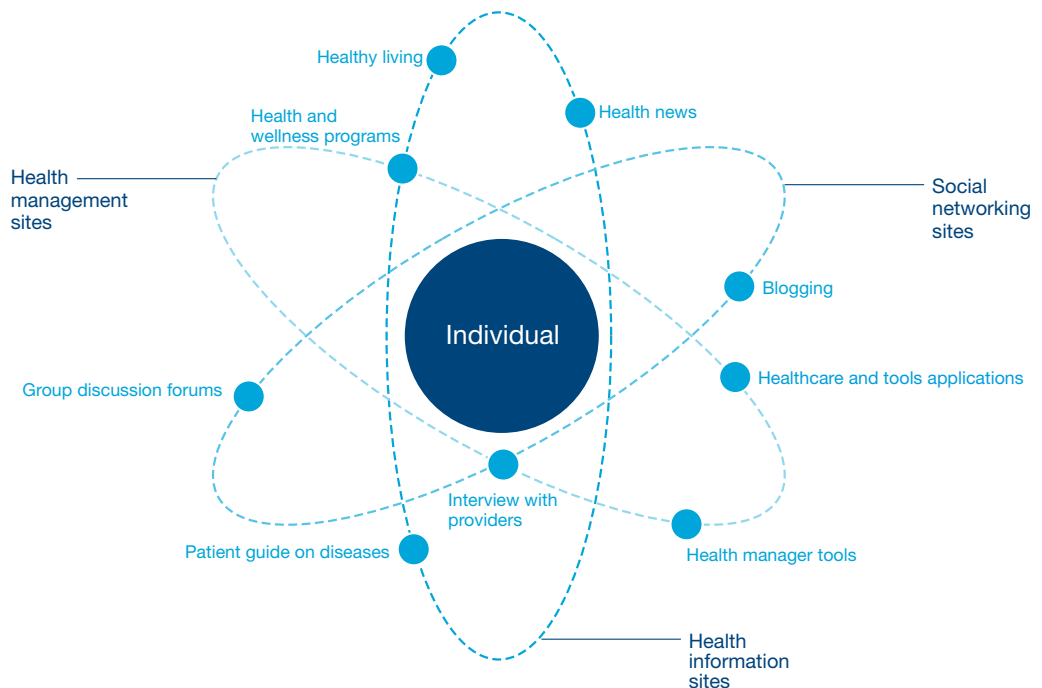
When PwC surveyed global health leaders about the most effective strategy to engage individuals in their own health, the top answers revolved around education and communication; they were health education, greater awareness and increased patient responsibility. The fourth was better communication, but the ordering of these strategies shows that health leaders know there is a lot of education and relationship building needed to support individuals.

Healthcare is behind many industries at segmenting their customer populations, understanding customer preferences, and designing products and services around those preferences. Some providers are

segmenting patients by technology skill-set so they can better meet expectations and achieve outcomes. “Some patients say, ‘why can’t I use e-mail in my bed,’” said Terri Nuss, vice president of patient centredness at Baylor Health Care System in the U.S. “Gen-Xers want kiosks where others want in-person service.” Baylor is also looking to involve patients and their families even more in care, by allowing them—for example—to call rapid response teams within the hospital. Rapid response teams are critical care teams called to the bedside when a patient’s condition is rapidly deteriorating.

Online databases, social networking and individual communities are creating new ways to share information that individuals can understand. In the U.K., a new regulatory body, the Care Quality Commission, collates and publishes data from patient and NHS surveys, providing one-stop shopping for online patients.

Figure 9: Convergence of social networking and health information sharing websites



Source: PricewaterhouseCoopers' Health Research Institute

Canada also is publishing more information online. Notes Linda Miller, deputy health minister for Alberta, Canada: “Information is key to moving to a patient-centric model. Right now, the provider has access to the information; the patient’s understanding is very limited. Providers have always dominated the system because they have the power of information. Give people access to data as well as access to the tools. This is critical to manage their care.” However, health literacy varies widely. The Canadian Council on Learning reported that 60% of adult Canadians lack the capacity to obtain, understand and act upon health information and services and to make appropriate health decisions on their own.¹⁰

Clinicians who communicate better with each other could end up communicating better with their patients. In the U.S., technology connector Sermo facilitates online discussions among physicians

to see that sort of transparency in every industry, not just healthcare, but healthcare seems the most topical because health is something we care about so much. It is the most precious thing we have,” said Jack Dorsey, Twitter’s co-founder. For example, some U.S. doctors have used Twitter to give real-time updates to patients’ families during surgery. From medication reminders that are texted to teenagers to video games that encourage seniors to get up and dance, technology is changing behaviours. Wii Fit was one of the top five games sold globally in the \$52-billion video game market in 2008.

Improved patient communication could accelerate research for new drugs. One in five clinical trials sponsored by the National Cancer Institute in the U.S. is abandoned because of low enrolment.¹¹ Enrolment rates across the U.S. have dropped from 75% in 2000 to 59% in 2006, and retention rates have fallen from

From medication reminders that are texted to teenagers to video games that encourage seniors to get up and dance, technology is changing behaviours.

on such topics as treatment options for individuals, managing their practices and family member health advice. Sermo founder and CEO Daniel Palestrant, M.D., notes, “patients benefit from the overall dissemination of information available, while physicians are eroding information asymmetry to enable better decision-making with their patients. Physicians and patients will continue looking for an efficient marketplace to access such information.”

Twitter, a social networking site—with user numbers estimated in the millions—has transformed the news and entertainment media and is already delivering a new level of transparency within healthcare. “I’d like

69% to 48% during that same period.¹² Awareness of trials must increase to advance new cures and treatments. Pharma companies that partner with trusted health organisations and community groups raise awareness, gain credibility and make individuals more comfortable about participating. Teaching hospitals are willing partners that appreciate the prestige research brings to them. “Having a technologically advanced hospital will not be enough to attract and retain talent,” said Daniel Bergin, executive project director at Sidra Medical and Research Centre in Qatar. “It is only a piece of the puzzle. Research is another critical piece.”

10 Canadian Council on Learning Reports and Data. “Health Literacy in Canada,” Canadian Council on Learning, <http://www.ccl-cca.ca/CCL/Reports/HealthLiteracy/HealthLiteracy2007.htm?Language=EN>.

11 Scott Ramsay and John Scoggins. “Commentary: Practicing on the Tip of an Information Iceberg? Evidence of Underpublication of Registered Clinical Trials in Oncology.” *The Oncologist*, Vol. 13, No. 9, 925-929 (September 2008) <http://theoncologist.alphamedpress.org/cgi/content/abstract/13/9/925>.

12 The Centre for Information and Study on Clinical Research Participation Scholarly Articles. “Public Confidence and Trust Today,” The Centre for Information and Study on Clinical Research Participation. http://www.cisrcp.org/professional/sch_articles.html.

**Information technology:
Interoperable digital records are the connective tissues that will support individuals to take a collaborative role in their care.**

By 2020, health systems will move from paper records controlled by the industry to digital ones controlled by patients. Opt in, opt out, consent, privacy and security, legal ownership of the record and legal protection for clinicians making decisions using information controlled by the patients are all under debate country by country.

Initially, EMRs may just replicate paper records. But with proper implementation, they will change the way individuals interact with caregivers and vice versa. By 2020, most industrialised countries expect to have “interoperable EMRs.” The architecture and amount of interoperable information intended to be shared between

Eighty-five percent of health leaders said making EMRs available to clinicians would make their systems more efficient by reducing duplication; 71% said making them available to patients would make them more efficient via enhanced self-management. And the eventual possibility of more effective clinical decision making, improved safety and quality and health outcomes is the larger aspiration. Forty-two percent of health leaders surveyed said EMRs would be operational in their countries within five years. According to Ilias Iakovidis, acting head, Information and Communication Technology (ICT) for Health Unit for the European Commission, Belgium, “Most of the 27 European Union (EU) Member states have an active political agenda for integrated electronic health record (EHR), but fewer than a dozen countries have regional or national scale EHR in routine operation. For example, Scandinavian countries embarked on e-health projects in the early 1990s and

Eighty-five percent of global health leaders said making EMRs available to clinicians would make their systems more efficient by reducing duplication; 71% said making them available to patients would make them more efficient via enhanced self-management.

care providers varies widely around the world. The investment in EMRs by governments in the U.S., Australia and the U.K. alone will total \$100 billion in the next five years and create a digital backbone that can support patients and their caregivers. The challenge of implementing large-scale use of EMRs is enormous. The landscape is replete with examples of waste and missed expectations, but lessons are being learned about the importance of delivering concrete benefits to the clinician and patient end users.

have achieved high levels of connectivity and use of information technology, ahead of most other countries, including the U.S. The challenge now is to use ICT to transform data and information into knowledge and help the patients in coping with their health conditions or risks,” Iakovidis added. Health leaders sense that EMRS will change the competitive landscape.

“The use of IT in healthcare is behind the times. Almost all sectors utilise IT better than the healthcare industry. But, the creation of EMRs will jumpstart the industry,” said

Chip Kahn, president and CEO of the Federation of American Hospitals, whose member companies represent about 1,000 hospitals in the U.S. In addition, countries that have been viewed as far behind in healthcare progress are catching up quickly by investing in EMRs.

Several interviewees in the PwC survey noted how the healthcare industry has lagged behind other industries in adopting these innovations. “The banking sector is a reference, as a sector that was transformed many years ago and has placed customers at the centre of all its operations, strengthening commercial aspects in a highly intelligent manner,” said José Luis Betrián, primary care business unit director of Schering-Plough, Spain. This lag is closing though, as evidenced by new entrants to the health market bringing tools from other industries into the realm of healthcare, especially in the areas of patient (and even medical student and professional) education, advocacy and community-building.

“In Siberia, I visited a hospital with complete electronic medical records that were connected to all of the satellite clinics that the hospital had. There was a large board when you walked in, that had all the scheduling and was electronic,” added Dr. Gerard Anderson, professor of health policy and international health at Johns Hopkins Bloomberg School of Public Health in the U.S.

EMRs and the devices they connect to will transfer tasks, responsibilities and decisions—previously locked within the domain of hospitals, physicians and nurses—to patients and their family members (or ‘health stewards’). Making

the patient the keeper or home of their own personal health information (via EMRs and other channels) “shows the direct need of the consumer to monitor and manage their personal health information,” said Duke’s Peterson. This transfer is coming about as a result of technological and human behavioural changes. “Provide a backbone of data liquidity so that other tools can assist you with health literacy,” said Adam Bosworth, founder of a health services start-up, Keas, and former vice president of GoogleHealth in the U.S. “We will learn to move to the Internet for almost all transactions.” As individuals have access to their own personal health data, they will start to demand that their treatment more clearly match their needs. They will demand to know their options and be included in treatment decisions.

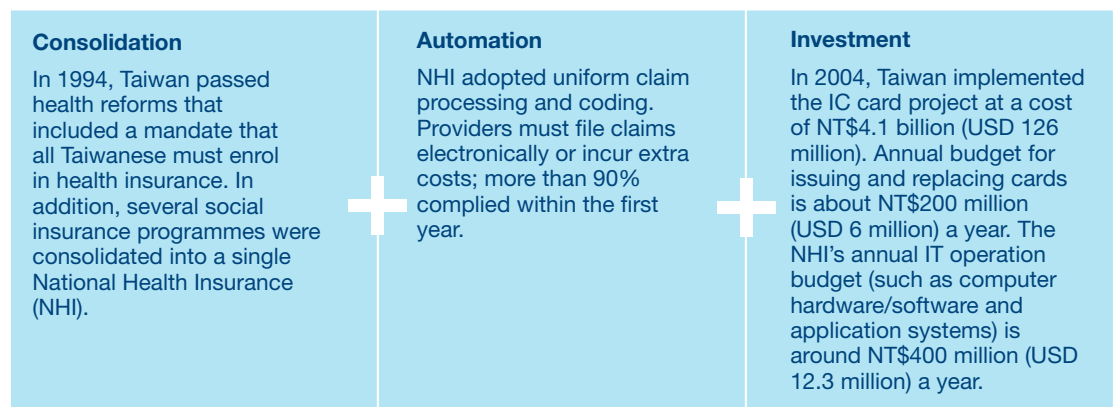
Jumping quietly to the vanguard of this push in the U.S. is the Veterans Health Administration (VA)—with some 8 million patients in 153 hospitals—which has already digitised health records. Patients carry out tasks such as measuring weight and heart rate with free devices given by the hospital and then input the data into their electronic folders, enabling more regular and more frequent monitoring and, theoretically better care. The benefits from this programme, according to the VA, have been realised already—a 25% drop in hospital admissions and 20% shorter hospital stays.

Countries with national health insurance schemes, such as the U.K. and Taiwan, have moved faster on electronic medical records. For example, Taiwan moved to a single insurance system in 1994, electronic billing in 1995, and smart cards that are tied to EMRs in 2004. (See Figure 10.)

This system provides an information exchange that benefits both patients and providers. “Before the IC card project, the Bureau of National Health Insurance (BNHI) built a data warehouse system to do personal profile analysis from monthly claim data to monitor the status of medical resource utilisation,” said Cheng-Hua Lee, M.D., vice president and CIO of the BNHI. “There was at least a six-month time gap for this monitoring mechanism. As the BNHI implemented the integrated circuit (IC) card project, the Bureau monitored the utilisation data on a daily basis.”

The move from desk-top to personal mobile computing has accelerated the need for integration among billions of personal mobile devices that can transmit and customise health information online. Web-based health portals, webcams and social networking have already brought about heightened creativity and mass customisation. These channels and the phenomenal adoption of the devices that connect them to patients (mobile phones, iPhones and Blackberries) will likely lead to the further shift in healthcare from traditional stakeholders to patients—and perhaps more

Figure 10: How Taiwan connected its health system to give every patient a ‘pocket’ medical record (the IC card)



Put patients at the centre of care...

Patient empowerment: All 23 million Taiwanese carry a ‘pocket’ medical record that contains information on the last six medical visits, prescriptions, allergies, organ donation willingness and vaccinations. Providers must upload info to the IC card within 24 hours of treatment. NHI supplies an interface device that writes data onto each card.

Efficiency: Use of the card reduces waste and fraud. Outpatient visits dropped by nearly 10% since implementation.

Care coordination: All providers have access to the same information and can link to more details. Prescribers can avoid drug duplication and interactions.

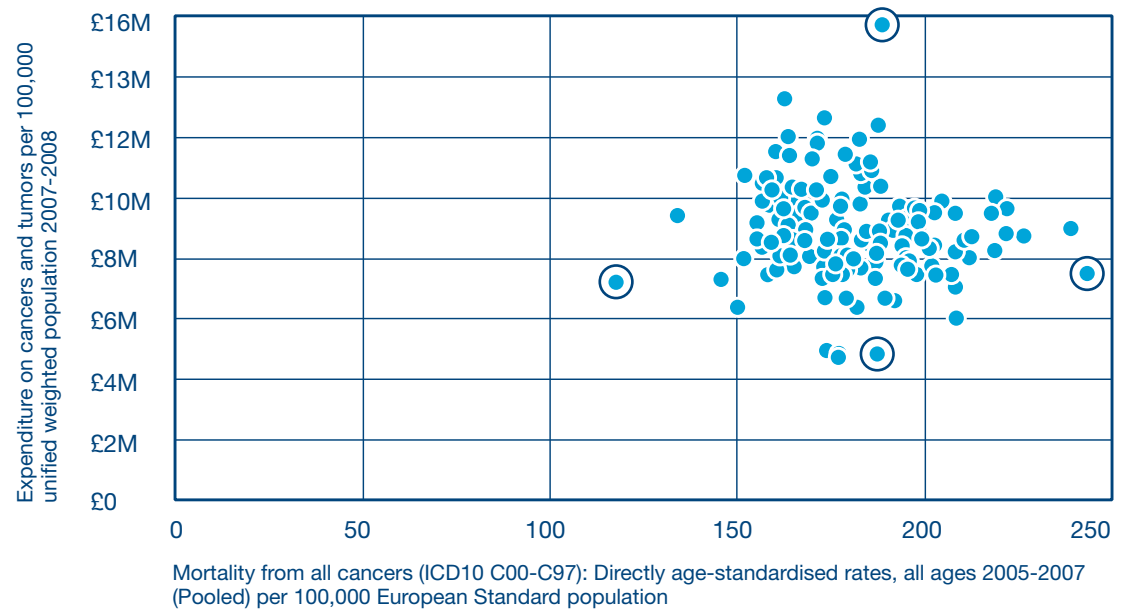
important to communities of patients. “The whole medical history can be stored on a cell phone,” added Koert Pretorius, CEO of Mediclinic in South Africa. In emerging countries, the use of mobile phones has leap-frogged older technologies, bringing healthcare to underserved populations. “From remote locations, patients can send certain tests, such as EKGs and X-rays, through their cell phones while travelling. Such advanced technology is not even available in developed countries,” said Denis Garand, a Canadian actuary and healthcare consultant, who has been involved in micro-insurance projects in developing countries such as India, Bangladesh, and several African countries.

Two-thirds of global consumers surveyed by PwC said they preferred electronic records to paper ones. When Hawaii’s largest insurer offered online physician consults in 2009,

1,000 patients responded within the first five months.¹³ Virtual connectivity platforms can be more cost effective than traditional ‘bricks and mortar’ infrastructures. Noted Dr. Adolfo Rubenstein, head of service for family and community medicine at the Hospital Italiano of Buenos Aires, Argentina, “The private system has to deal with a better informed community, on illnesses and treatments, using the resources the Internet offers.”

An avalanche of electronic health data is already supporting new reimbursement models. For example, the NHS has introduced programme budgeting that compares spending and outcomes among its Primary Care Trusts. Figure 11 shows the relationship of spending on each Trust’s cancer patients to patient mortality. Outliers for both spending and mortality are circled. This kind of analysis allows health systems to go beyond the crude metrics of how

Figure 11: Cancers and Tumors—mapping of PCT expenditure to mortality rates, 2007-2008



Source: PricewaterhouseCoopers

13 Jammed Access, PricewaterhouseCoopers’ Health Research Institute, July 2009.

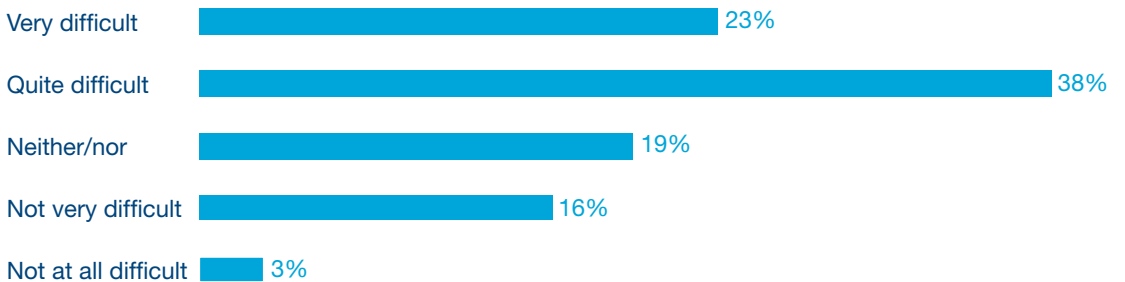
much is spent on hospital care or drugs. It brings the analysis closer to what can be expected to be spent on cancer patients, and what that spending produces. At the same time, applications like this can seed policy discussions about research priorities.

Regulatory reform is increasingly focused on government standards that promote interoperable IT networks. Approximately two-thirds of HealthCast global health leaders surveyed found electronic information sharing across their health system difficult. (See Figure 12.) However difficult, incentives are moving organisations toward integrated information platforms that streamline exchange of information to consumers.

But privacy is a rising concern, according to 90% of global health experts. Only one-third of consumers surveyed think data protection in their country is adequate for protecting health data. In England, the NHS has developed Connecting for Health Directorate, a centralised source for sharing

health information. Connecting for Health preserves medical records in a 'data spine,' a national database containing information on all patients. Only authorised NHS staff are allowed to access it through smart cards and personal identification numbers.¹⁴ Access to information is audited to ensure security.¹⁵ On the other hand, the National Health Service in Scotland has taken a scaled-down approach. It shares data on medications and allergies, deemed useful in case of emergencies. By staying within health system stakeholders' and individuals' comfort zones, the Scottish government was able to demonstrate value-add and instil confidence in the health information exchange process. Taking the first step and keeping it simple allowed the eHealth Directorate, a division of the Scottish Government Health Department, to proceed with further data sharing. In the U.S., the federal government is developing standards, certifications and privacy collaborations to ensure privacy and security.¹⁶

Figure 12. How difficult is electronic information sharing across your system?



Source: PricewaterhouseCoopers' Health Research Institute Global Health Leader Survey

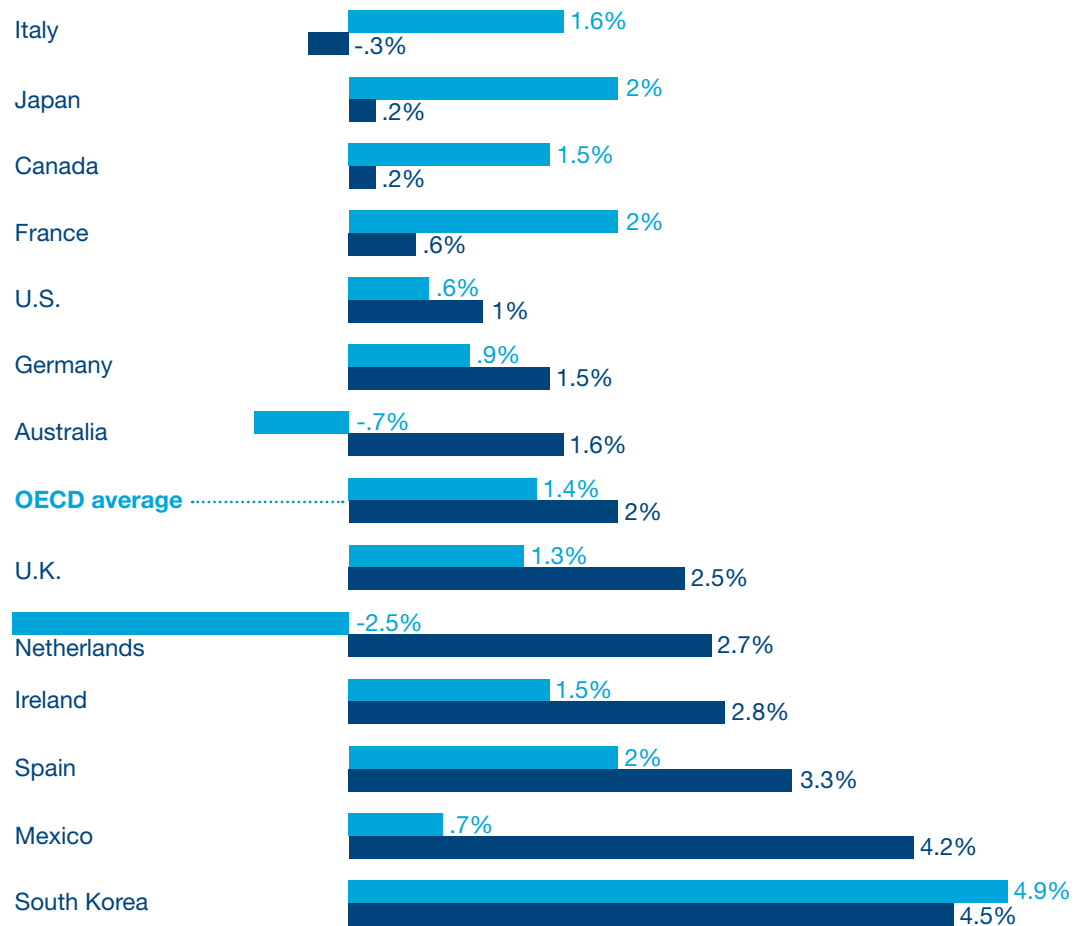
14 NHS Connecting for Health Resources. "Spine Fact Sheet," NHS Connecting for Health, <http://www.connectingforhealth.nhs.uk/resources/systems/spine-factsheet>.
 15 NHS Connecting for Health, Systems and Services. "Principles of information security," NHS Connecting for Health, <http://www.connectingforhealth.nhs.uk/systemsandservices/infogov/security>.
 16 Glen F. Marshall. "Privacy and Security Technology Standards: An Update from HITSP, CCHIT and NHIN" (Presentation from the Health Information Security and Privacy Collaboration (HISPC) National Conference, Bethesda, Maryland, March 5, 2009. http://www.rti.org/files/hispc/HITSP-CCHIT-NHIN_Session_2-20.pdf.)

Workforce: New models allow for greater flexibility and effectiveness to care for individuals.

As the demand for health services has grown, so have global workforce shortages. These shortages, along with the move towards coordinated care and incentive-based payment, break down traditional delivery hierarchies and create new roles.

Many countries are investing in the education of more and more doctors and nurses. (See Figure 13.) Yet, the optimal number of clinicians needed is debatable because current processes are inefficient and siloed. Shortages will always exist in the absence of new models that emphasise coordination of care. However, healthcare professionals often feel threatened by new models. As a result, new models can be disruptive and nurture a culture of

Figure 13: Average annual growth rate of physicians and nurses in OECD countries, 2000-2007



Source: Organisation for Economic Co-operation and Development Health Data 2009

■ Nurses ■ Physicians

depersonalisation—running counter to patients’ demands for customised care and services. While technology is enabling customisation, people will remain at the heart of healthcare.

As clinicians and patients rely more on shared repositories of electronic data and knowledge, medical expertise and accountability can be more readily shared. “Today, neither the doctor nor other professionals can declare supremacy in the field of knowledge and control. Without any doubt, the forces of change are centred on how to strategically access knowledge,” said Gabriel Pedetta, secretary of health programming for the Province of Córdoba in Argentina.

Governments are increasing funding for primary care, enabling payments for allied professionals and others who can perform primary care tasks, and new funding models are paying for care coordination and coaching tasks. In the U.S., the agency that advises Medicare has promoted a new system that boosts payment for primary care, but only to physicians who primarily perform those services. The methodology is to encourage more physicians to focus on primary care and discourage specialists from performing those services.

New entrants partner with incumbents to offer virtual training and education. The University of Auckland in New Zealand, for example, has created a virtual medical centre, or training space, within SecondLife, an online 3D virtual world, for its medical students. Its goal is to provide remote clinical simulations for students in rural areas that teach clinical procedures in multiple situations. The patient avatars are operated by clinicians, while students practice problem-solving and decision-making in an immersive and safe environment. In India, one health leader envisions a virtual medical school that caters

to global needs. “Medical education and treatment in India costs 10% of what it costs in the U.S.,” said Kushagra Katariya, M.D., chief executive of Artemis Health Sciences, which is developing the school in Gurgaon, India. “Why can’t a professor of medicine from Harvard or Stanford give a lecture virtually? A virtual school can be a huge advantage. There is no need for med school to be so expensive.”

Little progress will happen, however, with clinical licensure laws that inhibit flexibility. The HealthCast global health leader survey suggests clinical professional licensure laws may be ready for review: 58% of respondents anticipate a relaxation of the scope-of-practice laws by 2015. However, this issue differs largely by region. For example, in the U.S., 72% of health leaders agreed that a relaxation would take place. In more than half of U.S. states, nurse practitioners do not require physician supervision and are allowed to set up independent practices. “The improvement of the health system depends on a better division of labour in the medical/nursing area,” said Christa Tischer, former Nursing Director at Klinikum Augsburg, a German hospital. Professor Andrew Wilson, deputy director general, Policy Planning and Resourcing Division of Queensland Health in Australia explained, “A key determinant of health service capacity is the size and quality of the clinical workforce. Australia has set very high standards for the training of its health workforce, which has consequences for supply of clinical staff. Consequently, Queensland Health is looking at ways to extend the capacity of its clinical workforce. The physician assistant model is one approach which is being tested.” Added Michael Flemming, managing director of Life Healthcare, a hospital system in South Africa: “Computers have taken over many of the functions of the pathology specialist.”

What this means for your business

Health systems will use
five touchpoints to
engage individuals

A toolkit for change

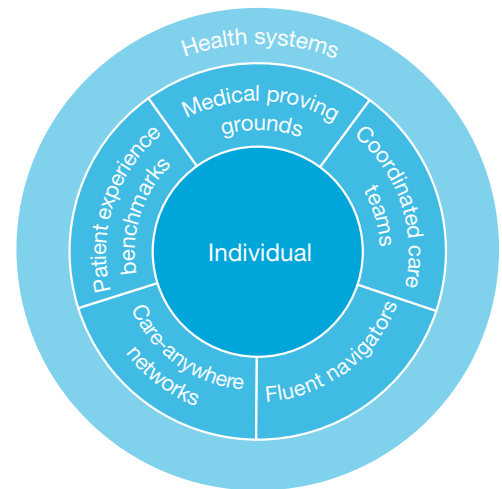
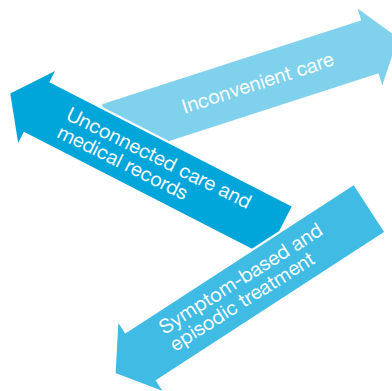
The 2020 health system features new touchpoints that change the relationship between patients and health systems. (See Figure 14.) These touchpoints could be viewed as a toolkit to guide health systems toward customising diagnosis, care and cure. Those touchpoints are:

- Coordinated care teams
- Fluent navigators
- Patient experience benchmarks
- Medical proving grounds
- Care-anywhere networks

Figure 14: Five touchpoints changing the relationship between patients and health systems

In 2010, individuals see a disorganised, impersonal and siloed system

In 2020, health systems will use five touchpoints to deliver organised, personalised care to individuals



Source: PricewaterhouseCoopers' Health Research Institute

Coordinated care teams

Consumers want better coordination of care, and funding methodologies are being altered to enable packages of care and better hand-offs among providers. Two-thirds of consumers surveyed by PwC said a coordinated team of clinicians was important to them. Yet, payment and regulatory silos make it difficult to integrate, and 40% of health leaders surveyed by PwC said hand-offs among clinicians were difficult or very difficult. Coordinated care, also known as 'chain care,' adapts to the patient as circles of information are continuously exchanged and plans updated. The availability and smart use of information is key to the patient value chain; efficiency and effectiveness are lost when information is fragmented and lodged in proprietary systems.

Coordination and integration of care delivery is one of the key benefits expected from use of interoperable EMRs that will enhance both horizontal and vertical coordination. "Patient information should be more

Health leaders realise that coordinated care depends on sharing information. "Norway is at the front when it comes to offering emergency medical treatment, but the organisation and logistics around that at the hospitals are poor because of lack of knowledge sharing between departments. Nobody thinks of the whole chain of treatment for the patient; instead each department thinks of its own part. IT technology is a driver, since there is no data system that is shared for all hospitals in Oslo," said a hospital CEO in Oslo.

Integrated organisations, such as Kaiser Permanente in the U.S., provide information to their patients that spans the course of their care. "There is electronic health tracking from the moment you walk in to the moment you depart," said Philip Fasano, Kaiser's chief information officer, who noted that one-third of Kaiser's 9 million members access Kaiser services remotely. "You leave with a summary when you walk out the door. If the doctor prescribed medication, you can pick up the prescription before you leave

"For every new service you commission, you generally need to decommission something—it's a Newtonian equation," said Tony Felton, director, FH Partnership, Ltd.

accessible to all providers to keep track of patients, past episodes and treatments given. A new information system will be tested very soon and will be rolled out countrywide," said Michael Flemming of Life Healthcare in South Africa. "We need to build an accurate patient profile and keep it available and accessible to all who need it to treat the patient. We need information on past medical history and treatment in order to look more comprehensively at patients."

Kaiser. If you need a lab test, you can go across the hall. By the time you get home, you can view your lab results online. We want to give you the tools to manage your own health."

As these coordinated care networks develop, various stakeholders will begin to time their opportunities. For example, "Do pharmaceutical companies need to totally rethink the business model in terms of how

they will continue to provide and supply hardware (medicines)? Or will we need to increasingly move into software or integrated aspect (not just hardware tests and drugs) but also knowledge base with feedback loops that provides the best way of using and applying the hardware,” said Professor Lindpaintner of bio-banks.com.

In the U.K., integrated care is becoming more prominent on the healthcare reform agenda. Currently, the NHS is conducting 16 integrated care pilots covering a range of disease-specific and full cradle-to-grave initiatives that will impact more than 2 million residents. In addition, in 2008, Somerset County devised an innovative COPD programme, which disrupted the traditional hospital-based

model in exchange for a more community-focused model. The programme, which is subsequently being emulated by other PCTs across England, is dependent on the seamless transition of COPD patients through the medical system. Too frequently however, coordinated care networks often entail adding additional layers onto already complicated delivery models, raising costs and convoluting pathways. “For every service you commission, you generally need to decommission something—it’s a Newtonian equation,” said Tony Felton, director, FH Partnership, Ltd. “Otherwise, you get inefficiencies, added costs and fragmentation. Ultimately, it is up to the commissioners to commission seamless care pathways.” (See Figure 15.)

Figure 15: How England’s Somerset County centred care around COPD patients

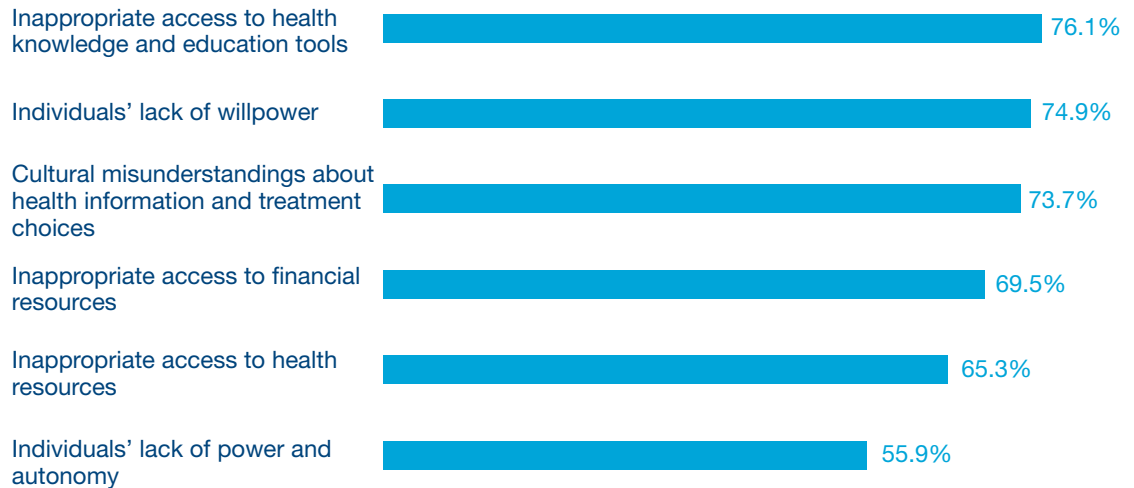
Traditional model	<p>Lack of coordination led to higher costs and dissatisfaction among patients.</p> <ul style="list-style-type: none"> • COPD management was defaulted to hospitals. • 10% of COPD patients had 2+ hospital admissions each winter. • Evidence suggested that one-fourth of admissions were preventable. • GPs either were not familiar with best practice protocols or were not implementing them. • Patients were very clear about what they wanted (e.g., the option to stay at home, information and education), but the service was not set up to deliver these benefits.
How the model was changed	<ul style="list-style-type: none"> • Research. Primary care trust (PCT) spent one year talking with patients about building a new model in the community. • Competition. NHS allowed the PCT to contract with private (non-NHS) providers, which worried NHS providers. • Financial incentives. The provider had to reduce hospital admissions to get paid. • New conversations. Clinicians needed to understand the new language and assumptions in risk-based contracting. They also needed to work together across organisations to realise benefits. • Patients are treated as an integral part of the multi-disciplinary care team; they are also involved in the development of personal care plans.
The result	<ul style="list-style-type: none"> • Community-based network focuses on preventing admissions rather than post-discharge care. New model includes home care, GPs, specialists, and oxygen services. • Community matrons (nurses) and mobile diagnostic services come to the patient, rather than requiring the patient go to them. • Patients are responsible for maintaining a paper notebook containing their personal care records, similar to ones used by pregnant women in the U.K. • Spending on hospital services and oxygen therapy was reduced.

Fluent navigators

Regardless of whether they live on \$1 a day or in the richest cities of the world, most individuals are not equipped or skilled enough to navigate the health system on their own. This is especially true for the frail and elderly who need the most help when they are the most vulnerable. “It is important to introduce navigators to help people understand what is available to them,” said Lise Denis, chief executive director, Association Québécoise D’établissements de Santé et de Services Sociaux (AQESSS), which represents 135 public institutions of health and social services in Québec,

Canada. “This is where a personal health portal would help, e.g., a GPS of the health system.” The key is the ability to connect individuals with information that is culturally appropriate by gender, age and ethnicity. About three-quarters of global health leaders surveyed by PwC said inadequate access to health knowledge obstructs individuals from managing their own health. (See Figure 16.) They also cited problems around cultural misunderstandings and access to health resources. The fact that so many health leaders cited “lack of willpower” as a barrier could signal a lack of sensitivity to patients’ needs.

Figure 16: Which of the following are barriers to individuals managing their own health?



Source: PricewaterhouseCoopers’ Health Research Institute Global Health Leader Survey

Numerous interviewees noted that navigators can come in various roles— family members to community-based volunteers or social service employees. While these localised networks will serve as a bedrock to personalised care, it is likely that the increasing need for a thicker layer of navigators will draw a new class of entrants: the professional health agent. In the same way that financial planners in the last two decades have become commonplace and available to more than just the wealthy, it is likely that a potentially burgeoning field of ‘health agents,’ both human and machine, will emerge.

The growing success of community health workers with underserved communities can provide lessons about how to navigate complex systems.

and training programmes. ASHAs are paid for performance; they must gain the women’s trust to leave their homes and deliver in a hospital. (See Figure 17.)

- In **Liberia**, community health workers of Tiyatien Health (‘Justice in Health’) make daily home visits to provide moral support, encourage adherence to medications, and link communities to health centres. They also deliver food and economic aid, such as microfinance grants. According to the founding director of Tiyatien Health, Rajesh Panjabi, M.D., “by training and employing community health workers, we have seen significant improvement in HIV/AIDS survival— converting HIV from a death sentence to a manageable chronic disease. The community health worker model itself has

In India, more than half a million village-based women have been trained as Accredited Social Health Activists (ASHAs) since 2005 when the government set a goal of having one for every village of 1,000. ASHAs work to reduce the country’s infant mortality rate, which is 10 times higher than Japan.

- In **India**, the government decided in 2005 to try to reduce the country’s infant mortality rate, which is 10 times higher than Japan, through Accredited Social Health Activists (ASHAs). Since then, India has trained more than half a million women with the goal of having one for every village of 1,000. “Payment of incentives is influencing them to be more proactive,” said Gubbi Venkatesh Nagaraj, M.D. ASHAs receive Rs 200 (\$4 USD) when one of their patients delivers in a hospital, and Rs 25 (50 cents in the U.S.) for getting a child immunised. ASHAs have flexible work schedules for two to three hours per day, four days per week, except during mobilisation events

become a source of jobs, desperately needed in a nation with over 85% unemployment. They can help to rebuild a world-class health system in the poorest, most remote corners of the planet.”

- In rural communities in **Bangladesh**, non-governmental organisations have equipped workers with PDAs to track the health of pregnant women. “I’ve been to these rural villages and seen the information get uploaded,” said Anderson of Johns Hopkins. “We have longitudinal data on people so rural clinics are able to follow up—checking for diabetes and making sure women come in for their well visits.”

- In the **U.S.**, hospitals are hiring ‘promotores,’ who serve as liaisons between local healthcare systems and Hispanic communities in South Texas.¹⁷ Promotores are state-certified and trained in communication, interpersonal skills, service coordination, capacity-building, advocacy, teaching, organisational skills and health knowledge.
- In **Canada**, Local Health Integration Networks (LHIN) are training staff at a new Centre of Excellence in Aboriginal Health. Understanding the patients’ beliefs, values, and cultural traditions allow providers to influence how healthcare information is shared and received. Many times, providers face an ethnically diverse population whose cultural beliefs in healthcare can hinder a doctor’s treatment protocol for their patients.
- In **Australia**, the government has committed to the ‘Closing the Gap’ initiative that aims to turn around indigenous disadvantages relating to life expectancy, child mortality, and access to education and employment are offered. Through a new Office for Aboriginal and Torres Strait Islander Health and Aboriginal Community Controlled Health Organisations, which are targeted at Indigenous Australians, Australia is offering services that meet the cultural and linguistic diversity of populations. Increasingly, pharmacists take on important navigator roles. Non-compliance with

Figure 17: How India is changing behaviour of mothers to reduce infant mortality rates

Traditional model	<ul style="list-style-type: none"> • India’s infant mortality rate is 30.15/1,000, ranked 143rd in the world. • Mothers often give birth at home rather than at the hospital where trained doctors and nurses could assist with the delivery. 																			
How the model was changed	<ul style="list-style-type: none"> • Education. The government designed a 23-day training programme for women activists (ASHAs) who would be a connection point between mothers and hospitals. • Recruitment. Many of the women understood the issues that their patients were dealing with. They, too, had delivered babies at home. Nearly half said they chose to do this work because they wanted to keep their community’s babies from dying. • Incentives. The Indian government offered cash assistance to both mothers and ASHAs. 																			
Example of incentives	<table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Rural</th> <th colspan="2">Urban</th> </tr> <tr> <th>Mother</th> <th>ASHA</th> <th>Mother</th> <th>ASHA</th> </tr> </thead> <tbody> <tr> <td>Hospital</td> <td>Rs 1400</td> <td>Rs 600</td> <td>Rs 1000</td> <td>Rs 200</td> </tr> <tr> <td>Home</td> <td>Rs 500</td> <td></td> <td>Rs 500</td> <td></td> </tr> </tbody> </table>		Rural		Urban		Mother	ASHA	Mother	ASHA	Hospital	Rs 1400	Rs 600	Rs 1000	Rs 200	Home	Rs 500		Rs 500	
	Rural		Urban																	
	Mother	ASHA	Mother	ASHA																
Hospital	Rs 1400	Rs 600	Rs 1000	Rs 200																
Home	Rs 500		Rs 500																	
The result	37% of women shifted from home to hospital delivery between their first and second child.																			

¹⁷ Texas Health and Human Services Commission Business Opportunities, “Promotores(as) / Community Health Workers in Texas Health Steps Enrolment Contract,” Texas Health and Human Services Commission, http://www.hhsc.state.tx.us/about_hhsc/BusOpp/Promotora.shtml.

medication regimens is a challenging and complex problem, resulting in poorer outcomes and increased costs. “Pharmacies can control this problem using software that alerts the chemist when the patient does not show up to refill his prescription, giving the indication that he is not taking the medication,” said Dr. João Silveira, PharmD, vice president of the Portuguese National Association of Pharmacies. “Our studies show that about 90% of the visits to a healthcare provider end up at the pharmacy to fill a prescription. It is both the beginning and the end of the value chain. Pharmacies

should be able to increase the scope of their intervention in healthcare,” he added.

Darrell G. Kirch, M.D., president and CEO of the Association of American Medical Colleges, said pharmacists’ roles are expanding in the U.S. “Pharmacists are becoming more involved with direct patient care and are even involved in rounds in some hospitals. These pharmacists act as ‘air traffic control’ by helping to coordinate and oversee the multiple facets of care the patient is given,” Kirch said.

Patient experience benchmarks

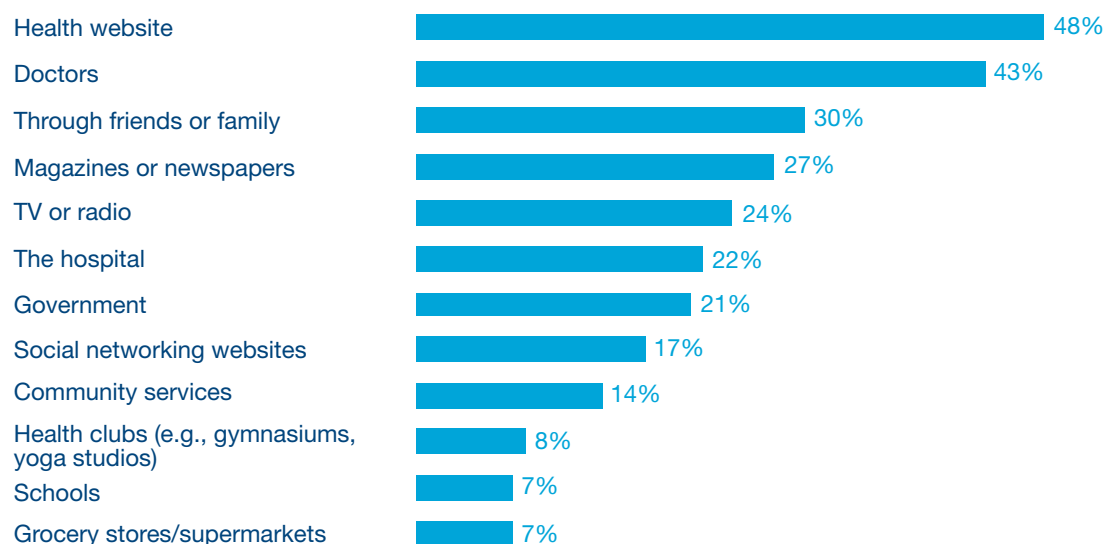
Individuals will begin to set their own rules by which health organisations must play. Individuals will expect one-on-one customised service, and their expectations will be broadcast with a speed and scale that could quickly separate winners and losers in the health marketplace. Retail industries have developed their own sophisticated measures of the customer experience. Some of these can be transitioned into patient experience benchmarks. The big umbrella of customer experience includes an understanding of the behaviours of individuals so that organisations can better adjust their business processes to get the desired outcomes. To excel at patient experience benchmarks, health organisations must learn to listen. There is a lot to hear. The patient's voice can be heard through traditional surveys and focus groups, as well as new

social media through real-time conversations on blogs and sites like Twitter.

Among the most visible patient experience benchmarks are wait times, which are increasingly being mandated by law. Both health leaders (85%) and consumers (66%) surveyed by PwC said short waiting times are important or very important for an 'ideal' health system. A focus on wait times is a key trend, in that it forces health stakeholders to make the appropriate adjustments in determining resources and care pathways to meet the government standards. For example, Australia has published a preliminary set of standards that assure patients access to primary care within a day and home visits to new mothers within two weeks of giving birth.¹⁸

The power of these benchmarks is accelerated by their broad dissemination through the Internet. Global consumers surveyed online by PwC said their

Figure 18: Where do you go to find information to make decisions about your healthcare? (Select all that apply)



Source: PricewaterhouseCoopers' Health Research Institute Global Consumer Survey

¹⁸ A Healthier Future for All Australians, Final Report of the National Health and Hospitals Reform Commission, June 2009 from the Australian Government Department of Health and Ageing website, <http://www.health.gov.au/internet/main/publishing.nsf/Content/nhhrc-report>.

top information source on health was online websites. (See Figure 18.) Social networking sites ranked eighth. “In our public health system (universal and free), one of the technologies that has changed the current role of players in the health sector has been the access to information and communication technology through the widespread use of the internet,” said Antoni Esteve, president of Esteve, a global pharmaceutical company in Spain.

By setting and publishing benchmarks that consumers can use, governments are responding to their citizens. Wait time limits are defined by consumer expectations—how long should an individual wait?—rather than clinicians’ schedules—what’s convenient for clinicians? In England, one of the centrepieces of the NHS’ focus on patient-centred care is a 2008 rule that no individual should wait more than 18 weeks from referral to treatment. The benchmark forces hospitals and physicians to reassess their patient throughput as well as resource allocation. Like any benchmark, this one has drawn consternation among some NHS managers who complain that the 18-week rule has become an overriding performance mandate.

Until recently, individuals did not have good information about the length of waits, and the accuracy of the measures was undermined by individuals putting their names on multiple waiting lists. That is changing dramatically as health systems move toward individual-centred metrics. In Portugal, wait lists triggered a host of process changes among hospitals and physicians. (See Figure 19.)

These new standards do not have to be government driven. For example, the Netherlands has not set waiting times targets; instead the government requires hospitals to publish wait times online, letting the market drive efficiency through transparency. Social networking sites that aggregate data from thousands of users are creating other types of benchmarks. PatientsLikeMe.com, which started in 2004, has 17 disease communities, within which members enter data pertaining to their condition. The site aggregates and shares this real-time data with all members. For example, the site’s Depression Community has some 12,000 members, with personalised profiles including a photo, and logs describing condition and therapy.

Figure 19: How Portugal reduced waiting lists and increased productivity

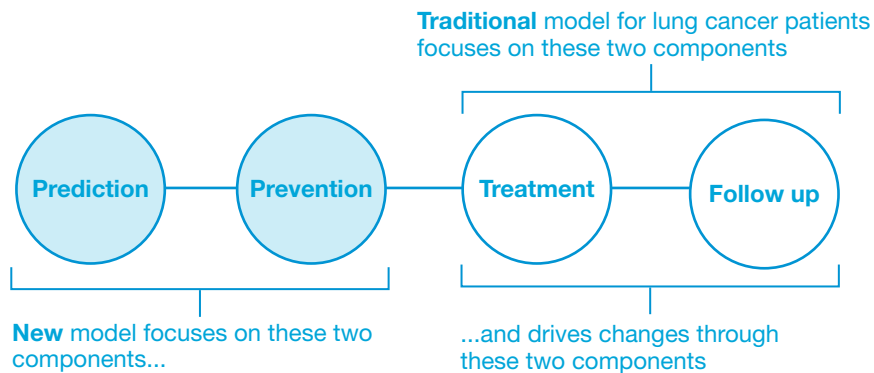
Traditional model	<ul style="list-style-type: none"> • Patients faced long waits for surgery. • The government did not have the capacity to increase the number of public hospitals or ORs, so waits grew longer.
How the model was changed	<ul style="list-style-type: none"> • Research. Officials analysed wait systems in Spain, U.K., Denmark, Canada, Australia, Finland and New Zealand. • Regulatory reforms. In 2004, the government mandated maximum wait time for surgeries. • IT deployment. New IT system enabled real-time data exchange among Portugal’s 125 private and public hospitals. • Process redesign. Physicians were required to enter surgery requests into the system. Each procedure is assigned to one hospital, which must schedule within 75% of the waiting period. • Patient empowerment. If the hospital fails to meet the time limit, the patient gets a ‘surgery cheque’ that enables him/her to be admitted to any hospital he/she chooses within the remaining 25% of the waiting period.
The result	Productivity increased 50% and waiting list time dropped 49%.

Medical proving grounds

Through collaboration and investment, some regions are making themselves medical proving grounds for a new generation of medicine that customises care to the individual. This also represents a new type of medical tourism. Just as France is known for wine and Switzerland for watches, biomedical centres are building global reputations in the new biological sciences. While medical tourism represents a small slice of overall delivery, medical proving grounds will attract patients, researchers and providers looking for a faster cycle from bench to bedside. In PwC's survey of global health leaders, almost half said they thought medical tourism would increase by 2015. However, while the previous trend in medical tourism has been built on low cost, the new one will focus on the value consumers put on coordinated research and care systems.

Combining the new science with care is the strategy of Luxembourg, which has one of the highest rates of spending on healthcare in Europe and a universal health system in which the government pays 90%. With no natural resources, Luxembourg leaders have learned to place a high value on sustainable investments. It has paid off. With less than a half million residents, Luxembourg has become a financial capital with the highest income per capita in Europe. "Many economists see innovation mainly as a cost driver for the healthcare system. Personally, I see innovation primarily as a chance and opportunity," said Mars di Bartolomeo, minister of health. "It is a chance for higher quality of life standards and an opportunity for increasing efficiency and security within healthcare." Now, the country is tackling lung cancer, one of the deadliest diseases. (See Figure 20.)

Figure 20: How Luxembourg is blending prediction, prevention, R&D, and treatment for lung cancer patients



How the model was changed

- Implement EMR system.
- Hospitals and labs collect tissue and blood samples from lung cancer patients and patients at high risk to identify biomarkers for early detection.
- Partner with Fred Hutchinson Cancer Centre, the Translational Genomics Research Institute (TGen), and The Biodesign Institute at Arizona University in the U.S. to develop molecular diagnostics.
- New treatment management options are developed for lung cancer patients and clinicians.

The result

Project sponsors believe identification of biomarkers will add 6.7 life years and save 1.6 million euros for every lung cancer patient.

Research and industry leaders are gravitating toward pharmacogenomics (the use of drugs only for those patients whose biology will respond to them) with corresponding diagnostics in order to test for the biomarkers that reveal whether a patient will respond to a given biologics treatment. In this way, biologics and a ‘sister’ diagnostic are used through clinical trials— involving only individuals with the biology to respond —and approved on parallel tracks. But realising the full potential of biologics will require a consolidated effort among all players shaping their development— venture capital firms, pharmaceutical and large biopharmaceutical companies, drug regulators, and payers.

Governments wanting to capitalise on centres of research and care may need to re-invigorate drug development with the same vigour as other innovations, such as energy exploration and the build-out of renewable energy generation. A balancing act exists between creating a regulatory climate that preserves profit incentives for developers and, ensures that biologics and their generic forms are developed quickly at a price that patients can afford. For example, the length of time for clinical studies on biologics has grown from 66 months in the early 1990s to 108 months by 2006.¹⁹ Data exclusivity periods illustrate the nettlesome

nature of maintaining this balance. In the EU, data exclusivity for biologics is 10 years, but in the U.S. that period it is still being hotly debated with proposals ranging from five to 12 years. Additionally, increased government backing is paving roads to accelerate the biologics commercialisation and wider application. For example, the U.S. stimulus funding in health IT could build a vast electronic bioinformatics database at a time when Phase III clinical trials in the U.S. are estimated to cost between \$135 million and \$270 million.²⁰

The financial tumult of 2008 and 2009 served as an even brighter light on problems inherent in the healthcare system and the burden of costs weighing heavier on patients, governments, and drug makers. The days of the ‘winner-take-all’ or ‘loser-lose-all’ in healthcare research funding may already be over, with the blockbuster drug model on the wane, and the U.S. stimulus funding demonstrating a revived role in public financing. The onus of paying for basic research and drug development may well move to a consortia of players. It may become increasingly incumbent upon governments—as healthcare costs consume greater percentages of national budgets—to create health policies that incentivise all stakeholders to produce cost savings.

¹⁹ Henry Grabowski, “Follow-on Biologics: Data Exclusivity and the Balance Between Innovation and Competition,” *Nature Reviews: Drug Discovery* 7 (2008): 479-988.

²⁰ *Pharma 2020: The Vision*, PricewaterhouseCoopers, 2008.

Care-anywhere networks

New entrants into the health industry are attracting consumers through technologies they have already embraced. The future health system will be one in which the patient is the centre of attention. It is not too difficult to picture this future. Just look at other industries—financial services, retailing, electronics, and the media. Imagine a world in which consumers have video and audio files about physicians, hospitals, drugs, lab tests and other medical services loaded on their iPod. They twirl a dial to make selections in the same way they now select songs and movies.

Mobile EMRs, telecommunications and in-home and implantable devices will reduce utilisation of hospitals, nursing homes and physician office visits. For example, remote monitoring systems now enable eICUs with physicians and nurses reaching out to home-based patients via a remote ‘command and control’ centre. “Individuals will not have to leave their homes for basic services, allowing for virtual visits of all kinds and from care practitioners of all levels,” said Kaiser’s Fasano. The past few decades have seen government financing and incentives for hospital construction. The government’s investment in bricks and mortar is turning to funding virtual access points, broad-band networks and telemedicine. “Healthcare is convenience-driven—patients need good access from home,” said Kevin Holland, managing director of Baxter Healthcare in the Middle East and Africa. According to the HealthCast global leader survey, 55% of respondents said that increasing the distribution of service delivery will make their health system more efficient.

In Portugal, P’ASMA is a web-based application that helps patients manage their asthma. The physician registers the patient’s clinical data, asthma control data and a specific treatment plan. At home, the patient

downloads his or her data and receives immediate graphic and written feedback based on the defined treatment plan. Also, the system delivers automatic messages and alerts online to each patient.

And, the networking does not stop at the patients’ e-mail box, but will connect literally to the patient. In the U.K., for example, Toumaz Technology is carrying out a clinical trial with the Imperial College Healthcare NHS Trust testing a digital ‘patch,’ a disposable device with a wireless sensor that sticks to a patient’s chest and can monitor, in real time, vital signs such as temperature, heart rate and respiration. This data can be downloaded on caregivers’ mobile phones and automatically inscribed into patients’ electronic medical records. In Sweden, Capio Health Care Nordic’s former CEO, Fredrik Thafvelin, states: “We can have a daily dialogue with our psychiatric patients via e-mail, for example, by using Montgomery-Åsberg Depression Rating Scale (MADRS) or comprehensive psychopathological rating scale (CPRS). And for orthopaedic rehabilitations patients, with regular reception on e-mail of animated training programmes when it is time for a training act.” In the U.S., Proteus is in clinical trials with ingestible monitors that sense and record when a patient takes one or more microchip-enabled drugs. The technology runs on an electric charge generated by the patient’s stomach acid.

What has really accelerated care-anywhere networks are wireless services that connect to all of a patient’s monitoring and safety devices. The Netherlands is on the leading edge of this trend, called domotica, in which sensors, central locking systems, radio frequency identification (RFID), ringing-mats and cameras are used to monitor patients. The Dutch Health Care Inspectorate recently reported that nearly three-quarters of rehab institutions and 90% of nursing homes are using domotica. In addition to allowing

patients to live independently longer, the report said that health workers liked the monitoring, citing a “feeling of trust and comfort/relief knowing that other colleagues who watch you from a distance or in emergency could be called on.”

In France, the government is making a progressive attempt to move more care out of the hospital and into homes equipped with electronic monitoring devices. “For the patient, Hospital Medical Care at Home successfully combines the technical quality of hospitals within the warmth of the home: it does not specifically belong to the one or to the other, but it contributes to both of them,” explains Elisabeth Hubert, president of the French Federation for Hospital Care

workers and occupational therapists,” adds François Berard of FNEHAD. Each patient is prescribed an individual care plan that coordinates his or her clinical care team. Before discharge, the hospital assesses the home environment to ensure that the care can be delivered effectively and safely.²¹ The equipment includes a multimedia telecommunications device at the patient’s bed that is connected to the home hospitalization network. This allows healthcare professionals working in the patient’s home to download the patient’s medical information, updated in real time and maintain remote access to monitor the patient’s health status.²² Between 2005 and 2008, the government said the programme reduced the number of hospital days by

In France, a multimedia device is installed at a patient’s bedside at home. Information is downloaded and updated in real time.

at Home (FNEHAD) and former French Ministry of Health. “It is the means to provide continual and coordinated medical and paramedical care in the patient’s own home, in association with a hospital physician, the patient’s GP and all paramedical, social

2.7 million.²³ The French Ministry of Health plans to aggressively expand the home care programme, which it predicts will eliminate 5 million hospital days by 2010.²⁴

21 Anissa Afrite, et al., “Hospital at Home (HAH), a structured, individual care plan for patients. An exploitation of data from the 2006 HAH medical information systems programme,” IRDES: Questions d’économie de la Santé, n°140 March 2009, from the IRDES website <http://www.irdes.fr/EspaceAnglais/Publications/IrdesPublications/QES140.pdf>.

22 Orange Activities and Key Features, “Orange Healthcare,” Orange, http://www.orange.com/en_EN/group/activities_key/health/index.jsp.

23 Rapport d’activité de la FNEHAD (Fédération Nationale des établissements d’hospitalisation à domicile) - Assemblée générale de juin 2009: French national federation for the HAH structures, 2008 annual report (only in french) from the FNEHAD website http://www.fnehad.fr/dl/2009/06/rapport-activite-fnehad_vd.pdf.

24 IRDES (French Institute for Research in Health Economy) Publications, “Comparative study of hospitalization cost in conventional and home care establishments,” from the IRDES website <http://www.irdes.fr/EspaceAnglais/home.html>.

Industry stakeholders must reassess their roles, relationships and priorities as care is customised for patients

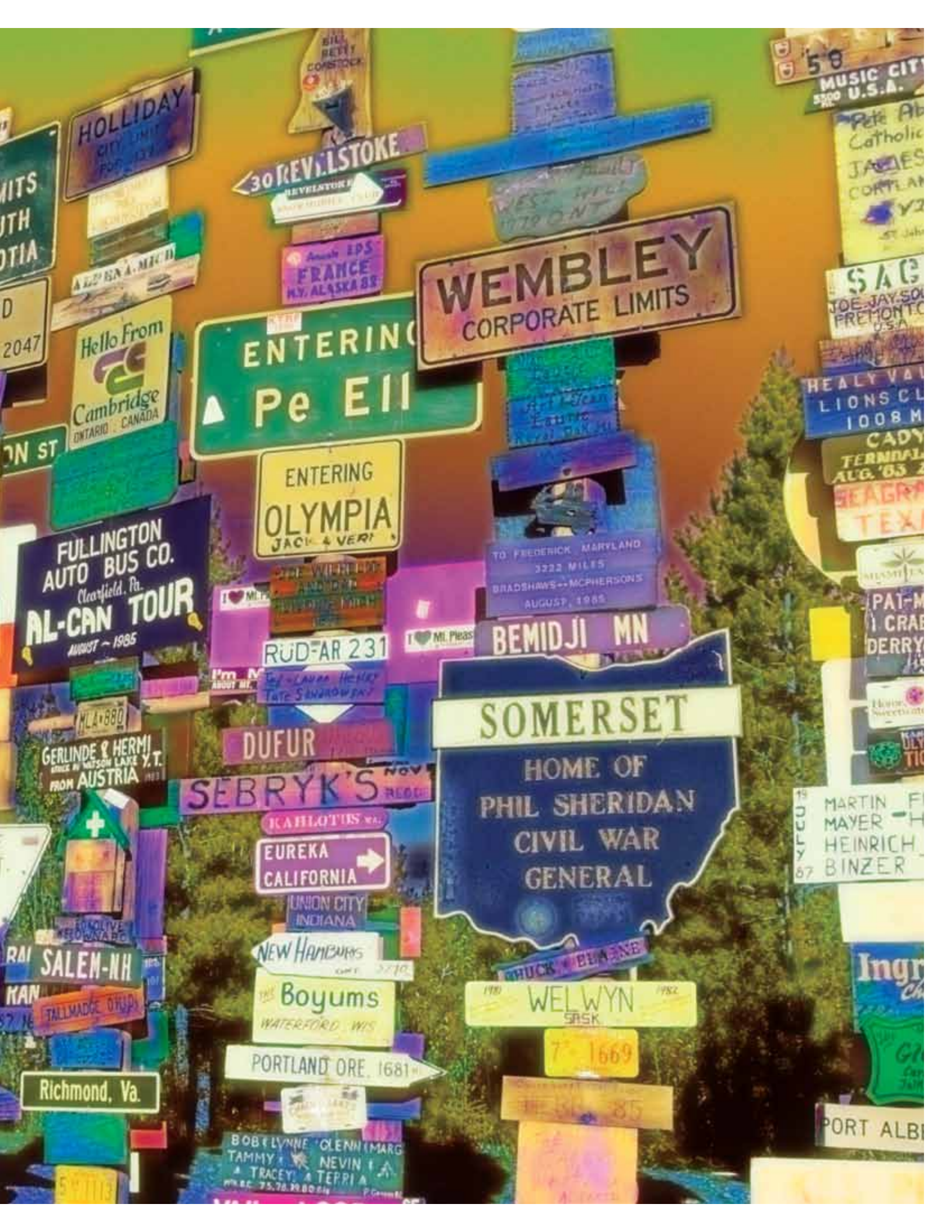
No sector can achieve success on its own; common goals require collaboration efforts. As Erwin van Leussen, manager of healthcare innovations for Achmea, an insurance company in the Netherlands, said: “Innovation in the healthcare sector is a very complex process. In other industries, it is often enough to create a win-win situation between two parties. In healthcare, there are so many parties whose interests

are intertwined, that you need at least a win-win-win-win situation in order to gain stakeholder acceptance for an innovation.”

The drive toward customisation could increase consumer demand for services. However, this will be offset by a proliferation of incumbents and new entrants bargaining with government for payment and investment on the basis of savings.

Recommendations by stakeholder

		Providers	Pharma	Government	Payers	New Entrants	Employers
Develop incentives that encourage partnership	Use segmentation to understand patient behaviours	•	•	•	•	•	•
	Integrate outcomes as part of new payment models	•	•	•	•	•	•
	Ensure that incentives include consumers	•	•	•	•	•	•
	Customise wellness to workers' needs/preferences						•
	Create an environment that supports healthy behaviours			•	•		•
Work on regulatory reforms that reward competition and innovation	Coordinate with other stakeholders to build the evidence base around innovation	•	•	•	•	•	•
	Find common ground among stakeholders to speed innovation	•	•	•	•	•	•
	Borrow best practices from other industries	•	•		•	•	
	Partner with patient-centred groups to increase participation in clinical trials		•				
	Embed incentives that encourage innovation			•			
	Create market rules that increase the number and types of access points			•			
Plan for redistribution of funding from sickness to wellness	Assume more accountability for care coordination	•		•	•		
	Realign compensation to emphasise coordination over procedures			•	•		
	Create infrastructure to contract for coordinated care	•		•	•		•
	Reallocate spending to reduce unnecessary hospital care			•	•		
Provide individuals with better information to support shared decision-making, concordance and choice	Use electronic tools to help consumers make better decisions	•	•	•	•	•	•
	Diversify range of products and services to humanize care and build public trust	•	•	•	•	•	
	Improve clinicians' ability to communicate among themselves	•		•	•		
	Use social networking and health gaming	•			•	•	•
Explore workforce models that allow greater flexibility and effectiveness	Increase payment rates for primary care and for care coordination	•		•	•		
	Partner with incumbents to offer virtual medical training and education			•		•	
	Review clinical licensure laws that inhibit flexibility and patient access			•			
Prepare for complexity of agile, interoperable IT framework for real-time, customer-driven market	Develop a clearly defined framework of standards with stakeholder input and incentives			•			
	Build in personal privacy guardrails to increase trust	•		•	•	•	



58
MUSIC CITY
5300 U.S.A.
Pete Ab
Catholic
JAMES
CORTELA
Y2

WEMBLEY
CORPORATE LIMITS

ENTERING
Pe Ell

ENTERING
OLYMPIA
JACK & VERI

FULLINGTON
AUTO BUS CO.
Clearfield, Pa.
AL-CAN TOUR
AUGUST ~ 1985

TO FREDERICK, MARYLAND
3222 MILES
BRADSHAW--MCPHERSONS
AUGUST, 1985

RUD-AR 231

BEMIDJI MN

SOMERSET
HOME OF
PHIL SHERIDAN
CIVIL WAR
GENERAL

SAG
JOE JAYSON
PREMONT
U.S.A.
HEALY VAL
LIONS CL
1008 M
CADY
TERMINAL
AUG. '83
SEAGRA
TEXI

DUFUR

SEBRYK'S

EUREKA
CALIFORNIA

PAT-M
I CRAB
DERRY
Eaton
Sweet
NEW
TIG
MARTIN F
MAYER - H
HEINRICH
BINZER

UNION CITY
INDIANA

NEW HAMBURG
AUG 1 2/10

Boyums
WATERFORD WIS

WEL WYN
595K

PORTLAND ORE. 1681

7-1669

Richmond, Va.

BOB LYNNE GLENN MARG
TAMMY NEVIN
TRACEY TERPIA
WV 82 75,78,86,89

PORT ALBI

Conclusion

This year's HealthCast survey signalled the entrance of a generation of new players—from patient navigators, to players bringing cutting-edge communications and other technology healthcare—that will shepherd empowered individuals through changes in the decade ahead. A 'smart' healthcare infrastructure coupled with advancements in personalised medicine and medical device development will provide the tools to form a customised, individual-centric infrastructure.

Stakeholders must show the leadership on how to buck a paradigm of self-preservation. This mentality says: Reform everyone else, not us. Well-designed incentives will be required to change behaviours and attitudes among all stakeholders, including patients. And, indeed, some systems will be more ready than others to change direction on important issues that affect patient care. As systems biology expert Dr. Leroy Hood warned, major players will have to change their business models, but "the 'arrogance of excellence' is a serious barrier."

The fact that the less than 20% of global health leaders surveyed by PwC were dissatisfied with their health system is curious, given the unsustainability of today's model. When PwC asked health leaders which country's system would they most like to emulate, the answers were equally instructive. The overall top vote-getter was the U.K. But it was the U.S. leader responses that were most interesting. The U.S. was the only country in which the top answer was that their own system was the best. The second top answer was "none."

PwC's HealthCast survey and interviews with stakeholders crossing geographical, cultural and professional boundaries yielded a wealth of perspectives on where consumers will lead the industry and how the industry can become part of that transformation.

Contacts

Health Research Institute

Kelly Barnes
Partner, Health Industries
Leader
+1 214 754 5172
kelly.a.barnes@us.pwc.com

David Levy, M.D.
Principal, Global Health Leader
david.l.levy@us.pwc.com
+1 646 471 1070

David Chin, M.D.
Partner, HRI Leader
david.chin@us.pwc.com
+1 617 530 4381

Sandy Lutz
Managing Director
sandy.lutz@us.pwc.com
+1 214 754 5434

Benjamin Isgur
Director
benjamin.isgur@us.pwc.com
+1 214 754 5091

Serena Foong
Manager
serena.h.foong@us.pwc.com
+1 312 298 3687

Research Analysts

Rama Asfahani
rama.a.asfahani@ae.pwc.com
+971 (0) 4 3043 100 (ext. 242)

Carrie Bersot
carrie.bersot@us.pwc.com
+1 415 498 7078

Filipe Brandão
filipe.a.brandao@pt.pwc.com
+351 213 599 190

Kim Dillen
kim.dillen@nl.pwc.com
+31 (0) 40 22 44 336

Jennifer Fenley
jennifer.a.fenley@us.pwc.com
+1 646 471 7501

Ryan Figueiredo
ryan.figueiredo@in.pwc.com
+91 22 666 9150

Carolina Galvão
carolina.w.galvao@us.pwc.com
+1 646 471 8607

Tarun Gulrajani
tarun.gulrajani@us.pwc.com
+1 678 419 1569

Celeste Long
celeste.iong@pt.pwc.com
+351 213 599 000

Ilse Krieger
ilse.krieger@nl.pwc.com
+31 0 38 4272650

Kira Levy
kira.a.levy@uk.pwc.com
+44 0 20 780 41833

Ingeborg Maes
ingeborg.maes@nl.pwc.com
+31 0 30 219 1421

Tarana Mendiratta
tarana.mendiratta@in.pwc.com
+91 22 6669 1057

Helena Miranda
helena.sofia.miranda@pt.pwc.com
+351 213 599 000

Lars Müller
lars.mueller@de.pwc.com
+49 69 9585 1649

Benjamin Qiu
benjamin.qiu@cn.pwc.com
+86 10 6533 7140

Research Team Leaders

Donal Landers, M.D.
Associate Director, Ireland
donal.landiers@ie.pwc.com
+353 1 792 8717

Jan Willem Velthuisen
Partner, The Netherlands
jan.willem.velthuisen@nl.pwc.com
+31 0 20 568 5231

Carrie C Schulman
Director, Australia
carrie.c.schulman@au.pwc.com
+61 2 8266 3170

Krishnakumar Sankaranarayanan
Managing Consultant, India
krishnakumar.sankaranarayanan@in.pwc.com
+91 124 462 0000

Steering Committee

Anne-Marie Feyer
Partner, Australia
anne-marie.feyer@au.pwc.com
+44 0 20 7212 4111

Simon Friend
Partner and Global
Pharmaceutical and Life
Sciences Leader,
United Kingdom
simon.d.friend@uk.pwc.com
+44 20 7213 4875

Bjørn Hesthamar
Partner, Norway
bjorn.hesthamar@no.pwc.com
+47 9526 1479

Simon MJ Leary
Managing Partner, Health
Middle East
simon.leary@ae.pwc.com
+971(0)508490682

David Levy, M.D.
Principal, U.S. and Global
Health
Advisory Leader
david.l.levy@us.pwc.com
+1 646 471 1070

Andre Loogman
Partner, The Netherlands
andre.loogman@nl.pwc.com
+31 0 30 219 1539

Debasish Mishra
Partner, India
debasish.mishra@in.pwc.com
+91 226 669 1287

Fiona Nicholas
Partner and Central Cluster
Leader,
United Arab Emirates
fiona.nicholas@ae.pwc.com
+971 4 3043 108

Wim Oosterom
Retired Partner, The
Netherlands
wim.oosterom@nl.pwc.com
+31 0 30 219 1528

Harald Schmidt
Partner, Germany
harald.schmidt@de.pwc.com
+49 69 9585 1702

General acknowledgements: (not including country contacts)

Argentina: Jorge C. Bacher, Claudio Antonio Picchi, Norberto Rodriguez

Australia: Kirsten Armstrong, Richard Baldwin, Caroline Coevoet, Michael Dickson, Sarina Fisher, Mary Foley, Caitlin Francis, Craig Gear, Nathan Schlesinger, Carrie Schulman, John Walsh

Canada: Fredrick Ashbury, Dominique Fortier, Wendy Gnenz, Michael Jordan, Bruce McCrae, Johanne Mullen, Keith I. Stark, Barbara M. Pitts, Deborah Tanaka, Benoit Valiquette, Robert L. Varga, Thomas Wong

China: Alan Ho, Richard Lu, Beatrijs Van Liedekerke

Czech Republic: Karel Pubal, Ivana Sobolikova, Vladislava Zizkova

Finland: Kirsi Kiviniemi, Helena Mustikainen

France: Benoît Caussignac, Olivier Paul, Jean-Louis Rouvet

Germany: Sylvia Balke, Michael Burkhart, Barbara Schroeder, Alexander Von Friesen, Holger Stürmann

India: Yeshesvini Chandar, Amit Govind Samarth, T M Sudarshan

Ireland: Jane Duncan, Maura Kelly, Paul Monahan

Italy: Cristina Santoro

Japan: Makoto Ohsawa, Takehito Sasaki

Jordan: Shaden AL-Hindawi

Luxembourg: Mykola Goncharenko, Michael Hauer, Luc Henzig

Mexico: Alberto Kuri Monterrubio

New Zealand: Margaret P Roberts

Norway: Adne Blomhoff, Kristin Dvergsdal, Dagfinn Hallseth, Terje Johannessen, Gunnar Krosby, Erik Magnus Sæther

Portugal: Manuel Carrilho Dias, Luis S. Ferreira

Russia: Olga Klimanova

South Africa: Derek Browne, Japie du-Toit, Jannie Prinsloo

Singapore: Shong Ye Tan

Spain: Ignacio Riesgo Gonzalez, Leticia Rodriguez Vadillo

Sweden: Carl-Åke Elmersjö, Anna-Karin Nesheim

The Netherlands: Marcel Jonker, Martijn Klunder, Anneke Offereins, Martijn Vulto, Els van der Heijden, Frank van Kommer, Antoine van Wijchen, Annelies Versteegden

Taiwan: Judy Ho

United Arab Emirates: Karma El Fadl, Ahed Ghanem, Fida Ghantous, Sally Jeffery, N. Viswanathan

United Kingdom: Emily M. Barker, Edward Bramley-Harker, Paul da Rita, Ashish Dwivedi, Sue Forster, Katie Hargreaves, Madiha Hasan, Matthew E. Jones, Michael Kitts, Robina Lawson, Saba Mirza, Peadar O'Mordha, Michael Palmer, Jo Pisani, Steve Saunders, Claire Williams, Neil Woodings, Ian Wootton

United States: Cristina Ampil, Pamela Ashbourne, Vinod Baya, Per G. Berglund, Cliff Bleustein, Magan N. Butler-Coleman, Reatha Clark, Dianne Dismukes, Bob Dondero, Janice S. Fang, Anthony L. Farino, Jeff Fusile, Michael Galper, Lucia A. Giudice, Bruce Henderson, Brett Hickman, Dee Hildy, Katie Kuesters Huyck, Jessica Kirshner, Natalie Kontra, Nicki Lapidus, Jessica Light, Mary Kay Leigh, Gerald McDougall, Alan S. Morrison, Abhijit Mukhopadhyay, Bo Parker, Ginger Parker, Carter Pate, Carol Pray, Sheela Ramaswamy, Jonathan Reichental, Ruth Roemer, Randi Serin, Gilda Sharp, Warren Skea, Ryder Smith, Michael Thompson, Alice Ting, Paul Veronneau, Peter Vigil, Chris Wasden, Steven Weintraub, Julie Weismann, Christine G. Wendin, Richard Wichmann

About PricewaterhouseCoopers

PricewaterhouseCoopers provides industry-focused assurance, tax, and advisory services to build public trust and enhance value for its clients and their stakeholders. More than 155,000 people in 153 countries across our network share their thinking, experience and solutions to develop fresh perspectives and practical advice.

Health Research Institute

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

HealthCast 2020 global contacts

Australia Mary Foley +61 2 8266 2936 mary.c.foley@au.pwc.com	Mexico Jorge Hernandez Baptista +52 1 55 52636000 jorge.luis.hernandez.baptista@mx.pwc.com
Canada Thomas Wong +1 604 806 7138 thomas.c.wong@ca.pwc.com	Middle East Fiona Nicholas +971 4 304 3108 fiona.nicholas@ae.pwc.com
Central and Eastern Europe Mike Hackworth +420 251 151 801 m.hackworth@cz.pwc.com	The Netherlands Andre Loogman +31 30 219 1539 andre.loogman@nl.pwc.com
China Mark Jon Gilbraith +86 21 6123 2898 mark.gilbraith@cn.pwc.com	Singapore Shong Ye Tan +65 6236 3262 shong.ye.tan@sg.pwc.com
France Frank Avrilleaud frank.avrilleaud@fr.pwc.com	South America Marcelo Orlando +55 11 3674 3875 marcelo.orlando@br.pwc.com
Germany Wolfgang Wagner +49 30 2636 1111 wolfgang.wagner@de.pwc.com	South Africa Jannie Prinsloo +27 12 429 0500 jannie.prinsloo@za.pwc.com
India Debasish Mishra +91 22 6669 1287 debasish.mishra@in.pwc.com	Spain Ignacio Riesgo +34 91 568 57 47 ignacio.riesgo@es.pwc.com
Ireland Donal Landers, M.D. donal.landiers@ie.pwc.com +353 1 792 8717	Sweden Roine Gillingsjo +46 857 887 716 roine.gillingsjo@se.pwc.com
Italy Lino Mastromarino +39 02 66720554 lino.mastromarino@it.pwc.com	Switzerland Rodolfo Gerber +41 58 792 5536 rodolfo.gerber@ch.pwc.com
Japan Makoto Ohsawa +81 3 6266 5756 makoto.ohsawa@jp.pwc.com	U.K. David Allen +44 0 20 721 33687 david.allen@uk.pwc.com
Korea Sook-Jung Shin +82 0 2 3781 9279 seung-cheol.shin@kr.pwc.com	U.S. Kelly Barnes +1 214 754 5172 kelly.a.barnes@us.pwc.com

www.pwc.com/healthcare
www.pwc.com/pharma
www.pwc.com/hri

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

Kelly Barnes
Partner, U.S. Health Industries Leader
kelly.a.barnes@us.pwc.com
+1 214 754 5172

David Levy, M.D.
Principal, Global Health Leader
david.l.levy@us.pwc.com
+1 646 471 1070

Simon Friend
Partner, Global Pharmaceutical and Life Sciences Leader
United Kingdom
simon.d.friend@uk.pwc.com
+44 20 7213 4875

Fiona Nicholas
Partner, Central Cluster Leader
United Arab Emirates
fiona.nicholas@ae.pwc.com
+971 4 3043 108

Mary Foley
Australian National Health Practice Leader
mary.c.foley@au.pwc.com
+61 2 8266 2936

This publication is printed on Mohawk Options PC. It is a Forest Stewardship Council (FSC) certified stock using 100% post-consumer waste (PCW) fiber and manufactured with renewable, non-polluting, wind-generated electricity.



Recycled fiber