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PwC Health Research Institute

# Global top health industry issues: Defining the healthcare of the future





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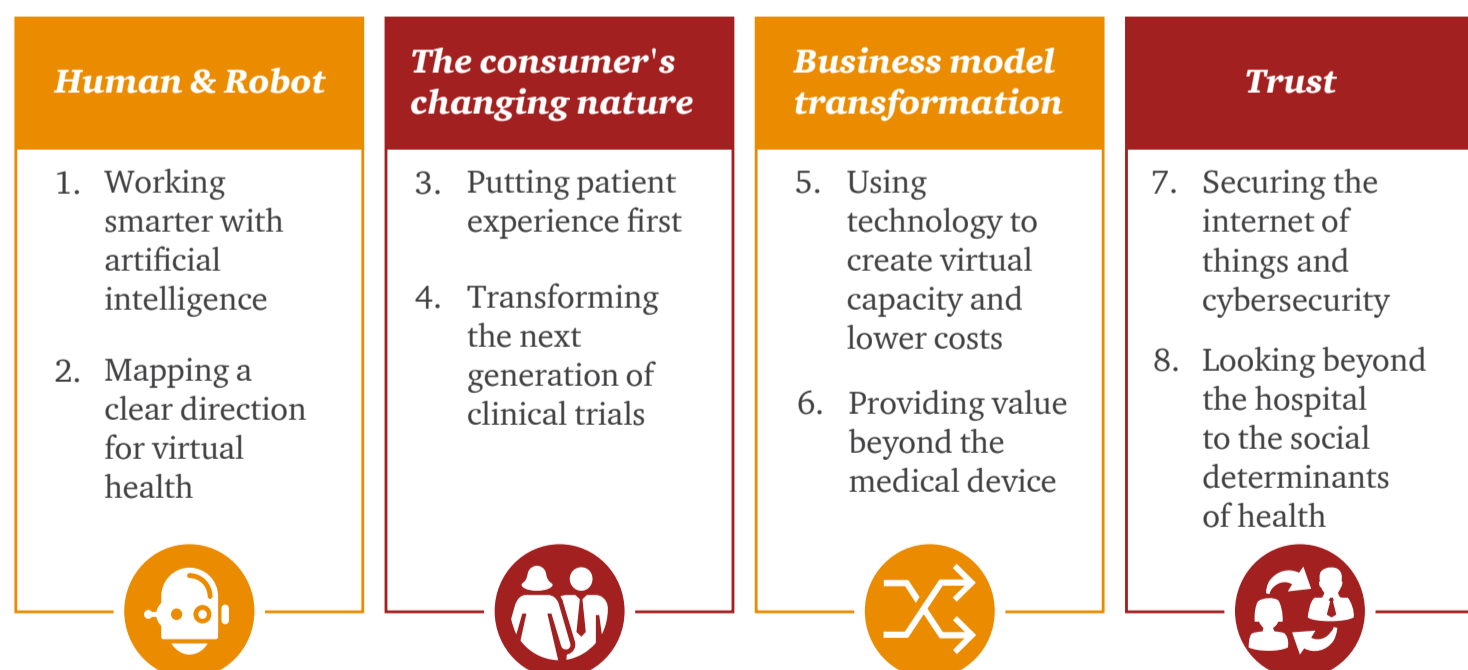
## Heart of the matter

More connected and consumer-oriented than ever before, the world's health systems are challenged to build resiliency in times of change. Traditionally viewed as a fragmented industry with hyperlocal challenges and solutions, healthcare faces near universal forces of rapid digitisation, increasing demands and expectations from informed and connected consumers, and shrinking resources to fuel innovation and build infrastructure. Health systems have a lot to learn from each other, other industries and from communities around the world. Systems will survive and thrive if they are able to connect, collaborate and create new solutions.

The top global issues span a wide range of themes, including human and robot, the consumer's changing nature, business model transformation and trust (see Figure 1). Machine learning, artificial intelligence (AI) and virtual care raise questions about interactions between people and technology, and increased people-to-people interactions using technology. AI challenges companies, organisations and governments to build intelligent and ethical institutions that benefit all. The number of apps and technologies delivering virtual care is exploding, potentially democratising care, increasing access to it and saving money. These innovations will require regulators and industry to help consumers navigate their options.

### Figure 1. The healthcare slice of global industry themes

These themes are evident in healthcare and across other industries



Source: PwC Health Research Institute analysis

Some healthcare consumers are starting to demand a positive, individualised customer experience, but many health organisations are struggling to deliver. Data and the technologies to collect them will be at the centre of this new healthcare customer experience. The next generation of clinical trials also will put the consumer at the centre as preferences and satisfaction scores are used to motivate more people to investigate and enrol. Medical device manufacturers are expanding their roles to deliver value beyond the device by helping hospitals report on quality, offering services that engage patients in real time, improving safety and compliance, and improving physician performance.

In this rapidly digitising and increasingly regulated environment, health systems are being asked to build even more trust with consumers. People are presented with a seemingly endless list of apps and technologies to manage their health, but they often receive little or no direction from healthcare providers about which they should use or how they should use them. Even if consumers do adopt health apps and technologies, their data rarely make their way into medical records. And when devices do sync with hospital data platforms, cybersecurity attacks—increasingly common—threaten consumers' trust in their health systems and can render existing data systems useless.

PwC Health Research Institute (HRI)'s Global top health industry issues report highlights the most important issues confronting the world's health systems, laying out a blueprint for a more sustainable and resilient path forward. Some countries may address these issues in the next 12 to 24 months, while others may find these issues manifesting over a longer timeline.

## Global forces: How health systems can learn from each other

Facing similar forces of change, health systems in different parts of the globe can still learn from each other (see Figure 2). Demographic and societal shifts such as urbanisation and ageing populations are intensifying resource pressures. The world population is expected to increase by 1 billion people by the year 2025; almost one-third will be age 65 or older.<sup>1</sup> Healthcare organisations should solve today’s pressing problems with a mindset of the future rather than relying on past assumptions.

### Figure 2. Health systems around the world face universal megatrends

Different health systems feel the forces of the megatrends to varying degrees



Source: PwC Health Research Institute analysis



Declining trust in institutions and technology is a global trend leading to swelling numbers of sceptical consumers demanding more information about their treatment choices. They also are expecting more from their providers, and they are thinking about this as they choose where they go for care. One in four global consumers surveyed by HRI would be willing to receive care in a nontraditional setting. These consumers want a healthcare experience that mirrors the convenience and transparency of their experiences in banking, retail and other industries.<sup>2</sup>

A second global trend is age, as a significant percentage of the population is getting older and placing more demands on local healthcare infrastructure and social institutions to deliver care and services. Global populations also are threatened with pandemics such as Ebola, influenza, cholera and other widespread infectious diseases. The 2013-2016 Ebola virus outbreak in West Africa claimed 11,325 lives with an alarmingly high case fatality rate of about 74 percent during the epidemic.<sup>3</sup> Concern mounted through globally connected communities, with 10 countries being affected by the outbreak, including Guinea, Liberia and Sierra Leone, where Ebola transmission was widespread.<sup>4</sup>

Dealing successfully with pandemics requires health systems to improve their readiness by having quarantine and contamination procedures and equipment, assessing supply chains, stockpiling drugs and considering other logistical challenges.

Disruption of business models and the blurring of industry boundaries constitute a fourth global trend. It is already evident, with workforce transformations that are dramatically changing the roles and job descriptions of tomorrow. Health systems and other industries are investing significant resources to train existing employees and define the talent needs of the future. Thirty-eight percent of CEOs responding to a PwC global survey said they are “extremely concerned” about skilled workers’ availability and how that may threaten business growth. Employers estimate that by 2020, one out of three of the desired core skill sets of most occupations will change.<sup>5</sup>

Distribution of resources, defined as increasing wealth disparity and the middle class’ demise, is another global trend. This phenomenon has been accompanied by growing populism and nationalism. These approaches are changing the fabric of societies, reversing, in some cases, their willingness to put healthcare front and centre for all of society. Rapidly escalating healthcare costs are depleting resources while demand for health services is increasing, putting pressure on governments to improve quality and access to care. Global spending on healthcare is projected to increase from US \$9.7 trillion

in 2015 to US \$18.28 trillion by 2040 with a projected worldwide shortage of 12.9 million healthcare professionals by 2035.<sup>6</sup> These global trends will continue to drive health systems' strategies in the short and long term.

In the midst of the changes health systems around the world face, some things remain constant. Health systems have similar components, even as the levels of development and pace of change differ across countries (see Figure 3).

**Figure 3: Health systems around the world have similar components—even as the level of development and pace of change differ**

Universal components include regulators, payers, infrastructure, consumer engagement and innovation



Source: PwC Health Research Institute analysis

Every health system has payers. Some, like Switzerland's, are largely privately funded. Some are publicly funded, such as the United Kingdom's and Denmark's, and some are a combination of the two, like the US' and Singapore's. Health systems have infrastructure, such as technology and physical facilities; reliable supply sources, trained professionals; and mechanisms to provide expertise and resources as needed that are centralised and developed in some places, or decentralised and developing in others.

Health systems around the globe are experiencing growing consumer engagement. In some countries, this is being experienced as improving access to services for populations and communities. In others, this engagement is focused on the individual and his or her personal choices. Another common element is innovation, with some countries being the developers and exporters of new technologies and ideas, while others import and use those innovations. In all countries, there are regulators that create highly structured or relaxed regulatory environments in which health systems function.

At the same time, health systems are becoming more alike. They are trading and connecting more. These systems are experiencing an internationalisation of care as established brands such as the US-based Cleveland Clinic expand to markets in Canada, the United Arab Emirates and the United Kingdom; and startups such as England-based Babylon, a primary care diagnostic app powered by machine learning and AI, enter markets in China and Rwanda.<sup>7</sup>





## Issue 1

# Working smarter with artificial intelligence

From Bangalore to Boston, new technologies are being used to automate business decision support applications, streamline regulatory functions and increase efficiency in reporting and medical product development. One of the most promising new technologies is AI. AI is a collective term for computer systems that can sense their environment, think, learn, and take action in response to what they're sensing and their objectives.<sup>8</sup> It is estimated that by 2021, healthcare organisations could realise 15 to 20 percent gains in productivity through the use of AI technologies.<sup>9</sup> AI likely will have a profound effect on the healthcare workforce, not by replacing jobs, but by becoming the “co-pilot” in the development of treatment pathways and routine business processes such as verifying patient insurance and improving clinical documentation.<sup>10</sup>

US-based Cogito Corp. is helping large American insurers use AI to deliver better customer service by analysing call centre data.<sup>11</sup> Cogito Corp.'s AI system helps call centre agents build trust with customers by analysing the conversation, its tone and its level of tenseness, and providing real-time feedback.<sup>12</sup>

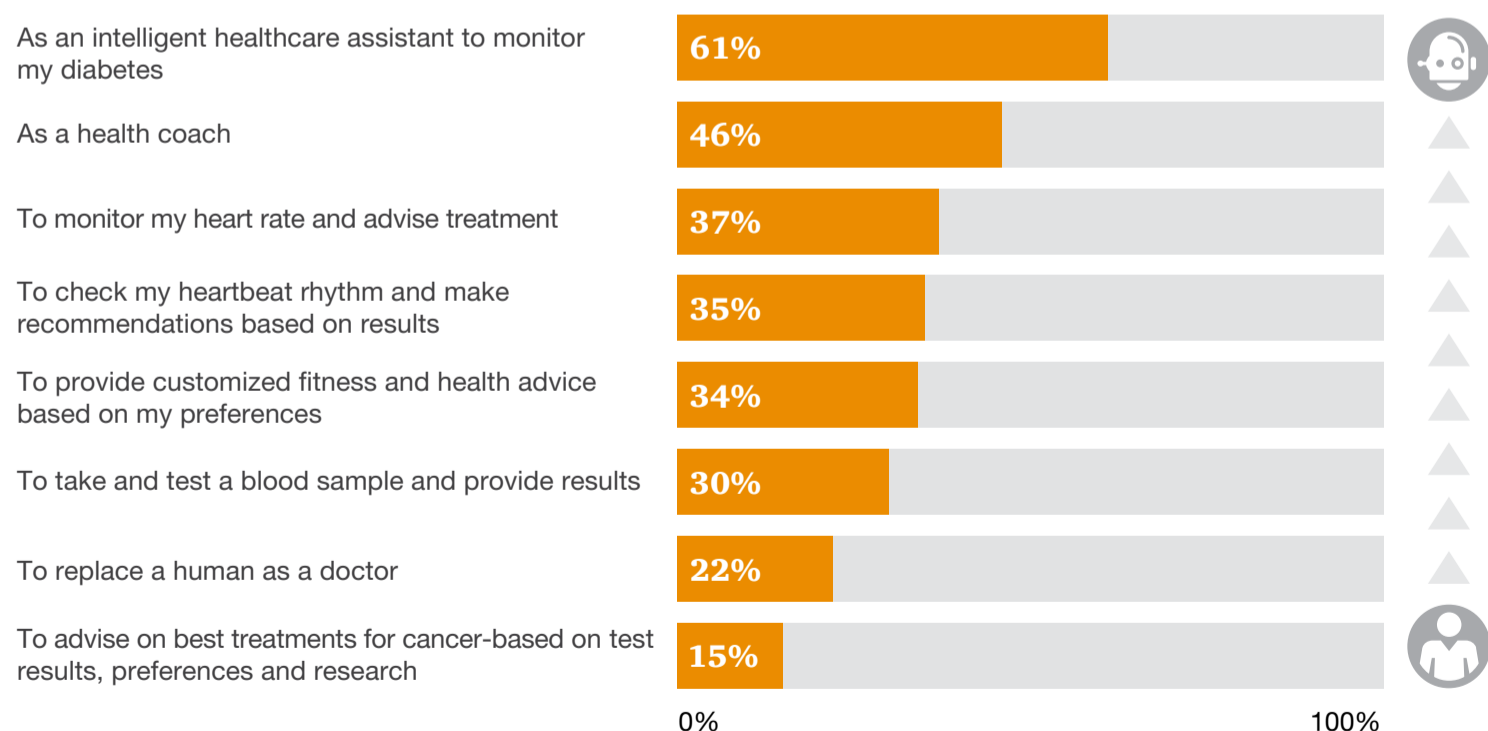
AI also is moving into clinical care. Tricog Health, a startup based in India, was selected by General Electric Company's healthcare accelerator program for its cloud-based cardiac diagnosis platform, which increases access to cardiac care across 340 cities in 23 states, including in some of the most remote locations in India.<sup>13</sup> The company's platform collects physiological and ECG data from medical devices in the field.<sup>14</sup> The platform processes the data in real time, providing diagnoses to cardiologists and enabling them to recommend actions to clinicians in the field.<sup>15</sup>

In China, AI-supported medical devices could help bridge workforce shortages, such as in pathology. Switzerland-based Roche Diagnostics has been working with the pathology department of West China Hospital and Knowledge-vision, a Chinese technology company, to develop algorithms in breast cancer pathology diagnosis.<sup>16</sup> In a contest between this algorithm and 10 experienced pathologists in 2017, an algorithm beat 90 percent of participating pathologists in accuracy and time.<sup>17</sup>

“To remain relevant and ahead of the curve, every Indian pharma, biotech and healthcare provider will need to adopt AI, XR (cross reality, which includes virtual and augmented reality) and prediction analytics,” said Kiran Mazumdar-Shaw, chairperson and managing director of India-based biopharmaceutical company Biocon, in an interview with HRI. Of healthcare leaders surveyed by HRI, 35 percent of Asian executives, 26 percent of North American executives and 23 percent of European executives said they plan to adopt AI to evaluate clinical trial data in the next two years.<sup>18</sup> In the Middle East, AI in the public sector, including health and education, is projected to contribute 18.6 percent to the GDP by 2030.<sup>19</sup> Yet challenges to increasing AI use remain, in part because many consumers are sceptical (see Figure 4).

### Figure 4: Consumers and providers are starting to embrace AI, but there is still room to increase trust

Consumers’ willingness to use services and procedures that could be performed by AI or robots



Source: PwC Health Research Institute analysis of PwC Bot.Me: A revolutionary partnership, PwC Consumer Intelligence Series survey, 2017, and PwC What doctor? Why AI and robotics will define New Health survey, 2017 <sup>21</sup>

## Working smarter with artificial intelligence: Snapshots from around the globe

Country	What is being done	Results so far
<i>India</i>	<p><b>Identifying drug consumption patterns:</b> The Redbook AI engine offers deep insights on drug consumption patterns in more than 500 India-based pharmacies.</p>	<p>For pharmacies, Redbook frees up resources and time by eliminating manual processes such as data collection, analysis and decision-making. The Redbook AI engine has increased business by over 15 percent with several features, such as integration between online ordering facilities, auto sync for offline use, timely information on stock expiration and micro-level insights about consumers that allow pharmacies to deliver personalised service.<sup>21</sup></p>
<i>Germany</i>	<p><b>Using real-world evidence—clinical evidence regarding usage, benefits and risks of medical products—to identify the most effective treatment for an individual:</b> Predictive Healthcare with Real-world Evidence for Neurological Disorders (PHREND) is a web-based tool used by German doctors. The PHREND app compares treatment effectiveness using real-world evidence derived from comparable patients. Using machine learning and statistical models applied to clinical outcomes, the program creates therapy recommendations based on individual patient characteristics.</p>	<p>German doctors who tested PHREND in 2017 had positive experiences with the tool. They have used the information from PHREND to test their own assessments of patients' conditions and have shared it with patients as a second opinion, when their patients have wanted it. The database contains the treatment data of 25,000 multiple sclerosis patients over the past 15 years as reference cases. An expansion to other complex neurological diseases is planned in Germany and potentially the Netherlands.<sup>22</sup></p>
<i>Mexico</i>	<p><b>Identifying evidence-based treatment options:</b> Grupo Angeles Servicios de Salud is a private hospital chain in Mexico that is piloting the use of IBM Watson for Oncology. Watson for Oncology uses an extensive library of data sources, including medical journals, textbooks and other medical evidence, to identify evidence-based treatment options.</p>	<p>Watson for Oncology has matched tumour board recommendations for treatment in up to 96 percent of cases, with additional adaptations needed to accommodate regional clinical protocols and drugs available in those markets.<sup>23</sup></p>
<i>China</i>	<p><b>Helping primary care doctors with diagnosis and treatment:</b> WeDoctor, a China-based internet company has developed two AI platforms, Ruiyi Cloud and Huatuo Cloud, to assist doctors with Western therapy and Chinese traditional therapy respectively.</p>	<p>Based on machine learning of large amounts of high-quality patient data, Ruiyi Cloud has achieved breakthroughs in identifying various diseases, including small pulmonary nodules and cervical cancer. The accuracy for identifying diabetic retinopathy is 95 percent. Huatuo Cloud has been installed in more than 400 traditional Chinese medicine hospitals in 11 cities, assisting doctors with more than 1.6 million prescriptions. It has become the most widely used traditional Chinese medicine cloud doctor worldwide.<sup>24</sup></p>



# Implications



## Industry

**Use AI to supplement the workforce.** Use AI to reduce or eliminate the routine and repetitive tasks that may keep employees from practising at the top of their ability.<sup>25</sup> Business executives told PwC they hope to be able to automate tasks such as routine paperwork, scheduling, time sheet entry and accounting with AI-enabled tools, giving employees more time to focus on tasks that can be performed only by humans.<sup>26</sup>

**An AI tool is only as good as the data it uses for decision-making.** To fully realise AI's potential, companies should start by investing in the basics, such as finding, acquiring and creating good data; standardising it; and checking it for errors.<sup>27</sup> Companies also should consider how their systems capture, collect, clean, integrate, enrich, store and analyse data, so that it can be integrated with other relevant systems.<sup>28</sup>

**Partner.** Although 75 percent of health executives plan to invest in AI in the next three years, many lack the ability to implement it.<sup>29</sup> Just 20 percent of respondents said they had the technology to succeed with AI.<sup>30</sup> Companies should consider ways to acquire these capabilities, including partnering with technology firms or hiring the right expertise and working with regulators to manage risk.<sup>31</sup>



## Call to action for policymakers and regulators

**Create trust in AI.** When investing in AI, companies should devise strategies or campaigns to showcase its reliability and benefits to generate buy-in from regulators. In a recent survey of global CEOs, anxiety about AI's impending promises and perils was reflected in 40 percent of respondents citing cyber threats, 38 percent speed of technological change, and 38 percent the availability of key skills as extreme concerns.<sup>32</sup> Investing in building trust is worth it, as PwC analysis projects that AI will likely contribute \$15.7 trillion to global Gross Domestic Product (GDP) by 2030.<sup>33</sup>



## Issue 2

# Mapping a clear direction for virtual health

Consumers are increasingly managing their own health and are often counting on the burgeoning virtual health system to help them. An abundance of resources and health products, such as mobile devices and health-related apps, exist, but consumers struggle to make choices without clear guidance from providers and health systems. The result is a lot of missed opportunities to embed virtual health into the traditional health system's care pathways.

Brazil's Ministry of Health is investing in a project to digitise operations and integrate systems in the national, state and municipal spheres of care for the Sistema Único de Saúde, or public health system.<sup>34</sup> The ministry also has launched more than 10 apps to adapt and train the population to access their personal online health records and health treatment content.<sup>35</sup>

Virtual health promises to improve access and deliver care with fewer resources. Indian healthcare providers surveyed by PwC cited lowering the overall cost of care for patients, connecting with previously unreachable patients and reducing administrative time for medical personnel as top reasons for adopting mobile health.<sup>36</sup> A recent PwC analysis found that these cost savings can lead to expanded access. Savings related to delivering healthcare virtually can be used to cover treatment for an additional 2.3 million patients in Mexico and 4.3 million patients in Brazil.<sup>37</sup>

Virtual health also is helping Australia meet the projected demand for aged care social infrastructure.<sup>38</sup> Australia spends approximately 75 percent of its AU \$1.62 billion residential care budget on care for the ageing.<sup>39</sup> Keeping older adults independent and out of residential care can enable better quality of life and can decrease residential care costs.<sup>40</sup>

A partnership between Samsung Electronics Australia, Australia's Deakin University and the city of Greater Geelong is helping seniors remain in their homes longer through a program known as the Holly Smart Home Solution trial.<sup>41</sup> Home sensors monitor and collect data that are processed through a machine learning system that alerts providers if an abnormal activity, such as a fall or other adverse health event, is detected.<sup>42</sup>

The Mexican government is developing telehealth systems and user-friendly apps aimed at overall wellness and chronic disease prevention, thanks to high rates of mobile phone access. The government's aim is to increase access to care and reduce spending. MIDO is a chronic disease information system that includes mobile health tools, a patient monitoring system and modules to monitor drug supplies and personnel training.<sup>43</sup> MIDO, which has been installed in more than 12,000 Mexican primary care centres, has, among other achievements, increased the percentage of diabetic MIDO users regularly taking the A1C test (to measure their blood sugar levels) from 14 to 48 percent.<sup>44</sup>

The private sector also has driven Mexican telemedicine innovation. Privately owned, Mexico-based Docademic allows patients with a smart phone and internet access to contact a doctor through videoconference—for free—using a mobile app.<sup>45</sup> AI supports Docademic doctors in making diagnoses; patient health history is kept on a blockchain, which is a decentralised ledger.<sup>46</sup> The blockchain allows patients to own their health information, with the eventual power to grant providers access to their records.<sup>47</sup> More than 76 percent of Docademic patients follow their physicians' directions, according to Arturo Diaz, Docademic chief technology officer. Docademic also is working with the Mexican government and private companies to provide research analytics to improve public health.

In the US, PwC and the University of Texas System are using technology to amplify services for the communities of South Texas, a region with high diabetes, prediabetes and obesity incidence.<sup>48</sup> PwC used DoubleJumpInterchange—a business collaboration platform that securely brokers cooperation among healthcare participants and connects clinics, pharmacies, retailers, and nonprofits—to connect each patient with his or her care team.<sup>49</sup> The businesses are connected with technologies such as remote monitoring tools and cognitive analytical applications that synthesize vast amounts of information to guide clinical and behavioural treatment decisions.<sup>50</sup> Patients receive tools such as wearables and use self-service kiosks to monitor their biometrics between doctors' visits.<sup>51</sup> A care team that communicates with them virtually supports them with the aim of gaining better control over their conditions.<sup>52</sup>

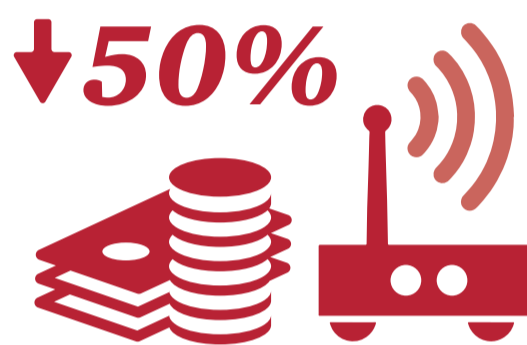


Despite consumer interest, virtual health cannot reach its full potential if health systems fail to offer guidance and support. Among 150,000 available health apps worldwide, almost half have been downloaded fewer than 5,000 times, which indicates fragmented adoption of apps (see Figure 5). Regulatory barriers still create hurdles regarding who can use virtual health, which clinicians can participate, and how to pay for it.

## Figure 5: More people are getting online around the world

With so many options, consumers need help choosing apps that will work for them

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**People across the world are getting online, with potential to access virtual health**

*Mobile broadband prices have dropped by 50% on average over the past three years, which has resulted in about half of the world's population now being online.*

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**There are too many apps, and consumers need directions to choose appropriately**

*There are more than 165,000 mobile health apps available worldwide, with 40% having fewer than 5,000 downloads*



Source: PwC Health research analysis of IMS Institute for Healthcare Informatics, 2015, and International Telecommunication Union Statistics global and regional ICT data, 2017

## Mapping a clear direction for virtual health: Snapshots from around the globe

Country	What is being done	Results so far
<b>India</b>	<b>Managing lifestyle diseases with the help of an AI-enabled nutrition app:</b> HealthifyMe, an India-based startup, is working on lifestyle diseases such as obesity, hypertension and diabetes. With its AI-enabled nutrition coach, Ria, HealthifyMe brings the best of elite nutrition expertise with AI in the loop.	HealthifyMe has more than 4,000 daily active users and includes more than 25,000 recipes. <sup>53</sup>
<b>Germany</b>	<b>Getting the regulatory green light for broad telemedicine use:</b> Telemedicine treatments in Germany have been highly regulated, and the German Medical Association has previously banned remote treatment from the professional codes of conduct. However, each individual case has to be assessed beforehand. Telemedical treatments have been allowed since May 2018.	The medical association of the state of Baden Wurttemberg pioneered in the field of telemedicine by allowing remote diagnosis and therapy through “TeleClinic” for privately insured patients and “DocDirekt” for publicly insured ones. A new eHealth legal initiative aims to expand the digital services provided by statutory health insurances, which are currently run as pilots. <sup>54</sup>
<b>Australia</b>	<b>Developing coordination platforms for aged care in the home:</b> Care Connect is Australia’s largest independent home care adviser and broker; it finds tailored home care options suited to each customer.	Care Connect conducted major customer experience studies for clients and providers that revealed that people value living happily at home for life. In 2016 Care Connect realised a 10% increase in their offering that allows the elderly to live in their homes as long as they would like. <sup>55</sup>

# Implications



## Industry

**Include virtual care in the overall strategy.** In fee-for-service markets, consider the potential of virtual care solutions that can drive direct revenue growth or expand market share through, for example, virtual geographic expansion as opposed to a brick and mortar facility.<sup>56</sup> In value-based care models or single-payer systems, factor in virtual care solutions that improve outcomes and reduce costs, expand access to services, improve utilisation management and promote preventive and chronic disease management.<sup>57</sup>

**Advise consumers on apps, wearables and other virtual technologies.** Consumers are starting to adopt virtual health—with 16 percent of global consumers surveyed already owning a wearable device that tracks or monitors their health, and 31 percent planning to own one— regulators and providers may be missing an opportunity to advise them on their options.<sup>58</sup> Health care organisations and regulators should work collaboratively to advise consumers. In Singapore, a regulatory sandbox is promoting innovation in healthcare models in a safe and controlled environment that protects patients' interests, gives providers early visibility into the regulatory environment, and supports the Ministry of Health in developing more timely and effective regulations.<sup>59</sup>

**Provide consumers with virtual health options.** In the US, 14 percent of consumers surveyed had been prescribed a mobile health app by a physician, nurse or other healthcare provider for themselves or a family member.<sup>60</sup> Virtual health can improve outcomes, increase access and lower the cost of care, which is a win-win for the regulators, consumers, payers and providers who embrace the technology.<sup>61</sup>



## Call to action for policymakers and regulators

**Develop cybersecurity standards to encourage healthcare entities to adopt virtual care.** The US and Singapore have published guidelines, such as Singapore's National Telemedicine Guidelines, that are publicly available, but more guidance is needed.<sup>62</sup> Seventy-two percent of US consumers surveyed by HRI are concerned about the security of the health information they store or share on a mobile health app on their phones.<sup>63</sup> A cybersecurity strategy is essential to gaining the trust of consumers, regulators and payers.



## Issue 3

# Putting patient experience first

Globally, consumerism in healthcare is growing at different cadences and for different reasons. In some countries, the drivers are increased cost-sharing and the desire for a better overall experience. In others, the demand for greater access to care and better outcomes is fuelling the trend.

Governments are finding that the demand for convenient, cost-effective care is outstripping their ability to fund expanded health services to meet growing consumer demands. Fuelling these demands are relatively high out-of-pocket costs for many services. Governments are trying to simplify the ways in which patients navigate the available service types and their settings while streamlining these processes on the back end to ultimately improve patient outcomes.

Across health systems, improving patient experience can change behaviour and lead to better outcomes by collecting meaningful information about consumers' social circumstances. "We interact with people as a set of transactions, but people are on journeys," said John Glaser, senior vice president of population health at US-based electronic medical record company Cerner, in an interview with HRI.<sup>64</sup> "We need to understand the journey the patient is on, where he or she is on that journey, and how we can help him or her."

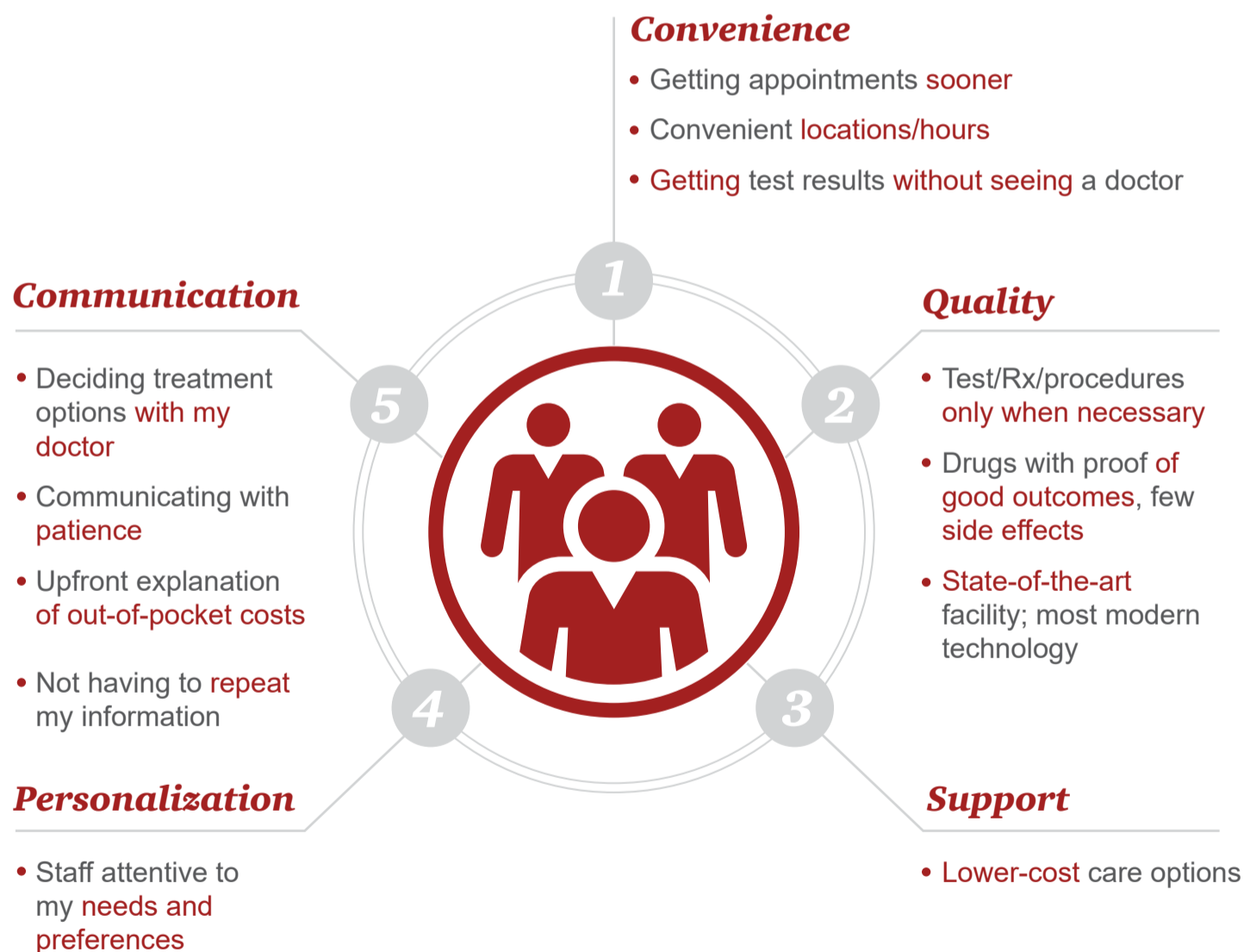
Consumers know what they want. Grasping the nuances of what kinds of experiences they value—and addressing those—can generate a return on investment.<sup>65</sup> Data are critical to developing a complete view of patients as consumers. US-based health system Banner Health looked to consumer expectations from retail and applied those lessons to its inMoment tool, which gives Banner providers real-time information about their patients'

needs and complaints.<sup>66</sup> These types of tools are starting to be used by health organisations, as they can get their responses faster than traditional satisfaction surveys.<sup>67</sup>

Individual consumers may differ, but consumers generally value many of the same aspects of patient experience. HRI surveyed 1,500 American consumers and found 12 highly valued features in five categories that are common to all consumer segments—from frail elderly and those with chronic disease to healthy families and adults—for a positive customer experience (see Figure 6).

### Figure 6: Five pillars of customer experience in healthcare

The features listed were found to be of high importance across customer segments



Source: PwC Health Research Institute analysis <sup>70</sup>

Australia is changing customers' fragmented care journeys by making it easier to navigate and pay for services. The Australian government has spent millions of dollars investing in data infrastructure—such as My Health Record, the country's national digital health record system—and in creating the Australian Digital Health Agency.<sup>69</sup> Government health officials expect their efforts will produce significant quality and safety benefits for patients and service improvements for the system overall.<sup>70</sup> Some benefits include better standards of care, reduced clinical incidents, more access to health services for rural and remote communities and lower cost per admission because of shorter stays.<sup>71</sup>

Similarly, the UK's National Health Service (NHS) is shifting from care models that focus on institutions to a patient-centred care approach, which encourages patients to be more actively involved in their care, treatment and support.<sup>72</sup> The NHS expects that this approach will improve outcomes and generate savings.<sup>73</sup> A recent meta-analysis of patient-centred care interventions showed that 73 percent of them resulted in improved health outcomes.<sup>74</sup> Another analysis showed that the use of patient decision aids reduced the number of people choosing major elective surgery over more conservative options.<sup>75</sup>



Country	What is being done	Results so far
<b>UK</b>	<p><b>Making appointments and tracking referrals digitally:</b> Starting in late 2018, the NHS will require that all first outpatient referrals be made electronically instead of on paper. Electronic referrals will allow patients to choose an appointment date and time that suits them. If the wait time for a particular hospital is long, patients have the option of choosing an appointment available sooner at a different hospital. Digitising referrals will also free up clinician time through fewer no-shows, less time spent on paperwork, and fewer visits from patients inquiring about the status of their hospital appointments.</p>	<p>After they're fully implemented in October 2018, electronic referrals are expected to save the NHS at least 50 million pounds in efficiencies gained from fewer missed appointments and freeing up clinician time to see more patients.<sup>76</sup></p>
<b>Denmark</b>	<p><b>Collecting patient reported outcomes to understand how to provide better quality care:</b> The Danish Health System has started collecting and using the insights from patient reported outcomes (PROs) to improve care quality and give patients customised experiences.</p>	<p>PROs have been used to screen patient symptoms and determine whether a consultation is needed, which has helped patients avoid unnecessary in-person visits. PROs also yield quality assurance data and will be integrated with patient clinical data to create a more complete understanding of patient experiences and preferences.<sup>77</sup></p>
<b>Austria</b>	<p><b>Using video glasses to keep patients calm and reduce stress during procedures:</b> Austria-based HappyMed produces video glasses that immerse patients in films to reduce anxiety during medical procedures.</p>	<p>Of the patients sampled, 92 percent would gladly use HappyMed again, and 90 percent would recommend the video glasses.<sup>78</sup></p>
<b>Australia</b>	<p><b>Improving patient and clinician experience with technology:</b> Australia-based St John of God Health Care has invested in Salesforce to improve patient and clinician experience through a portal that streamlines admissions and payment.</p>	<p>The portal is being used by more than 6,900 patients with an 85 percent adoption rate in four months compared to 30 percent for other solutions.<sup>79</sup></p>

# Implications



## Industry

**Choose the data cure for customer experience.** Create different strategies to revamp the customer experience by using or becoming data hubs or aggregators, commercialising your own insights, and pursuing direct data partnerships.<sup>80</sup> Data hubs can be created by aggregating data from wearables, electronic health records, and monitoring and screening data so that the information can be shared across care and support settings.<sup>81</sup> Data aggregators can house data sets from multiple sources and provide de-identified data sets that can offer insights for healthcare stakeholders while sidestepping grassroots collection.<sup>82</sup> To commercialise insights, invest in proprietary data and tools to generate them, and sell them to other industry players, such as insurers with strong analytic abilities that are diversifying into nonregulated lines of business.<sup>83</sup>

**Make customer experience second nature for staff.** The appropriate tools and training can reduce the time employees spend looking for and reviewing data, giving them more time for meaningful interactions with consumers.<sup>84</sup> Invest in digital platforms and automation, such as a patient education system, to help patients be more active in their care and reduce the burden on clinicians. Also invest in systems with protocols to promote information-sharing between physicians and patients.<sup>85</sup>

**Unwire the experience.** Give consumers what they value, through convenient locations and hours, the chance to see a provider quickly and the choice of low-cost care options.<sup>86</sup> Digital technologies such as telemedicine, Wi-Fi-enabled scales, mobile health apps for chronic disease monitoring, and wireless biometric sensors mean that the care experience is no longer tied to the physician's office.<sup>87</sup> Select digital solutions to complement—not replace—human interaction.



## Call to action for policymakers and regulators

**Make consumer-centered care the new norm.** Recognise its financial and population health benefits, and develop policies that give priority to the consumer. Encourage organisations to participate by creating new initiatives based on the five pillars of customer experience, reimburse for those services, and rate healthcare providers and payers on those features.



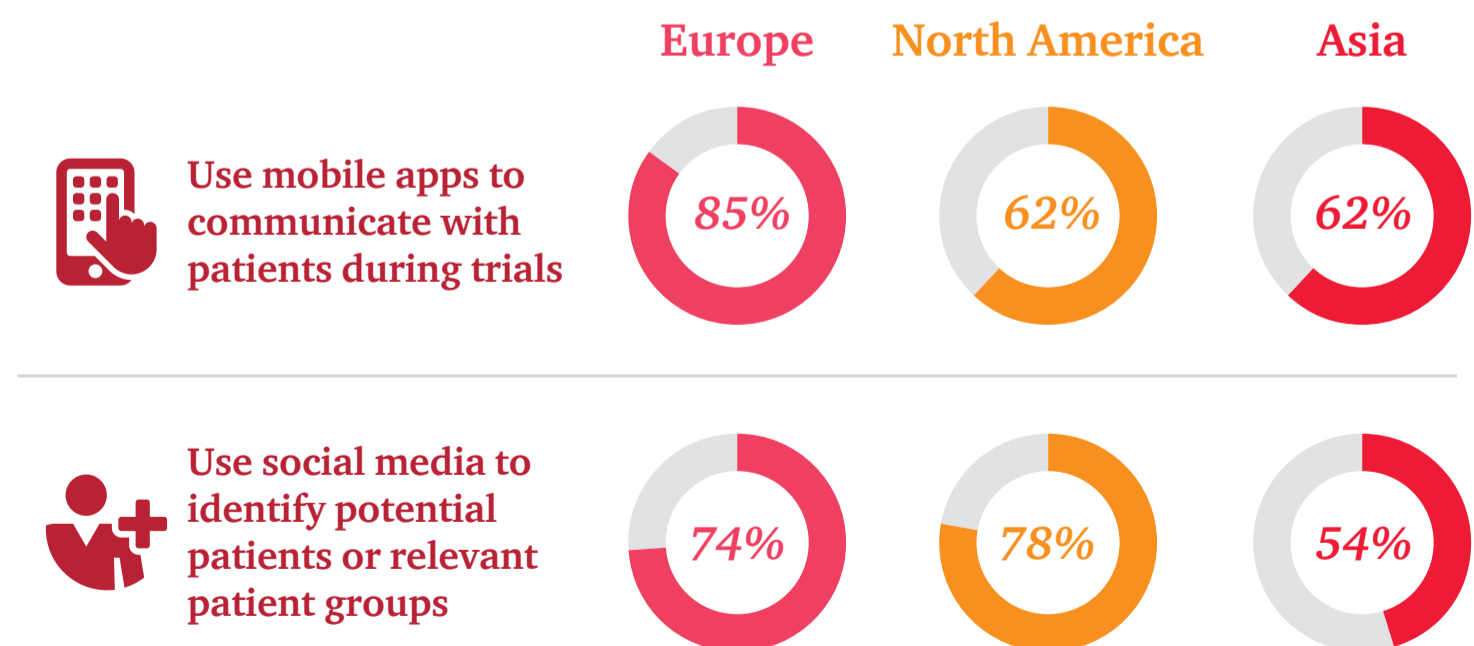
## Issue 4

# Transforming the next generation of clinical trials

To recruit and retain clinical trial participants, companies are adopting digital tools and patient-centric approaches (see Figure 7). Patients consider the potential risks and benefits, the study's purpose and the research centre's location to be the most important factors influencing their decision to participate, according to the Center for Information and Study on Clinical Research Participation.<sup>88</sup> Mobile apps and telemedicine are letting patients participate in clinical trials outside of traditional trial sites, making trials more convenient and accessible.<sup>89</sup>

### Figure 7: The pharmaceutical and life sciences leaders HRI surveyed are using digital technologies to recruit and engage with trial participants

What types of new tools, services or analytics has your organisation used in its clinical trials?



Source: PwC Health Research Institute Clinical Trial Innovations survey among pharma life science executives, 2018

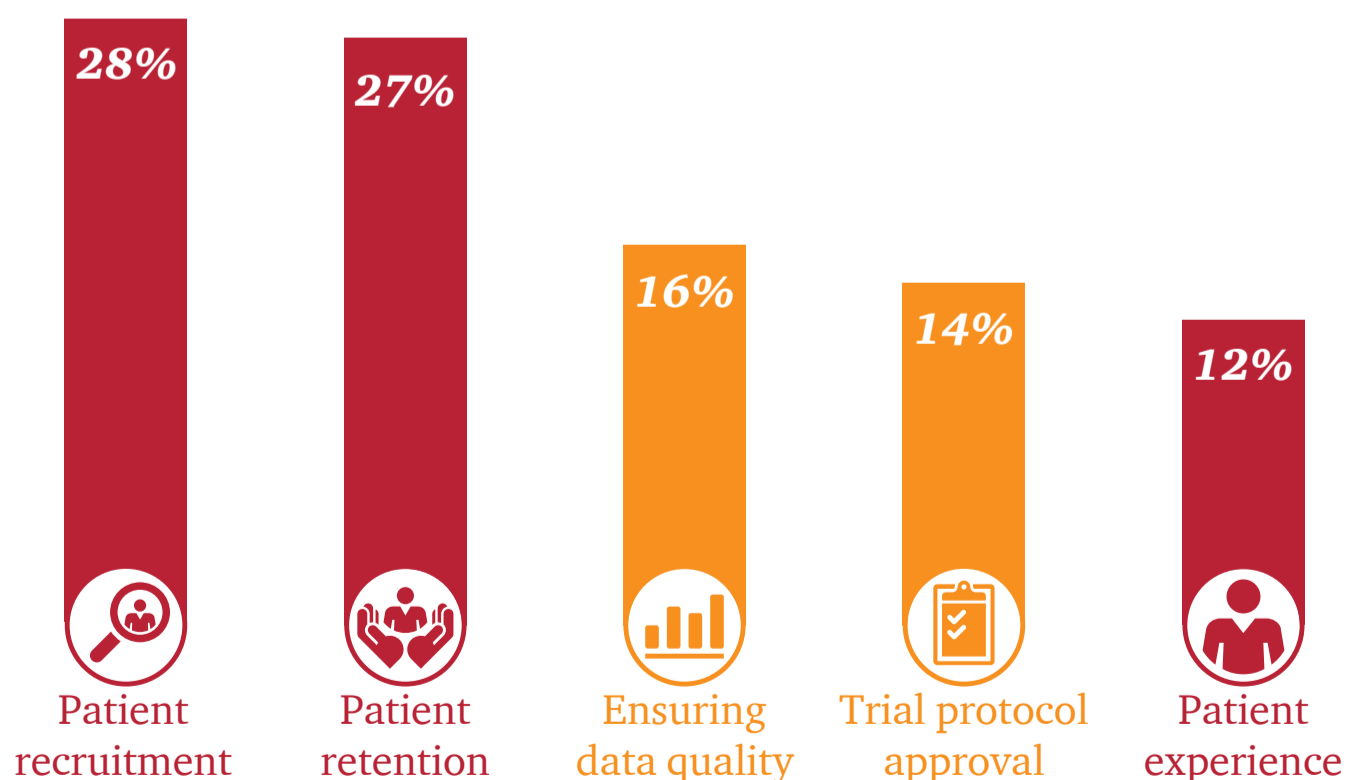
Clinical trial search tools can help patients find and enrol in trials with eligibility requirements matching their profiles.<sup>90</sup> Physicians aren't always aware of trial opportunities, or they lack clear incentives to recommend trials to patients, so it's critical that patients be able to search on their own. Physicians also may have a strong inclination toward a specific treatment for a given patient, or may be concerned that a clinical trial will interfere with their relationship, according to a US-based National Institutes of Health study.<sup>91</sup>

Only a small percentage of eligible patients participate in clinical trials, even though 70 percent of Americans are estimated to be inclined or very willing to participate.<sup>92</sup> Among trial participants, American patients are the most proactive about contacting a trial site to inquire about enrolment, compared with patients in Africa, Europe, South America and Asia Pacific, according to a 2017 FDA report.<sup>93</sup>

Biopharmaceutical companies and medical device manufacturers are competing to produce the best drug and device portfolios, and conducting clinical trials with the appropriate patient populations is one way to get high-quality, effective drugs to the market. Yet patient recruitment and retention are the two biggest reasons for delays in clinical trial completion, according to an HRI survey of global pharmaceutical and life sciences leaders (see Figure 8).

**Figure 8: The pharmaceutical and life sciences leaders that HRI surveyed identified patient recruitment and retention as the top barriers to clinical trials**

Percentage of respondents who chose the following as the top barrier to completing clinical trials



Source: PwC Health Research Institute Clinical Trial Innovations survey among pharmaceutical life sciences executives, 2018.

To reduce the logistical issues of a physical trial site, Switzerland-based pharmaceutical company Novartis and Science 37, a US-based clinical research and technology company, will launch 10 increasingly decentralised clinical trials that blend virtual and traditional trial sites over the next three years, with the goal of moving to a completely “site-less” model.<sup>94</sup> A virtual trial will overcome some of the geographic, logistical and financial barriers participants face in getting to a trial site, such as the time and expense to travel to a site multiple times during a study. “Opening the aperture and democratizing access [to trials] will solve some of the recruiting challenges that have plagued the industry,” said Jake LaPorte, head of digital development for Novartis, in an interview with Scrip.<sup>95</sup>

Pharmaceutical companies can help patients navigate their options and decide about participating in trials. “No one is really owning the more progressive ways by which you could insure that patients, their caregivers and providers are fully aware of relevant trials, and really streamlining that communication,” Doug Noland, head of patient experience at Japan-based Astellas Pharma, said in an interview with HRI.<sup>96</sup>

## Transforming the next generation clinical trials: Snapshots from around the globe

Country	What is being done	Results so far
<b>US</b>	<p><b>Using electronic health records to connect physicians and patients with clinical trials:</b> Cerner, a US-based electronic health record vendor, has developed a clinical decision support engine to match patients to trials based on clinical data in the electronic health record.</p>	Clinical research teams in health systems can run study eligibility requirements against an entire patient population. Once eligible patients have been matched with studies, study coordinators can create recruitment strategies. <sup>97</sup>
<b>US and Switzerland</b>	<p><b>Using electronic health records to identify specific patient populations:</b> Switzerland-based Roche has acquired US-based Flatiron Health Inc., which is an oncology-focused electronic health record provider.</p>	Through the acquisition, Roche has access to Flatiron’s provider partners, which include 2 million active patient records and 55 community oncology practices across 20 states. <sup>98</sup>
<b>US</b>	<p><b>Using technology to help patients find and navigate clinical trials:</b> US-based ClinOne is a web and mobile application that allows real-time screening so patients can find studies that are best suited for them. The Patient e-Portal Knowledge Base contains information about trials and details for patients to share with family members.</p>	Once patients are enrolled in a trial, the ClinTrialConnect Digital Concierge helps patients navigate trial participation. The solution acts as a central resource for visit calendar management, a Google maps integration to provide guidance on travel and logistics, visit expectations, and alerts and reminders in 30 languages. ClinOne is used by 2,500 active clinical trials in 48 countries. <sup>99</sup>



# Implications



## Industry

**Build solutions for more efficient trials.** Traditional healthcare companies, nonprofits and new entrants bring unique capabilities to accelerate patient recruitment, analyse data and increase access to new therapies. Organisations that have identified bottlenecks in the trial process can partner with technology and other third-party vendors to create an ecosystem that eliminates inefficiencies. Such a best-of-breed approach to trial recruitment will include ways to improve awareness of and education about available clinical trials globally.<sup>100</sup>

**Strategically select digital platforms to fully integrate experimental and real-world evidence.** These digital platforms can be used in conjunction with acute data point collection in a traditional clinical setting to leverage holistic patient insights not normally seen in classical models. “That is really the next step for successfully integrating digital solutions into our industry,” said Mohammed Ali, global head of digital trials, global clinical operations at Germany-based Boehringer Ingelheim Pharmaceuticals Inc., in a conversation with HRI.<sup>101</sup>

**Create an intelligent data environment.** Strong data integrity is crucial in both traditional and virtual trial formats. Trial sponsors should review their data and analytics capabilities to decide if investing in the capabilities of, or partnering with, a data or technology provider will most effectively create enterprise capability to support clinical trials across different R&D programs and therapeutic areas. Drugmakers should also use real-world evidence to support regulatory submissions, for additional drug indications, and to inform new drug development.<sup>102</sup>



## Call to action for policymakers and regulators

**Promote and reward early engagement.** Twenty-four percent of large pharmaceutical and 25 percent of all pharmaceutical and life sciences leaders whom HRI surveyed reported regulatory uncertainty as the largest barrier to their organisation conducting remote clinical trials.<sup>103</sup> Regulators should work with companies that communicate early about their intended trial designs, protocols and digital collection strategies to ensure data integrity and successful trial execution. For example, the US Food and Drug Administration (FDA) is collaborating with companies to test electronic patient-reported outcomes in oncology.<sup>104</sup>





## Issue 5

# Using technology to create virtual capacity and lower costs

The promise of technology is to increase value for consumers and alleviate resource constraints on healthcare entities by creating virtual capacity. Virtual capacity is created by supplementing the labour force and shifting care away from traditional, more costly settings such as hospitals and emergency rooms to clinics and homes, and investing in technologies that reduce costs. Across the globe, countries are increasingly using these new tools.

Virtual capacity is needed because healthcare systems and decision-makers face resource constraints as costs outpace economic growth. This near-universal phenomenon can be seen in both growing and developed economies, and in privately funded and publicly funded health systems. Pressure to reduce costs is manifesting itself in debates over value-based drug pricing and drug pricing transparency in the US and other markets.<sup>105</sup> Between 2012 and 2016, the percentage of GDP spent on healthcare increased in most countries.<sup>106</sup>

Singapore, for example, is using technology to improve care coordination. Patients in Singapore who receive abnormal screening results from a virtual health screen are six times more likely to follow up with a physician using the virtual platform MyDoc than through an in-person consultation, according to a study by PwC and the National University of Singapore's Centre for Health Services and Policy Research.<sup>107</sup> MyDoc enables virtual consults and connects pharmacies and care managers, anytime, anyplace.<sup>108</sup> MyDoc use increased follow-up care and reduced inpatient admissions for diabetes, resulting in five times greater savings for patients and payers, according to the same study.<sup>109</sup> MyDoc's virtual visits delivered SGD 3 million in savings.<sup>110</sup>

Technology also can reduce costs in hospital operations and finance. In Australia, technology is producing efficiencies in health system back-office operations by digitising and automating finance functions. That is freeing up time for finance professionals to analyse data and identify inefficiencies while improving clinical and population health outcomes.<sup>111</sup> PwC research shows that the top digital finance functions are operating at almost half the cost of comparable groups while providing substantial insight and direction to enhance the patient experience.<sup>112</sup>

One approach to determining a new technology's value is to assess whether new drugs and devices improve quality at lower costs. Japanese health spending as a share of GDP is 10.9 percent, the sixth highest among the Organization for Economic Co-operation and Development countries, due in part to high per capita drug costs.<sup>113</sup> The Japanese healthcare system is piloting an initiative to evaluate new technologies and price them according to cost-effectiveness.<sup>114</sup> The evaluation begins with manufacturers submitting data that are reviewed by academic groups and ultimately appraised by an expert committee.<sup>115</sup> The government uses the appraisal to determine what is paid for in its universal health coverage system.<sup>116</sup>

This approach to improving quality at lower costs has succeeded in the UK, where the net benefits of paying only for new treatments that are proven to work have resulted in an estimated savings of 3 billion to 5 billion pounds.<sup>117</sup> Drug companies are feeling the pressure to reduce costs; HRI's survey of pharmaceutical executives found that more than 70 percent of them believe developing lower-cost drugs is more important now than in the previous two years (see Figure 9).

### Figure 9: Pharmaceutical and life sciences leaders are responding to pressure to reduce costs



Source: PwC Health Research Institute Clinical Trial Innovations survey among pharmaceutical life sciences executives, 2018

## Using technology to create virtual capacity: Snapshots from around the globe

Country	What is being done	Results so far
<i>India</i>	<p><b>Using image recognition to spot early signs of diabetic retinopathy:</b> US-based Google has recently partnered with India-based Aravind Eye Hospital, the largest eye care provider in the country, to use image recognition algorithms to detect early signs of diabetic retinopathy.</p>	<p>Aravind Eye Hospital has given Google 128,000 retinal images to use as reference images so the AI algorithm can learn to diagnose diabetic retinopathy.<sup>118</sup></p>
<i>UK</i>	<p><b>Improving patient experience and the bottom line with technology:</b> The NHS in the UK is implementing new technology interventions to improve efficiency and patient outcomes. Technologies will transform care delivery, logistics and care management. Care delivery will use technology to monitor and communicate with patients in new ways using wearables, apps and virtual consults. Care logistics will transform how patients are managed through the health system with technologies that enable automatic referrals, notifications, and management of appointments and treatment schedules online. Care management technologies will empower patients to manage their health and well-being with apps and online communities.</p>	<p>According to a PwC UK analysis, using the appropriate technological interventions to improve efficiency in the short term, and change healthcare delivery to improve patient outcomes in the longer term, could deliver net benefits between 8 billion and 13 billion pounds by 2020/2021.<sup>119</sup></p>
<i>UK</i>	<p><b>Democratising care with AI:</b> UK-based Babylon Health plans to use technology to democratise care globally with its AI-enabled mobile app that gives patients diagnoses, information, health assessments, treatment and coaching.</p>	<p>Partnering with the NHS, Babylon delivers the “GP at hand” service to NHS members. The average wait time for a mobile consult with a GP for those using the app is less than two hours, or within a day for a consult at a physical location. In Rwanda, Babylon has partnered with the Ministry of Health and Social Security board to register more than 20 percent of the adult population with the app, and has delivered more than 150,000 free doctor consults to date.<sup>120</sup></p>
<i>Dubai</i>	<p><b>Dispensing medicines faster and more accurately with a pharmacy robot:</b> The Dubai Health Authority (DHA) has launched a smart pharmacy in the Rashid and Dubai Hospitals. The smart pharmacies include a robot that can store and dispense prescription medications, freeing up pharmacist time to give patients direction on how to take medications correctly.</p>	<p>The pharmacy robot can dispense up to 12 prescriptions in less than a minute and minimizes human error. Medicine dispensing is initiated by scanning a barcode. The DHA plans to put the pharmacy robot in all DHA hospitals.<sup>121</sup></p>

# Implications



## Industry

**Use multiple approaches to get ahead of costs.** Investing in digital solutions can avoid additional costs down the line by improving client engagement, reducing human error, producing safer care and optimising operations by reducing redundant processes. Digital solutions can free up time for human capital to engage in activities that add value. The global shortage of healthcare professionals is expected to rise from 7 million in 2013 to 13 million by 2035.<sup>122</sup>

**Invest in patients and their communities to keep costs low.** With clinical care representing just 20 percent of an average individual's health, technology can be used to address the remaining 80 percent, which includes health behaviours, physical environment, and social and economic factors.<sup>123</sup> Collaborate with nontraditional partners to collect the appropriate data and address these social determinants of health. In the US, ProMedica's screenings and interventions for food insecurity were associated with a 3 percent drop in emergency visits, a 53 percent drop in hospital readmissions and a 4 percent increase in primary care visits.<sup>124</sup>

**Layer technology with human support.**<sup>125</sup> Consumers prefer to speak to a person when making health decisions. The most used and preferred customer service channel is a customer service agent on the phone, according to PwC's survey on customer care evolution.<sup>126</sup> When creating digital capacity, factor in where human interaction is valued and invest in technology that supports and enhances such interactions.<sup>127</sup> To get a broad picture of members, payers can invest in flexible data platforms and business intelligence tools that integrate claims data, actuarial analysis, case management and other data.<sup>128</sup>



## Call to action for policymakers and regulators

**Expect value-based care.** Some governments are encouraging value-based investments with social impact bonds, as in Australia and the UK. In the UK, investors who can demonstrate outcomes-based solutions and products are reimbursed by government payers with a premium, lowering the risk for payers and creating incentives to innovate.<sup>129</sup>





## Issue 6

# Providing value beyond the medical device

As technology has advanced the practice of medicine, medical devices have expanded access, improved care and enhanced convenience. Medical device companies are moving beyond delivering just the device: They are offering services to hospitals, patients, clinicians and more in response to a changing industry that responds to consumer needs and desires.

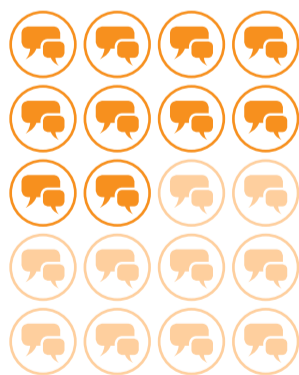
Medical device and technology executives interviewed by HRI emphasized the importance of incorporating the consumer perspective into product design, including making medical technology and devices easier to operate.<sup>130</sup>

### Figure 10: The global medical device leaders HRI surveyed are incorporating consumer perspectives into product design



**12 out of 20**

My organization incorporates consumer perspective into our design through post-market consumer data to update and redesign our products



**10 out of 20**

My organization incorporates consumer feedback into our design through patient focus groups during the product design and development phase



**9 out of 20**

Our services demonstrate value beyond any device, diagnostic or technology

Source: PwC Health Research Institute survey among pharmaceutical life sciences executives, 2018



A recent HRI survey of 20 global device leaders found that consumer perspectives are an important element of product design (see Figure 10).

While medical devices have influenced healthcare primarily in the US and Europe over the past few decades, today their impact is being felt worldwide. In Mexico, the medical device and pharmaceutical industry is projected to grow from \$17.6 billion in 2013 to \$27.9 billion in 2020.<sup>131</sup>

US-based Proteus Digital Health is focused on improving patient outcomes through better use of medications. The company enables digital medicines (“DigiMeds”) - a new category of therapy approved by the FDA that includes drugs that communicate with a patient’s cell phone when ingested. Andrew Thompson, Proteus co-founder and CEO, told HRI that DigiMeds have been shown in numerous studies to improve health outcomes and reduce total cost of care for patients who are failing conventional drug therapy. According to Thompson, “These results are driven by increased patient engagement that results from accurate, timely feedback resulting in much improved trust and communication with the care team when this data is shared.”<sup>132</sup>

Around the globe, investors and inventors are pooling their resources and knowledge through creative partnerships, including healthcare incubators, to bring new technologically advanced medical devices to the marketplace. One Drop, a digital health company based in the US, introduced a Bluetooth-enabled blood glucose monitoring system that syncs directly with its mobile app.<sup>133</sup> Individuals with diabetes subscribe to a monthly plan that includes blood glucose testing supplies and 24/7 live in-app support from diabetes experts.<sup>134</sup>

US-based Palarum created PUP (the Patient is Up), a patient “smart sock” that uses conductive textiles to wirelessly transmit real-time digital alarms to immediately notify nearby caregivers that a patient who has been identified as high-risk for falls is out of bed, standing or attempting to walk unassisted.<sup>135</sup> “Our goal with PUP is to improve patient safety, reduce costs associated with falls and enhance the overall hospital experience for patients,” said Patrick Baker, Palarum CEO, in an interview with HRI.

Cloud DX’s Vitaliti platform is in clinical trials pending FDA clearance.<sup>136</sup> “The system was a winning entry in the Qualcomm Tricorder XPRIZE competition, and was designed to give the user an engaging ‘Star Trek-style’ experience,” said Robert Kaul, founder, president and CEO of the Canada-based company.<sup>137</sup> Vitaliti consists of four wireless devices connected to a mobile app, allowing patients to quickly access multiple test results for up to 19 conditions, including chronic obstructive pulmonary disease (COPD), atrial fibrillation, hypertension and sleep apnea.<sup>138</sup>

Large device manufacturers are moving toward solutions. HRI analysis revealed that of the top 10 medical device companies, five offer customised solutions and seven have undergone organisational changes reflecting a

shift toward services-based offerings; all provide training and educational resources.<sup>139</sup> Smaller device manufacturers may not have the resources to provide these value offerings, but the space is being filled by new entrants, such as the Belgium-based company LindaCare. LindaCare provides a single platform for remote patient monitoring for implantable cardiac devices. The LindaCare platform links directly with patients' electronic medical records, making it easier for providers to monitor patients.<sup>140</sup>

## Providing value beyond the medical device: Snapshots from around the globe

Country	What is being done	Results so far
<i>US</i>	<p><b>Conducting remote consultations for patients using medical devices:</b> US-based remote monitoring company Medtronic Care Management Services and US-based telehealth services company American Well have partnered to integrate telehealth capabilities. The goal is to increase chronic and co-morbid patients' access to their care team and give clinicians the patient information they need when making care decisions.</p>	<p>The partnership aims to allow patients to access Medtronic's video-enabled platforms and American Well's telemedicine services. The information collected through video or telemedicine consults will feed into Medtronic's care management system and let clinicians monitor patients remotely.<sup>141</sup></p>
<i>Singapore</i>	<p><b>Combining telehealth with devices to reduce heart failure:</b> Netherlands-based Royal Philips partnered with Changi General Hospital in Singapore to help patients manage their heart conditions at home. Participating patients were given a weight scale and blood pressure monitor to check their weight, pulse and blood pressure readings daily. A personal tablet wirelessly captured the readings and uploaded them to a central monitoring system. Nurses remotely monitored patients and intervened when care was needed.</p>	<p>After one year of the pilot program, the length of stay for heart failure-related admissions was reduced by 67 percent, and the total cost of heart failure-related care dropped by 42 percent.<sup>142</sup></p>
<i>Mexico</i>	<p><b>Designing a device around patient experience and comfort:</b> US-based Abbott has created "Freestyle Libre," a personal and professional continuous glucose monitoring system that captures glucose readings and patterns while eliminating finger stick calibrations.</p>	<p>Freestyle Libre was launched at the end of 2017 in Mexico. The sensor is a thin, flexible filament that is inserted just below the skin. Scanning the sensor provides the glucose readings for the last eight hours, with an arrow indicating the trend reflected in the reading.<sup>143</sup></p>

# Implications



## Industry

**Decide whether to offer solutions or discrete products.**<sup>144</sup> Established players planning to broaden their service offerings to become solutions-based should consider value-based contracting in specific product segments while monitoring changing customer needs among health systems and other providers.<sup>145</sup> New entrants are creating commercialisation models with robust, consumer-centric services. Those who decide not to become solutions companies still should focus on building the customer and patient perspective into product design efforts.<sup>146</sup>

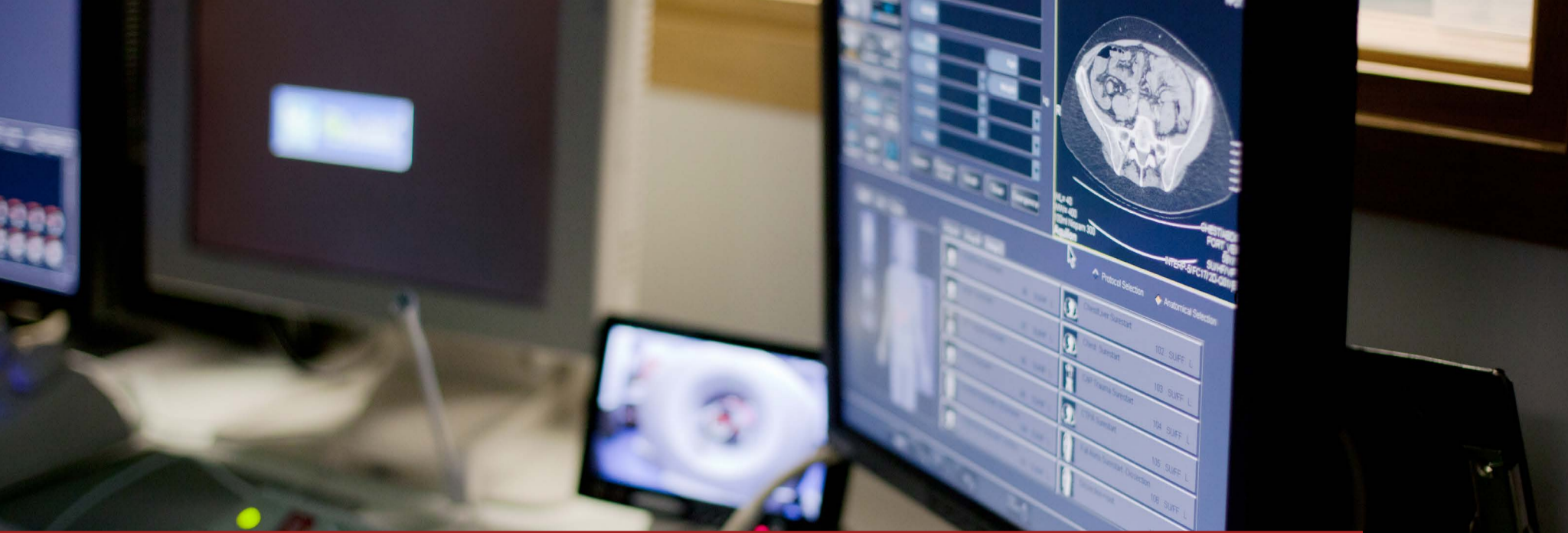
**Prepare to enter into value-based contracts and assume risk for outcomes.**<sup>147</sup> Medical device manufacturers have a unique opportunity to help healthcare providers fulfil value-based contracts with insurers and government payers.<sup>148</sup> Special attention should be given to navigating potential regulatory and distribution gaps, which can disrupt value chains.<sup>149</sup>

**Develop devices with the capability to feed data back to providers and patients.**<sup>150</sup> Medical device makers should integrate their data and insights into physician workflows. Physicians will view devices that deliver data as far more valuable than devices that don't.<sup>151</sup> Giving patients access to their data will increase patient engagement and yield insights about the patient journey for device makers.



## Call to action for policymakers and regulators

**Provide guidance to organisations to navigate data privacy regulations.** Regulations such as the European Union's Data Protection Regulation (GDPR) have the potential to significantly affect how data are shared across regions or countries. Work with organisations to define the data types and protocols to share data and remain compliant.



## Issue 7

# Securing the internet of things and cybersecurity

Internet-connected medical devices and health system networks and systems are increasingly at-risk for cyberattacks and in some cases, ransomware and malware, such as the WannaCry malware attack in 2017 that affected 300,000 computers in 150 countries.<sup>152</sup>

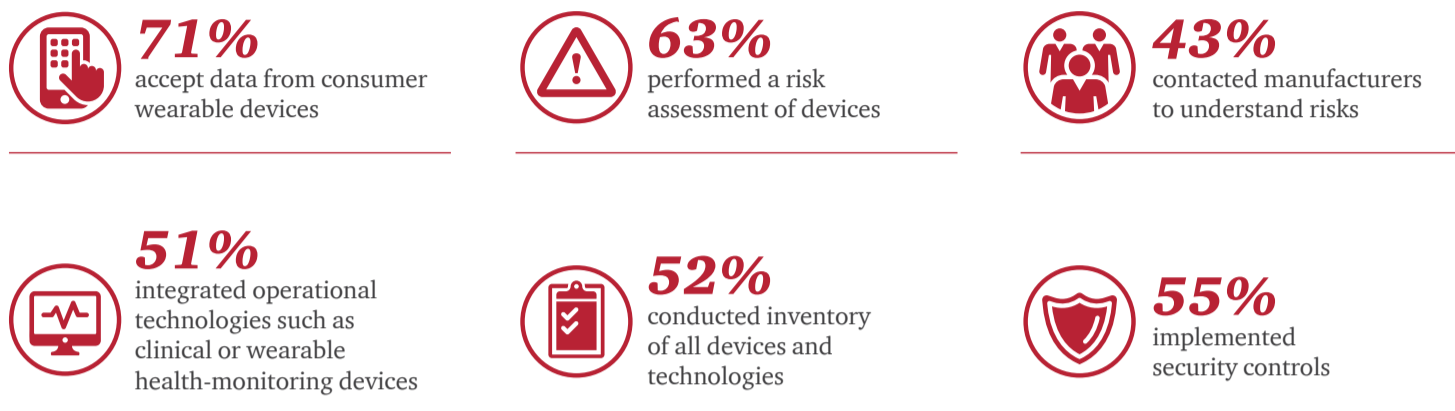
“Everyone is rethinking their security practices in the wake of WannaCry,” said Chantal Worzala, vice president of health information and policy operations at the US-based American Hospital Association, in an interview with HRI. The problem, Worzala said, is that “hospitals literally deploy thousands of devices, and trying to remediate all of those devices is a pretty daunting challenge in the heat of the moment if there’s a cybersecurity attack. This is particularly true when many device companies do not provide information about potential vulnerabilities, or updates and patches to fix vulnerabilities. The FDA has signaled its intent to focus on medical device security in its 2018 Medical Device Safety Action Plan. Hopefully, the FDA will move forward with its plans expeditiously.”<sup>153</sup>

The World Economic Forum lists cyberattacks against businesses and massive data fraud among the top five highest global perceived risks for governments and international organisations.<sup>154</sup> Last year, a record number of cyberattacks on health systems occurred, and the number of medical devices vulnerable to cyberattack increased by 525 percent.<sup>155</sup> As medical device applications are projected to grow, and health systems begin to realise big data’s benefits, cybersecurity should rise to the forefront of health system risk management priorities (see Figure 11).



## Figure 11: Global healthcare payer and provider leaders are acting on the need for increased data privacy and trust

Payer/provider respondents say they are taking steps to provide security for technologies



Source: PwC Health Research Institute analysis of PwC Global State of Information Security Survey, 2018

Hacks such as ransomware can encrypt critical systems that perform basic computing functions, which can disrupt IT activities that involve patient data. Other forms of malware can damage information systems and compromise manufacturing and supply chain operations.

When thinking about cybersecurity, organisations should consider their supply chains. When work is done in other countries, data should remain secure in both countries with the same implemented security controls for health systems and their vendors. The data owner should have the ability to manage and monitor the service provider. The service provider in turn should deliver continuous evidence of good practices and certifications that verify those practices' implementation and use.

Recognising the need to protect sensitive patient information, the UK's NHS Digital, the national information and technology partner of the healthcare system, recently announced an investment of 20 million pounds to increase cybersecurity to monitor potential threats, provide on-site data security assessments and offer specialist support for NHS organisations that may have been affected by a cybersecurity incident.<sup>156</sup>

Health systems also stand to lose their consumers' trust if their health or financial data are compromised and the health system's response affects service delivery or doesn't decisively and effectively contain the crisis. One in four Chinese consumers surveyed by HRI said that their experiences with hospital billing and payment damaged their opinions of hospitals.<sup>157</sup>



Consumers also can be reluctant to use internet-connected medical devices after a cybersecurity incident, with 85 percent of US consumers surveyed by HRI holding an insurance company responsible if their health information was stolen from the organisation.<sup>158</sup>

## Securing the internet of things and cybersecurity: Snapshots from around the globe

Country	What is being done	Results so far
<b>US</b>	<p><b>Providing regulatory guidance to keep medical devices secure:</b> In response to the US-based St. Jude Medical implantable cardiac device cybersecurity vulnerability, the FDA reviewed the software patch and issued recommendations for health care providers, patients and caregivers.</p>	<p>Every device manufactured after Aug. 28, 2017, has had the cybersecurity update preloaded in the device.<sup>159</sup></p>
<b>EU</b>	<p><b>Creating regulations to protect European citizens' data:</b> The European Union is addressing cybersecurity through the GDPR, which applies across all sectors, data types and entities targeting or monitoring European citizens. The GDPR deadline was May 25.</p>	<p>Some corporate GDPR preparations didn't meet the May 2018 deadline. PwC's third GDPR pulse survey found that 28 percent of US corporations had started putting changes into practice, and one in 10 had finished. In the UK, more than a third had started, and only 7 percent had finished, while in Japan, 13 percent said they had begun and 6 percent finished. Corporations are budgeting for ongoing GDPR maintenance and planning to implement technology to become GDPR-compliant.<sup>160</sup></p>
<b>China</b>	<p><b>Cybersecurity law provides guidance for domestic and foreign corporations to keep data safe:</b> The China Cybersecurity Law defines the scope of critical infrastructure, enforces penalties both within China and abroad, and puts more emphasis on personal information security, cybercrime, network operators and sovereignty rights in cyberspace.</p>	<p>A recent poll of 215 foreign firms in China revealed that those firms are concerned about the increased operating costs resulting from the cybersecurity law.<sup>161</sup></p>

# Implications



## Industry

**Understand the risks to organisations—the fallout from a breach could have a broad impact.** The increasing use of connected devices in electronic health record systems means companies' value-based payments also could be at risk if there's concern about the collected data's integrity. Organisations should measure the impact from threats and risks and allocate resources to the most critical needs. Risk measurement should include multiple factors, such as patient safety, financials, regulatory fines, brand and reputation, and operations.

**Prepare for the inevitable.** Forty percent of global CEOs now consider cyber threats to be a serious concern in 2018, compared with 24 percent in 2017.<sup>162</sup> Executives recognise that improving cybersecurity should be a priority for all healthcare organisations, whether or not they have experienced an incident. Many healthcare payer and provider organisations worldwide have an information security strategy—but 34 percent of those surveyed say they don't.<sup>163</sup>

**Providers should strategically consider how they manage internet-connected devices—and manage risks with a multilayered approach.** Cybersecurity risks can be managed using a layered approach, including limiting who has access to devices and limiting what the devices can do. While 96 percent of provider executives think their practices are secure against cybersecurity threats, only 36 percent of providers and payers have access management policies in place, and 34 percent have a cybersecurity audit process in place.<sup>164</sup> Many companies lack in-house cybersecurity expertise and will have to find it elsewhere. Companies should use language in vendor contracts to establish what device manufacturers are responsible for, including security updates and security support. The US-based Mayo Clinic, for example, requires its vendors to adhere to security standards before Mayo will purchase their products.<sup>165</sup>



## Call to action for policymakers and regulators

**Make cybersecurity an expectation.** Set an expectation in agencies and industries for securing data. After a cybersecurity attack, Mexico's Central Bank issued a cybersecurity directorate to establish policies, guidelines and institutional strategies to protect data, setting a precedent for other industries.<sup>166</sup>



## Issue 8

# Looking beyond the hospital to the social determinants of health

Chronic diseases are costly, to both health systems and individuals, whose quality of life suffers. Public payers, in particular, are stressed with chronic diseases' mounting costs. In light of this burden, wellness and disease prevention are becoming a growing focus as regulators, payers and providers seek to empower communities and people to take charge of their well-being. Consumers are similarly motivated; spending on wellness is forecast to grow by 20 percent from 2016 to 2020.<sup>167</sup> Disease prevention and wellness extend beyond the hospital—researchers say that social determinants such as education, income, nutrition and housing all affect health outcomes.<sup>168</sup>

In the US, health systems are defining health in ever-broader terms by including social determinants in the care continuum alongside interactions with doctors and hospitals. HRI estimates that health disparities account for \$102 billion a year in direct medical costs. Healthcare organisations are adding nutritionists, behavioural health specialists, social workers and community workers to their care teams.<sup>169</sup> Seventy-three percent of provider executives and 50 percent of payer executives surveyed by HRI reported that their organisations have, or are creating, partnerships with schools, grocery stores, churches and others in local communities. Seventy-two percent of American consumers surveyed by HRI want their doctor or hospital to have such partnerships.<sup>170</sup>

In Mexico, the government introduced a special tax to reduce the number of sugary drinks consumed. Mexican adults consume twice as much of sugary drinks than they do regular fruits and vegetables, while children drink four times as much.<sup>171</sup> The tax resulted in the reduction of sugary drink consumption by 6 percent, potentially preventing 30,000 cases of obesity per year.<sup>172</sup> Mexico is facing an obesity epidemic, with an estimated 72 percent of adults and 33 percent of children considered to be overweight or obese.<sup>173</sup>

With the region of Western Sydney in Australia identified as a diabetes “hot spot,” 50 organisations formed the Western Sydney Diabetes initiative to target at-risk populations through diet and activity interventions.<sup>174</sup> The initiative also offers pre-diabetes screening, lifestyle coaching, enhanced diabetes management and specialised consultations.<sup>175</sup> A mobile app that provides education and information is planned to help people manage the problem themselves.<sup>176</sup> PwC estimates that 10,000 of the 270,500 people targeted by 15 of the primary care interventions will avoid developing diabetes over a 14-year period. The savings is estimated to be almost AU \$600 million.<sup>177</sup>

Another social determinant of health is mental health. Approximately 45 percent of working-age Australians experience a mental health condition at some time. The estimated impact on Australian workplaces is AU \$11 billion per year from missed days of work and reduced productivity.<sup>178</sup> Intervening to target mood disorders such as depression can produce an average benefit of 2.3 times the cost of doing so, but many organisations don’t provide or promote healthy workplace programs (see Figure 12).<sup>179</sup>

### Figure 12: Organisations are missing an opportunity to improve mental health in the workplace

Workers across the world lack access to or knowledge of what mental health programs are available to them



**67%**

of the consumers we surveyed in the **US** reported that their employer or another healthcare company has never discussed depression or mental health concerns with them.



**81%**

of organization leaders in **Australia** indicate their workplace has one or more mental health support policies, procedures or practices, but more than **a third** of employees don’t know these resources exist or have access to them.



**7%**

of all mental health promotion and prevention programs in **the Americas** target workplace mental health promotion.

Source: PwC Health research analysis of PwC Consumer Survey, 2017; State of Mental Health in the Australian Workplace, 2014; and Mental Health Atlas of the Americas, 2015 <sup>186</sup>



## Looking beyond the hospital to the social determinants of health: Snapshots from around the globe

Country	What is being done	Results so far
<b>UK</b>	<p><b>Vetting and approving apps to help consumers manage their health:</b> The NHS in the UK is testing an NHS Apps Library, which contains “NHS Approved” or “Being tested in the NHS” health management apps for consumers. The library contains 50 apps for diabetes, COPD, mental health and pregnancy health, among others.</p>	Developers have been invited to add new apps to the NHS Apps Library that empower patients to take control of their health. <sup>181</sup>
<b>Brazil</b>	<p><b>Training community health workers to increase access to primary care and disease prevention:</b> Brazil’s Family Health Strategy (FHS) focuses on training community health workers (CHW) to increase primary care. A core team of a physician, nurse and approximately six CHWs serves geographic regions of 3,000 to 4,000 people by providing primary care support.</p>	FHS coverage has resulted in an immunisation level of almost 100 percent and a greater reduction in avoidable hospitalisations for chronic diseases and other primary care-sensitive conditions. <sup>182</sup>
<b>South Africa</b>	<p><b>Incentivising healthy food purchased through a cash-back rebate program:</b> Johannesburg-based Discovery, South Africa’s largest health insurer, launched its health promotion and loyalty program, Vitality, in 2009. Members receive a 10 percent rebate on healthy food purchases, and that increases to 25 percent if they complete a risk assessment questionnaire. This program is integrated into the larger wellness program, which supports Discovery’s shared-value insurance approach and, rewards members for keeping fit, being active, quitting smoking and regularly participating in gym and fitness programs.</p>	Members who enrolled in the Discovery Vitality rebate program purchased 6 percent more healthy food and reduced their purchases of less desirable food by 5.6 percent of their total food expenditure. <sup>183</sup>
<b>US</b>	<p><b>Modeling an individual’s future health:</b> PwC’s Bodylogical is a “digital twin” that predicts the health of “future you” by modelling the human body using prescriptive analytics.</p>	Bodylogical results have been validated by a peer-reviewed scientific journal in the factors driving the onset of Type 2 diabetes in an individual. <sup>184</sup>
<b>China</b>	<p><b>Bringing accumulated knowledge of chronic diseases to the community through physician education:</b> France-based Sanofi, the Chinese Medical Doctor Association and Community Health Association of China are combining knowledge and treatment outcome data to educate physicians and improve community health services. The project targets cerebrovascular diseases, diabetes and central nervous system diseases.</p>	The Health Community project aims to cover 8,500 community medical institutions with 30,000 community doctors and 23 million patients by 2020. <sup>185</sup>

# Implications



## Industry

**Give consumers what they want.** Consumers are hungry for wellness solutions, with 52 percent of consumers surveyed in the US already participating in some form of wellness intervention. Consumer spending is expected to grow 34 percent on nutrition and 20 percent on wellness overall by 2020 in the UK.<sup>186</sup> Public payers, health insurers and retailers can collaborate to develop financial incentives for consumers to make healthy purchases or engage in other disease prevention behaviours. In Mexico, social security contributions by employers and employees could be linked to body-weight measures to encourage healthy behaviours.<sup>187</sup>

**Focus on sustainability by creating an expanded care team.** A 2016 study by HRI showed that in the US, an extended care team for a large panel of patients that included nutritionists and social and community health workers could save \$1.2 million for every 10,000 patients served.<sup>188</sup> Focus on having the right representation on your teams to achieve better health outcomes.<sup>189</sup>

**Look at the data to see the full picture.** Almost four out of five US provider executives admit that they do not have the data to identify consumers' societal needs.<sup>190</sup> Data-sharing partnerships and collaboration across health systems and other sectors will be critical in identifying the broader social determinants of health and developing the appropriate interventions.<sup>191</sup>



## Call to action for policymakers and regulators

**Encourage healthcare entities to address the social determinants of health.**<sup>192</sup> In the US, the Centers for Medicare and Medicaid Services (CMS) granted \$157 million last year to 32 healthcare organisations in its two-track Accountable Health Communities Model.<sup>193</sup> The five-year demonstration model will test innovative payment and delivery models for organisations that become hubs that align community organisations and help patients connect with those organisations.<sup>194</sup>



## Critical takeaways for today and tomorrow

Healthcare organisations around the globe will continually face challenges to care for those they serve in smarter ways, emphasising preventive efforts, more access, a personalised approach, and better quality and outcomes—all while being more efficient and cost-effective. The lifeblood of meeting these challenges will be data and technology.

The trick will be to integrate technology such as AI and medical devices with smart data that can illuminate how to meet each population's cultural and geographic needs. Technology also will help increase access to and participation in clinical research. Healthcare organisations must recognise that consumers' trust in their physicians and hospitals to secure their personal health information has eroded, so they should take extra measures to secure the information and how that information is exchanged. Finally, healthcare organisations should broaden their definition of health to include social determinants that affect their populations' well-being.

Healthcare organisations that connect with each other, share best practices, partner in innovation and research, and put the patient squarely at the centre of care are the ones that will thrive.



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## About this research

HRI releases an annual report entitled Top health industry issues within the US. This annual report discusses the top issues for healthcare providers, health insurers, pharmaceutical and life sciences companies, new entrants and employers.

This year, HRI identified eight issues that affect health systems globally. We conducted a series of interviews and industry executive surveys to develop this analysis while incorporating insights from our global member firms.

## About the PwC Network

At PwC, our purpose is to build trust in society and solve important problems. PwC is a network of firms in 157 countries with more than 223,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at [www.pwc.com/US](http://www.pwc.com/US).

## About the Health Research Institute

PwC's Health Research Institute provides new intelligence, perspectives and analysis on trends affecting all health-related industries. The Health Research Institute helps executive decision-makers navigate change through primary research and collaborative exchange. Our views are shaped by a network of professionals with executive and day-to-day experience in the health industry. The research HRI produces is independent and not sponsored by businesses, government or other institutions.



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