future
health
index
2018

Moving data to the **heart of health systems**

Increasing **vital technology** adoption to make value-based healthcare a reality

Contents

Delivering value through data collection and analytics

As the use of digital health technology continues to increase, data has become the lifeblood of modern healthcare systems. The first part of the 2018 Future Health Index (FHI) sets out the Value Measure, an indicator of the value being delivered by healthcare systems in 16 countries. The FHI also identified the digital solutions that are among the best placed to help healthcare professionals and institutions accelerate their journey towards value-based healthcare. One of these is data collection and analytics, an area that has shown an ability to boost factors that indicate value (access, general population and healthcare professional satisfaction, and efficiency).

It is therefore all the more troubling that many countries, institutions and individual healthcare professionals continue to struggle to collect, organize and use health data in a meaningful way. What's more, most people have little or no ownership over their health records. Parameters and formats vary widely across institutions, devices and individual health records, creating significant barriers to the movement and exchange of information. The rise of consumer wearables and the trend for companies (such as insurers) developing records of their own mean more and more health data is being produced outside the reach of traditional institutions, and may never be shared with them at all.

The pillars of a new approach

Research conducted for the FHI explores three technologies we believe will prove crucial in advancing integration and enabling data to be used more effectively. Digital identity tools, such as universal electronic health records (EHRs) – that is, EHRs based on standardized data and protocols that can be accessed, used and updated by actors across the healthcare spectrum – can make the collection and exchange of healthcare data much easier. Data analytics and artificial intelligence (AI), meanwhile, can mine that information for connections and insights that will benefit both healthcare professionals and patients. This runs from the identification of health trends at the level of an entire population, to the more accurate diagnosis and treatment of individual conditions. Finally, consumer wearables promise to bring real-time, readily accessible health-related data to individuals around the world. We believe that if patients and their medical devices can be securely identified and authenticated anywhere, and key medical data accessed with robust consent management, the foundations for a new wave of medical innovation will be set.

In many of the 16 countries in the FHI, both the general population and healthcare professionals demonstrate strong awareness of the value of a more transparent, integrated and systematic approach to health data. Yet, along with limited interoperability, this approach faces a host of other challenges.

Legal frameworks for the exchange and use of data can range from undeveloped to overly restrictive. Regular security breaches have stoked concerns among regulators, healthcare professionals and the general population about the privacy and security of their health data. The accuracy of the consumer wearables that provide health-related information has been called into question. And in many cases there is still a degree of reluctance among both the general population and healthcare professionals to adopt solutions that may deliver value over the long term, but involve some degree of short-term disruption.

In this second FHI report of 2018, we have put together eight 'points of view' (POVs) on the challenges that our data tells us are standing in the way of better collection and use of data in healthcare. Importantly, we have sought the views of leading experts in the integration of EHRs and the application of AI in healthcare to help provide concrete recommendations on how these challenges can be overcome.

The barriers to delivering greater value from healthcare systems – and individual countries improving their Value Measures – should not be understated, but neither should the opportunities. This report indicates many of the latter lie within relatively close reach.
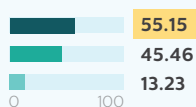
Value Measure by country

The Value Measure, as set out in this year's first FHI report, highlights areas where national health systems are already providing value, and where value may need to be better defined and delivered. It also makes clear that no one market is a consistent performer across all factors.

Insights from the data points that make up each country's Value Measure, along with the identification of pockets of excellence and areas where improvement is needed, informed the selection of the eight POVs in this report.

United States
37.95
Value Measure

55.15
45.46
13.23
0   100

United Kingdom
45.27
Value Measure

54.38
55.18
26.25
0   100
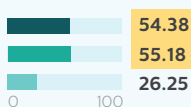
Netherlands
48.93
Value Measure

63.57
60.86
22.35
0   100
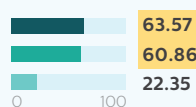
Germany
50.93
Value Measure

78.72
53.30
20.77
0   100
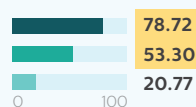
16-country average
43.48 Value Measure

50.91
52.85
26.69
0   100
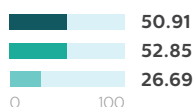
Brazil
26.71
Value Measure

36.99
21.08
22.06
0   100
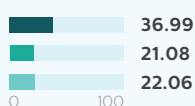
Spain
48.58
Value Measure

51.43
66.50
27.79
0   100
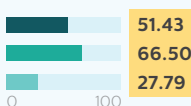
France
50.85
Value Measure

67.45
63.77
21.33
0   100
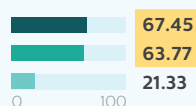
Italy
41.78
Value Measure

53.11
44.97
27.24
0   100
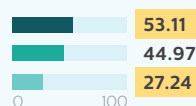
Measurement

- ■ Access score
- ■ Satisfaction score
- ■ Efficiency ratio score

- ■ Above 16-country average

Sweden
48.10
Value Measure

Access	62.14
Satisfaction	61.05
Efficiency	21.11

0   100
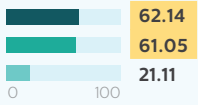
Russia
40.90
Value Measure

Access	63.58
Satisfaction	31.75
Efficiency	27.38

0   100
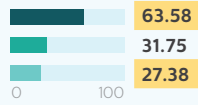
China
38.11
Value Measure

Access	31.50
Satisfaction	44.63
Efficiency	38.19

0   100
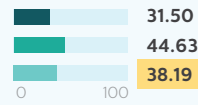
Singapore
54.61
Value Measure

Access	45.46
Satisfaction	68.27
Efficiency	50.11

0   100
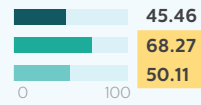
South Africa
26.61
Value Measure

Access	29.21
Satisfaction	39.53
Efficiency	11.09

0   100
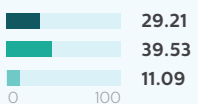
Saudi Arabia
50.17
Value Measure

Access	43.59
Satisfaction	62.75
Efficiency	44.17

0   100
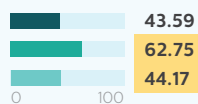
India
33.64
Value Measure

Access	13.23
Satisfaction	59.67
Efficiency	28.02

0   100
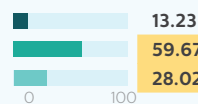
Australia
52.59
Value Measure

Access	65.05
Satisfaction	66.85
Efficiency	25.87

0   100
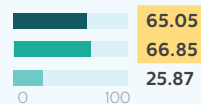
1 EHR interoperability: From **aspiration** to reality

Introduction

The electronic health record (EHR) is often viewed as the fundamental building block of a more technology-driven, integrated approach to healthcare — and yet there's a notable lack of integration in the EHR landscape itself. The EHR market is highly fragmented, with hundreds of different solutions adopted at the institutional, local and national levels.[1]

This has made interoperability a significant challenge to connected care. The vision of a universal health record, easily shared and seamlessly updated whenever or wherever it is used, is still a distant prospect in many markets.

Of the 16 countries covered in the 2018 FHI, there is an **even split** between those with 'universal' EHRs and those without

Learnings

The EHR impact

Of the 16 countries covered in the 2018 FHI, there is an even split between those with 'universal' EHRs (Australia, China, France, Germany, Italy, Russia, Singapore and Spain) and those without (Brazil, India, the Netherlands, Saudi Arabia, South Africa, Sweden, the UK and the US).[2,3] The former group has a substantially higher average Value Measure than the latter (47.29 on average versus 39.67) as well as higher average levels of trust in the healthcare system among healthcare professionals and the general population (67.79 versus 62.99, respectively).[4]

Characteristics shared by countries with 'universal' EHRs include comprehensive policies on EHRs and the collection, use and sharing of data, and sophisticated mobile infrastructure. Singapore, which has a comparatively exceptional Value Measure, is also the top or near top-ranked country in overall mobile network speed, availability of 3G (or faster) mobile networks and internet penetration.

Healthcare professionals and the general population in countries with 'universal' EHRs are also more likely to see health system integration as a goal worth pursuing. In Spain, for example, 96% of healthcare professionals and 85% of the general population believe integration is important, versus 75% of healthcare professionals and 70% of the general population in the US.[4]

Countries with 'universal' EHRs

Average Value Measure	**47.29**
Healthcare professional and general population trust	**67.79**

0 — 100

Countries without 'universal' EHRs

Average Value Measure	**39.67**
Healthcare professional and general population trust	**62.99**

0 — 100
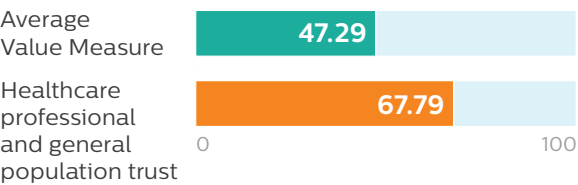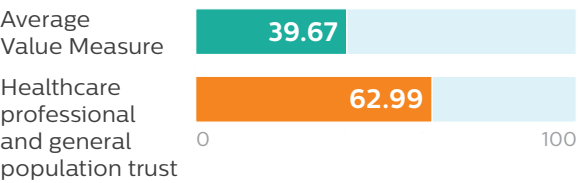
Recommendations

1

EHR interoperability should be based on standards that are open and accessible to all

Organizations across the world are working to advance the cause of interoperability. In 2017, the US's Healthcare Information and Management Systems Society (HIMSS) published a call to action to create a secure, nationwide electronic health information exchange. According to HIMSS, this needs to be based on interoperability and trust, the participation of stakeholders from across the healthcare continuum, and standardized business rules and identity management approaches, among other factors.[5]

Non-profit organization Health Level Seven International (HL7), meanwhile, focuses on the development of healthcare informatics interoperability protocols, and has devised a draft standard and application programming interface (API) for the exchange of electronic health information called Fast Healthcare Interoperability Resources (FHIR).

Grahame Grieve, Principal at Health Intersections and FHIR Product Director, says the initiative looked to the internet for inspiration, realizing that any standard needs to be open, web-based and readily available. "The web is a complicated network of things that work together really seamlessly and that allows you to create platforms that transform industries," he says. "We believe it will be beneficial for healthcare to have the same transformation."

2

Efforts to advance interoperability should focus on results, not processes

To promote interoperability, Grieve believes it is essential to underline the value of interoperability by demonstrating that it drives positive outcomes – as outcomes are ultimately how the value of health systems is defined.

"Too often interoperability is introduced to serve institutional funding or mandatory reporting requirements, or used to automate paper-based workloads, so very often the outcomes of interoperability are less than they should be," he says. "It only becomes something that transforms healthcare when people are using it in the clinical context."

Promoting interoperability also requires strong leadership since it often runs counter to established processes and interests, notes Volker Amelung, Specialist Professor for International Health Systems Research at the Medical University of Hannover. "[In Germany] there are too many particular interests who prefer not having interoperability; the providers of hospital information systems, for example. There's a general interest in solving the issue, but not in having everything open."

The case of Estonia, frequently held up as a model of digital care,[6] indicates a legal impetus for integration may be needed.

"To overcome interoperability issues, we made it mandatory to get a license to operate in Estonia," says Madis Tiik, the former CEO of the Estonian E-Health Foundation and now an independent e-health consultant. "You had to integrate with the central platform in order to operate – it was the law."

3

Interoperability must involve all stakeholders – particularly patients, who in many cases play the deciding role in the use of their data

It's also important to remember that "interoperability is a people problem," Grieve says. Beyond any technical standards, it ultimately needs to be based on the collaboration of different actors in the healthcare system.

Mahiben Maruthappu, CEO and co-founder of UK-based social care start-up Cera, agrees that exchanges should take place in a human as well as a technical manner. "We don't necessarily integrate at a technical level," he says. "We have patients referred to us, and once they come into our care it's all digitized."

This means integration may be served through a bottom-up as well as a top-down approach. Particularly in countries where integration is minimal and levels of trust are low, a 'personal' EHR tied to the individual may prove a more conducive platform for interoperability than a centralized data exchange. This format gives patients more stewardship over their health information – which encourages them to share and use it.

"Until now we've talked about digital integration between institutions – how to integrate EHRs with institutions at a local level or a national level," Tiik says. "But we've never discussed how to connect digital information at the patient/citizen level, and how citizens can be a partner in these developments. Or how patients can enrich this with not just 'sick' data but 'well' data, too. I think this is the future of healthcare data exchange."

1. The State of the EMR Market in 2017. (April 29, 2018). Retrieved from https://www.kaloramainformation.com/Content/Blog/2017/04/28/The-State-of-the-EMR-Market-in-2017 2. The Commonwealth Fund. (2010-2015). 3. WHO. (2010-2015). 4. Future Health Index. (2017). 5. HIMSS Call to Action: Achieve Nationwide, Ubiquitous Secure Electronic Exchange of Health Information. (October 11, 2017). Retrieved from https://www.himss.org/library/himss-call-action-achieve-nationwide-ubiquitous-secure-electronic-exchange-health-information. 6. Digital health has potential but needs to be secure. (October 24, 2017). Retrieved from https://euobserver.com/health/139590

2 Integrating EHRs into the **e-citizenship agenda**

Introduction

Government support and citizen participation play important roles in the adoption and interoperability of EHRs. Indeed, for EHRs to achieve their full potential as part of an integrated healthcare environment, experts believe they must be just one facet of a broader push that accustoms people and institutions to the digital delivery of public services, and promotes the effective and responsible use of personal data across the board.

There are encouraging signs people are increasingly engaged with their **health data**

Learnings

Leading on policy

There are encouraging signs people are increasingly engaged with their health data. The survey conducted as part of the 2017 FHI found in the 16 countries covered, out of those who have used connected care technology, 63% shared data or information gathered from that technology with healthcare professionals.[1]

Of the eight countries with universal EHRs covered in the 2018 FHI, all with the exception of China have defined policies on data protection/security and regulations around data sharing.[2,3]

Among the eight countries without 'universal' EHRs, the extent of legislation is more mixed. While the Netherlands, the UK and the US have comprehensive data protection and sharing policies, such legislation is lacking in Brazil and South Africa, which also have comparatively low Value Measures. Creating clearer frameworks for the use, protection and exchange of data could not only provide a sounder platform for EHRs, but advance digitization in other areas.[2,3]

Data sharing between the general population and healthcare professionals

Percentage of the general population who:

🟩 Have shared data		**83%**
🟦 Know when to share data		**35%**
🟧 Know the easiest way to share data		**35%**
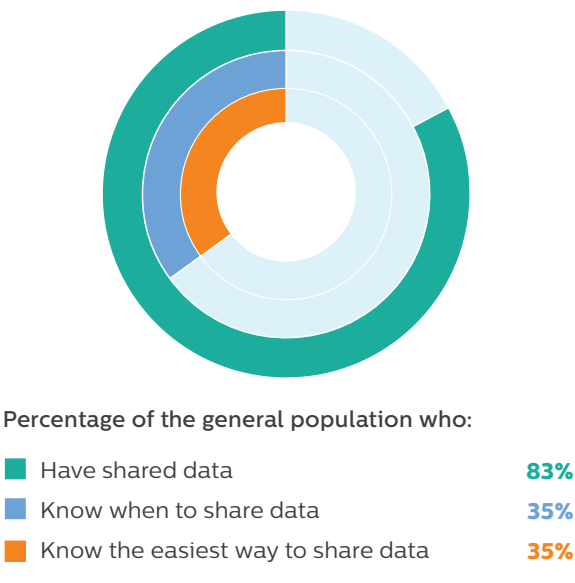
Recommendations

1

More must be done to educate citizens on where, when and how to use and exchange their health data

Beneficial as data exchanges may be, there are also indications that they are somewhat arbitrary, and that not all useful data is shared. Only 35% of the general population polled for the FHI said they know when to share data with healthcare professionals, or the easiest way to do so.[1]

This points to a need for further education on data sharing and use. Experts believe these efforts will be most effective in healthcare if they are part of a broader national fabric.

2

Rules and practices around EHRs are most effective when they are part of – and aligned with – broader approaches to data and digitalization

"I recommend to many countries that they shouldn't start digitizing healthcare until they have many other digital services in place," says Estonia's Madis Tiik. "Healthcare is actually the most difficult area to digitize, because it's very rigid; it takes a lot of time and effort to make small changes.

"It's important to have a country build the structure for e-services in general – not just e-services in healthcare. When you have the basic structure in place, it's much easier to build effective services in any industry."

3

Privacy and security concerns must be addressed through comprehensive regulatory frameworks for EHR adoption and use to flourish

Robust national standards around data privacy will help enable EHR adoption and integration. EHR security remains a major concern, with high-profile breaches continuing to affect millions of patients worldwide, most recently in Australia,[4] Singapore[5] and the US.[6]

Christiane Grünloh, a PhD student at the KTH Royal Institute of Technology, Stockholm whose research focuses on user experience with e-health applications, believes security issues are behind the varying progress with digital health initiatives in Germany and Sweden. In her view, citizens in Sweden are more accustomed to interacting with their data,

and the regulatory framework around e-health services is better established.

Whereas in Germany the security of any effort to digitize health (or other) personal information is immediately questioned, in Sweden "the assumption is this is from the government; therefore it has to be super secure, otherwise they wouldn't implement it," she says. "Giving [Swedes] the opportunity to access all their health data is in line with their culture of participation and trust in their government. In other countries it would be very different."

Even if EHR adoption is high, worries about privacy or security may undermine efforts to build a nationally integrated system by causing people to guard their health data more closely, notes John Moore, Director of the Customer Lab at insurer Bupa.

"As privacy concerns become greater, an individual might feel more comfortable carrying their own health record, rather than ever trusting a government," he says.

Somewhat counterintuitively, this may mean that countries where citizens have grown accustomed to the idea of their data being monitored and accessed by the government – such as China – will find it easier to drive adoption and acceptance of national EHRs, since privacy is a less pressing consideration for the general population.

Education will encourage citizens to interact with their health data

1. Future Health Index. (2017). 2. The Commonwealth Fund. (2010–2015). 3. WHO. (2010–2015). 4. Data breach of Australia's Medicare exposed, HER safety concerns raised. (July 13, 2017). Retrieved from https://today.mims.com/data-breach-of-australia-ehr-safety-concerns-raised 5. Hackers breach 1.5 million Singapore patient records, including the prime minister's. (July 20, 2018). Retrieved from https://www.healthcareitnews.com/news/hackers-breach-15-million-singapore-patient-records-including-prime-ministers 6. 1.4 million patient records breached in UnityPoint Health phishing attack. (July 31, 2018). Retrieved from https://www.healthcareitnews.com/news/14-million-patient-records-breached-unitypoint-health-phishing-attack

3 EHRs: Securing the support of **healthcare professionals**

Introduction

Working on the front lines of health systems, healthcare professionals are generally aware of the advantages of a more seamless flow of health information and a more integrated approach to care. The 2017 FHI found that an overwhelming majority of nurses (89%) and doctors (88%) see integration as extremely or somewhat important, despite just 24% of doctors and 32% of nurses viewing the health system as very or completely integrated currently.[1]

A significant proportion of doctors (41%) also think integration of the health system will make healthcare less expensive overall in the long term, compared to 32% of nurses.[1]

EHRs continue to face a **degree of resistance** that can prevent them from being deployed and used in the optimal way
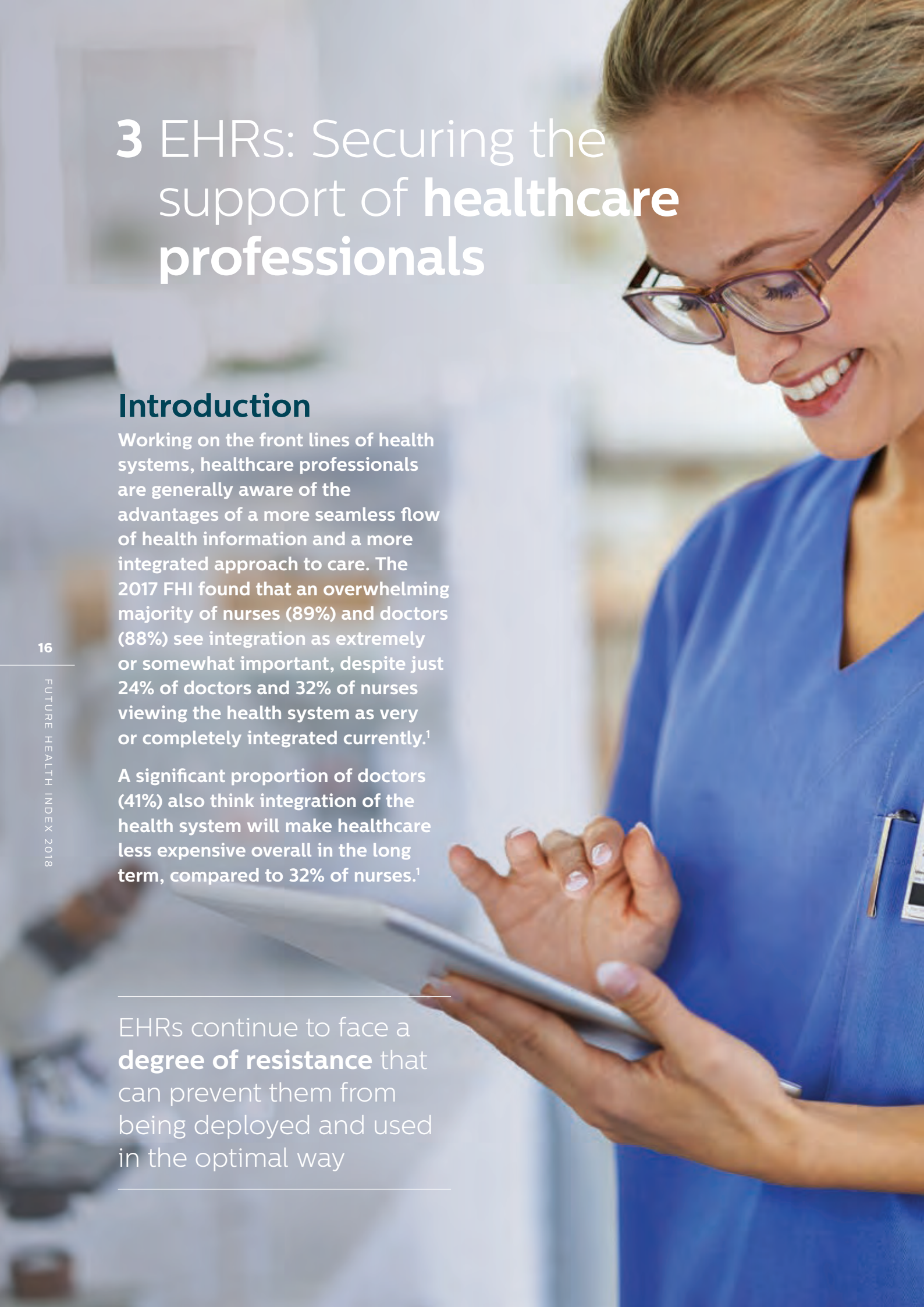
Learnings

Benefits and burdens

While there is broad provider support for integration overall, EHRs continue to face a degree of resistance that can prevent them from being deployed and used in the optimal way. Christiane Grünloh of the Royal Institute of Technology, Stockholm, points to the example of Sweden, where healthcare professional opposition delayed efforts to make patient records accessible via a single online portal.

Moreover, now that this portal has made health data more readily available to patients, doctors and nurses could be more reluctant to update records. "A physician told me that if they know they'll see the patient next week, they won't put a note in that says the cancer is progressing, because they know the patient will read it," Grünloh says. "While that might be well-intentioned, is it really patient empowerment? And is it really good for the doctors that they have to remember everything because they dare not write it in the record?"

Studies also indicate the adoption of EHRs can have unintended negative consequences in the professional environment. One recent poll of US primary care physicians by Stanford Medicine showed doctors want a full-scale overhaul of EHRs, with 71% believing they are a major contributor to physician burnout; over half (54%) saying EHRs negatively impact their professional satisfaction; and 40% feeling they create more challenges than benefits.[2]

A majority of doctors and nurses see **integration** as extremely or somewhat important

Primary care physicians

Believe EHRs are a major contributor to **physician burnout:**

71%

Believe EHRs **negatively impact** their **professional satisfaction:**

54%
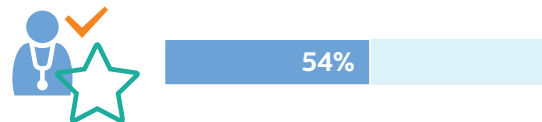
Believe EHRs create **more challenges than benefits:**

40%
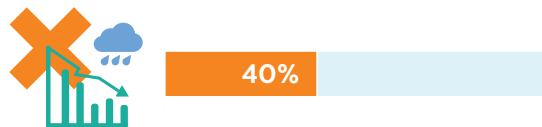
Recommendations

1

Medical school curriculums must better prepare healthcare professionals for a more connected healthcare environment

Given the central role of EHRs in building value-based health systems, it is vital that these perceptions are addressed. According to the experts interviewed for the 2018 FHI, this process should begin with the way healthcare professionals are trained.

"I strongly believe we should focus on education, even if it takes ten or 15 years," says Volker Amelung of the Medical University of Hannover. "We have to change the attitude of the medical schools completely; the more technology the better. Whenever you want to have primary care – which isn't given a lot of attention at medical school – you need to make sure that you train nurses, doctors and pharmacists all together and influence them with these new ideas as quickly and early as possible.

"We need to come to a point where a doctor sees new technologies as the tools they need in order to practice medicine, the same way in which someone in business needs MS Office to do their work," Amelung adds. "These health tools need to be seen as the enablers of modern medicine."
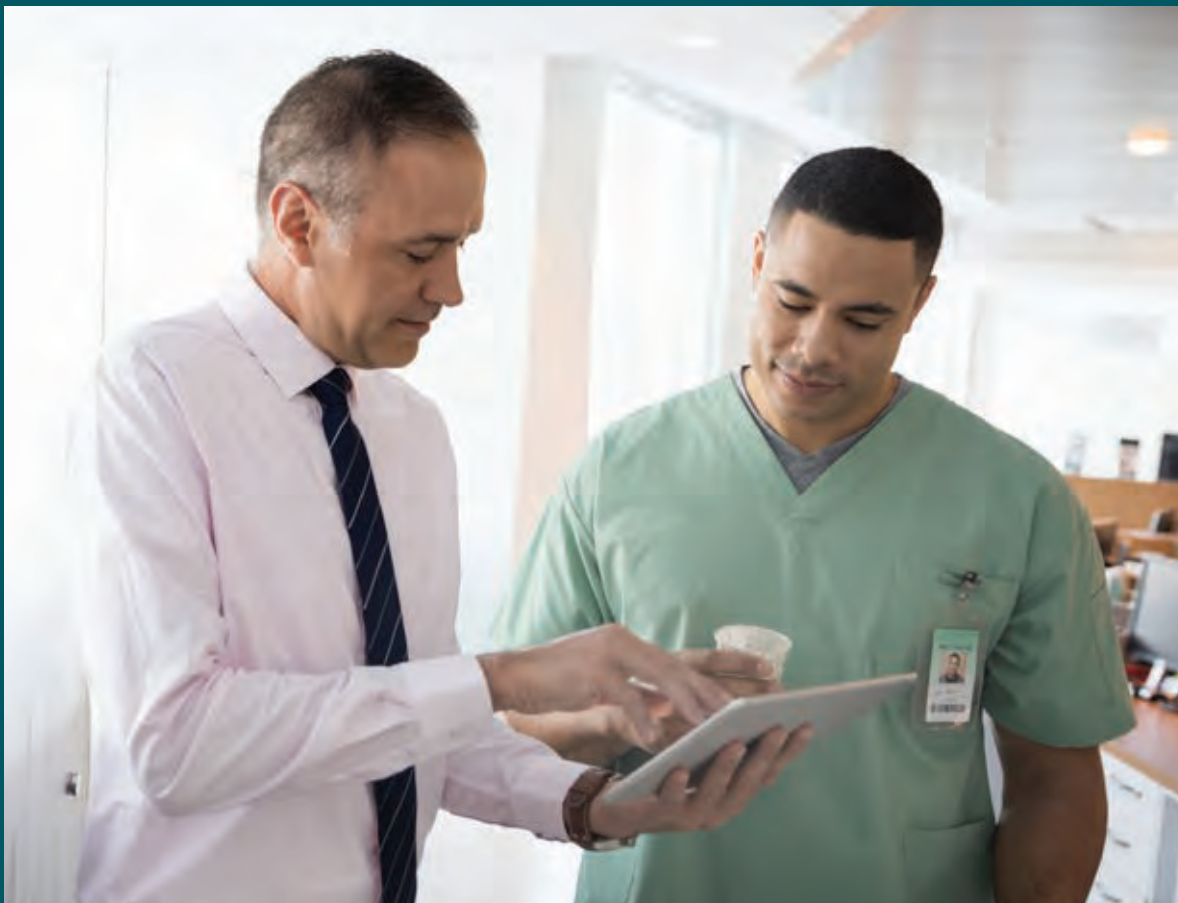
2

Healthcare technology providers should design EHRs and other tools based on healthcare professionals' needs and input

Another factor that could do much to improve the healthcare professional experience with EHRs is better design.

In general, "the people who design EHRs are not the ones who use them," points out Dean Sittig, Professor of Biomedical Informatics at the University of Texas Health Science Center at Houston. "Few are good designers and fewer are designers and doctors, so there's a lot we can learn."

This means information systems are not necessarily 'road tested' for the typical healthcare professional's environment or optimized for the ways they consume and input data. The result, according to Sittig, is that frequently "the data entry problems outweigh the data review benefits" – and that healthcare professionals may be doing a lot more work to benefit patients, payers, hospitals and the healthcare system, but not themselves.

The obvious way to change this is to involve healthcare professionals at an earlier stage in the development process for EHR solutions. This is why the innovations introduced by Bupa, an international healthcare group based in the UK, spend a considerable amount of time in the development and testing phases, and are often 'co-created' or 'co-designed' with healthcare professionals or other future users, according to John Moore, Director of Bupa's Customer Lab.

"You see low healthcare technology rates where there's not enough focus on healthcare professionals," he says. "You need to make their lives easier, not just the consumer's."

3

EHRs should incorporate emerging technologies to promote ease of use – without going overboard

There may be opportunities to harness technological advances to make health information systems more user-friendly and enhance their utility for healthcare professionals.

Voice recognition, for example, has been shown to reduce the time needed for physicians to complete EHR processes, ultimately reducing workloads and fatigue.[3] But again it is key that advances are integrated to address the needs of the user base, rather than simply adding technology for technology's sake.

"The whole culture needs to change somehow; we need to become more accountable," says interoperability expert Grahame Grieve. "There's no point building a system if doctors don't believe they're benefiting by being a part of it."

EHRs have to fit the way healthcare professionals work

1. Future Health Index. (2017). 2. Doctors Call for Overhaul of electronic Health Record. (June 4, 2018). Retrieved from https://www.prnewswire.com/news-releases/doctors-call-for-overhaul-of-electronic-health-records-300659100.html 3. EHR With Voice Recognition Features May Reduce Clinician Fatigue. (July 9, 2018). https://www.infectiousdiseaseadvisor.com/practice-management/ehr-voice-recognition/article/779066/

4 EHRs: Enlisting payers in the **drive for adoption**

Introduction

Insurers, sharing the overall goals of higher efficiency and reduced costs, have been a key enabler of EHR implementations in countries such as the US.[1] Along with healthcare professionals and consumers, they can act as a significant force for the adoption and use of EHRs in health systems, thereby accelerating the journey towards value-based care.

The more frequent **integration** of EHRs into insurance offerings could further boost adoption

Learnings

Gathering momentum

The more frequent integration of EHRs into insurance offerings could further boost adoption. There are clear signs that this is already taking place; nearly half (46%) of the more than 150 insurers polled across five countries for the 2017 FHI said they had already incorporated access to proprietary (or approved) EHRs into their offerings and/or pricing for consumers.[2]

Another 46% said they were in the process of doing so, and just 7% said that they had not taken this step yet but intended to do so in the future.[2] This indicates there is a clear business case for insurers to support EHRs, and even to offer incentives to patients and providers to use them.

For all this potential, any efforts by payers to promote EHRs are likely to run into some of the same constraints faced by other agencies. When asked which factors would have the biggest impact on the healthcare industry of the future, most insurers pointed to the health system bureaucracy (29%), the attitude of healthcare professionals towards adopting new technologies (28%), and government health-related policy (23%) – all factors that (as previous sections of this report have shown) can hold back the advance of EHR adoption and interoperability in health systems.[2]

What will have the biggest impact on the healthcare industry in the future according to insurers

Health system **bureaucracy**
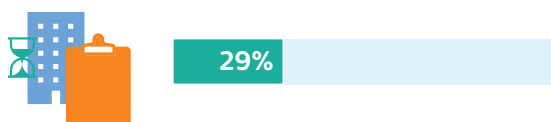
29%

Attitude of healthcare professionals towards adopting new technologies

28%

Government **health-related policy**

23%
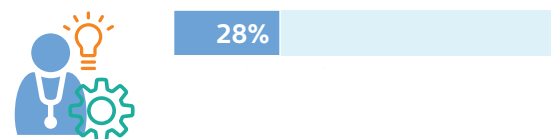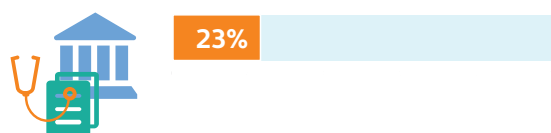
Insurers can play a key role in pushing **cooperation** in EHR creation
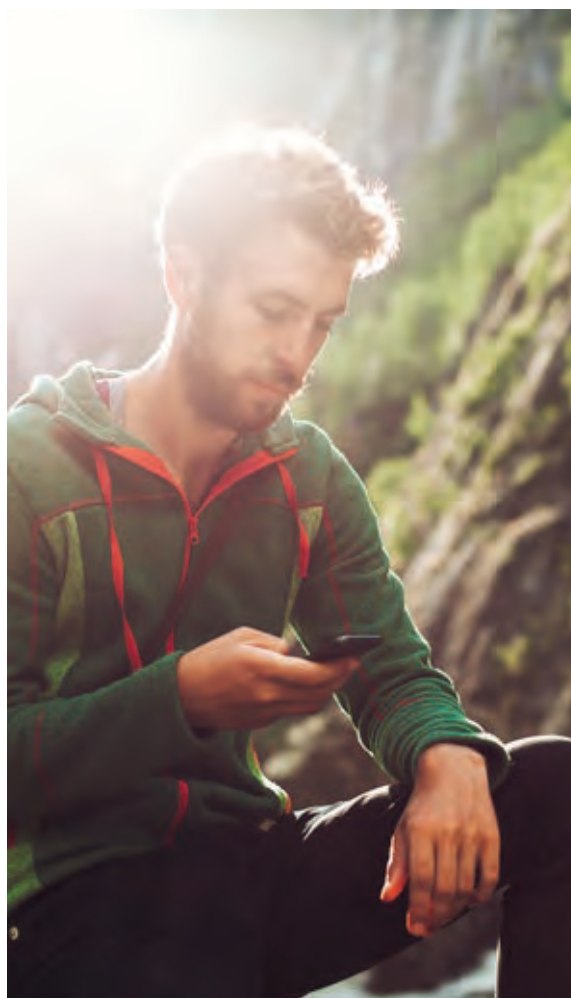
Recommendations

1

Insurers should be looked at as leading potential drivers of EHR proliferation and innovation, particularly in countries where the public sector finds that challenging

Experts see reason for optimism about the role of private insurers as EHR advocates because, in many cases, insurers are able to move more quickly than the public sector and are freer to pursue technological innovation.

"We have insurance companies that are pushing EHRs [in Germany] to give their policyholders access to their records," says the Royal Institute of Technology, Stockholm's Christiane Grünloh. "Five years ago, I would have probably freaked out about the prospect of giving insurance companies this kind of data. But given that the government has really moved nowhere for the past two decades, maybe there has to be a push from the industry to keep them moving, so that they know they have to start and keep regulating and adopting these solutions."

"In Germany we have lots of insurance companies that are developing their own patient records as a tool to compete in the insurance environment," says Medical University of Hannover's Volker Amelung. "That makes sense. People might not change providers over €10 a month or so, but when you have an electronic vaccination record that you could access on your smartphone to check your status – that would be something people would be pretty sensitive to, and might create new customers and a competitive advantage."

While government policy and the stance of single payers can be important factors in the adoption of EHRs, it may be the countries with a greater private sector presence in the health system – like the US – that are best positioned to make early progress.

"At Kaiser Permanente in California, whenever you enter as a doctor you get told who the IT contractor is, and what the digital means are to communicate with patients and professional groups," Amelung explains. "Tech is the glue that connects that particular health ecosystem. That's why I think we stand the best chance in the US. Groups like Kaiser Permanente run closed systems and use technology to power those systems. Tech is the backbone of the business model."

2

Governments and healthcare professionals should encourage the efforts of insurers to integrate EHRs into their offerings

While they may have a degree of first-mover advantage, private insurers are quick to acknowledge they can't go it alone in creating or promoting EHRs or other connected care solutions. In fact, according to Bupa's John Moore, it is key to involve and seek feedback from all stakeholders, particularly patients and providers, during the development and testing phases.

"It's not just the patient's experience, it's also the provider's," he says. "In healthcare if the provider isn't enjoying the experience, they won't encourage their patients to use it. It's actually quite a strong symbiotic relationship between the provider, the customer and us as the payer. We try to connect all three."

3

EHR solutions should be pursued cooperatively, taking a cue from the customer-centric approaches of insurers and startups

Moore believes working with outside organizations, including startups, can help payers and other health system stakeholders develop and implement solutions that are more attuned to the needs of the patient or practitioner, and therefore ultimately more successful. This is why Bupa has teamed up with HealthTap, a Silicon Valley-based startup focused on the digital management of records, treatment plans and other aspects of the healthcare journey.

"[HealthTap says] there's no reason you can't have an EHR working in combination with a personal health record that you yourself maintain," Moore explains. "The role of the individual, the provider, the government; all come into a triangle with data as well. Because EHRs don't cover the stuff that you don't go see a doctor for."

29% of insurers think the **attitudes** of healthcare professionals are crucial in determining the adoption of new technology

1. Insurers Take Lead in EHR Implementation. (August 18, 2010). http://www.insurancetech.com/insurers-take-lead-in-ehr-implementation/d/d-id/1312276d41d.html? 2. Future Health Index. (2017).

5 Enhancing public trust in **AI and data analytics**

24

Introduction

EHRs lay the groundwork for more data-driven health systems based on the efficient collection and exchange of medical information. But these systems can only achieve real change when this data is analyzed and used effectively to produce better outcomes – which is where data analytics and AI come in.

The 2018 FHI identifies AI as a significant contributor to a healthcare system's ability to provide data-driven care. Singapore, the country with the highest Value Measure, ranked third for spending on healthcare-related AI for therapy planning, while Sweden earned top rank in AI for preliminary diagnosis spending.

When it comes to the general public, particularly young people, **AI adoption** seems to stand on relatively fertile ground
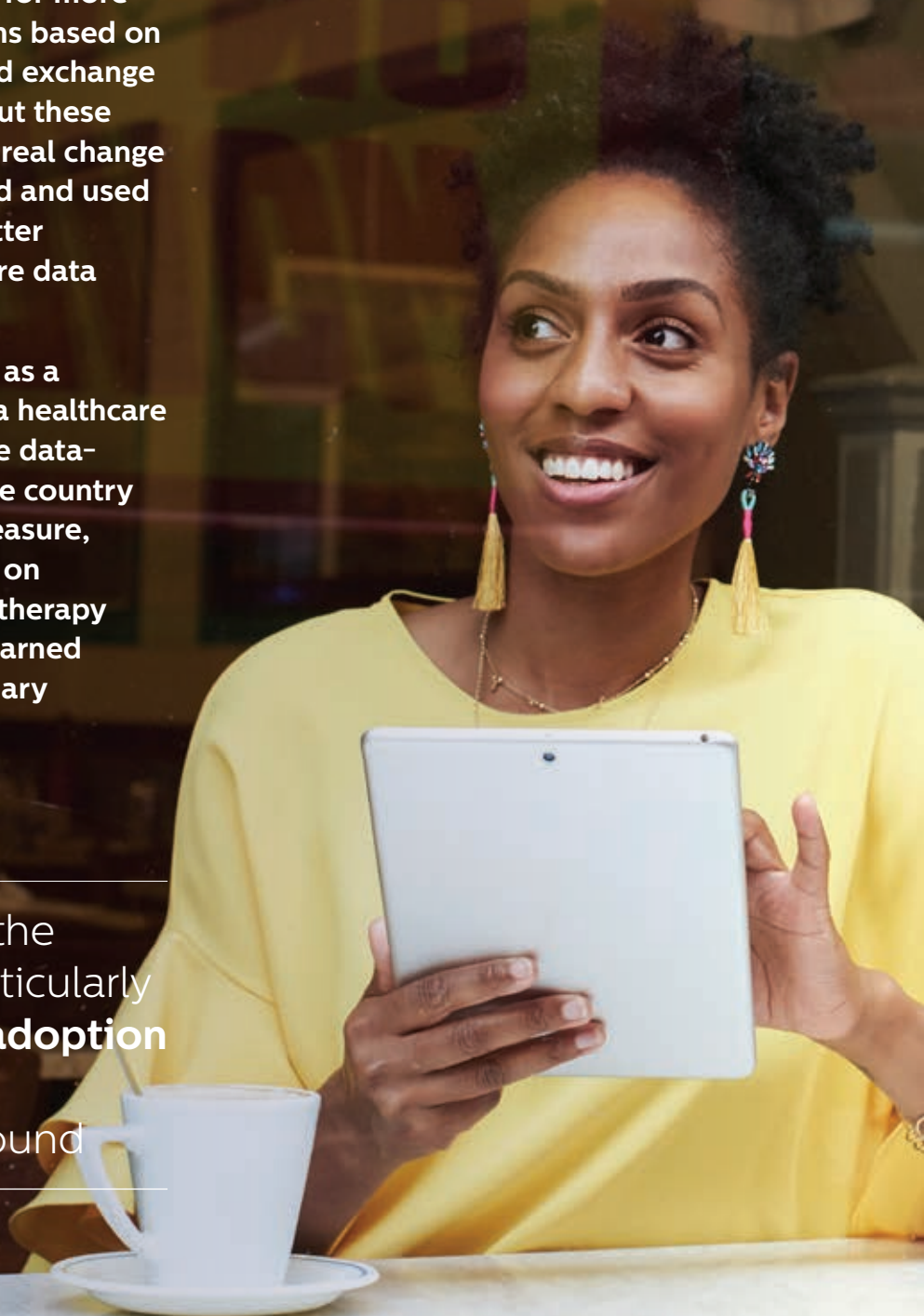
Learnings

A trusting public?

When it comes to the general public, particularly young people, AI adoption seems to stand on relatively fertile ground. Research has shown that in the US, for example, 45% of patients are excited about the potential of AI to positively affect healthcare, climbing to 59% of those aged 18–34.[1] According to a study by PwC, around half (54%) of people worldwide are willing to engage with AI and robotics for their healthcare needs, rising to 67% of those aged 25–34 and 69% of 18–24 year-olds.[2]

Keeping healthcare safe – and human

However, there is also a degree of apprehension around AI, particularly its implications for data privacy and security, and the patient–doctor relationship. According to Deloitte, more than 80% of US consumers feel they have lost control over how their personal information is collected and used.[3]

This is particularly relevant to healthcare given the sensitivity that surrounds the sector. According to the FHI, more than 55% of the general population would least want their health data to be made public if they were hacked, outranking even email and social media.[1]

Next to data, the other element patients seem to fear losing is the dynamic with their (human) physicians. In the PwC study, the lack of a 'human touch' was cited by patients as the main disadvantage of using advanced computers or AI-equipped robots in healthcare.[2] These views, along with concerns about the ability of AI to make the right decisions, mean patients generally want the technology to assist healthcare professionals in improving outcomes, rather than replace them altogether.

There's excitement about AI as long as health retains a **human element**

How does the perception of integration influence how the general population **trusts the health system?**

Those that see it as:

🟩	Very or completely integrated	**79%**
🟦	Somewhat or not at all integrated	**47%**
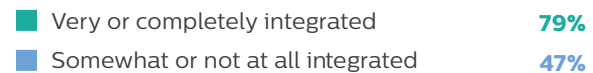
Recommendations

1

Patients should be involved in the development of AI projects and solutions to ensure they speak directly to patient needs

Many working in the field think that, in order to transform health AI into a mainstream technology, it's critical to boost its credibility in the eyes of the general population.

"What's really needed is to build trust with our patients to show them [AI is] safe, to show that it can help them, and to explain what it could mean to them," says Lucien Engelen, Director of the REshape Center in the Netherlands, a department of Radboud University Medical Center dedicated to healthcare transformation, and Global Strategist Digital Health at the Deloitte Center for the Edge.

More than anything else, he says, this trust requires "evidence" – as well as the involvement of patients from the start of any AI project. "A lot of the new innovations in healthcare are not adopted because someone has created something no one was waiting for," he explains. "We need to get the patient perspective in everything we do, right from the get-go."

2

Regulators should develop frameworks and standards for AI in healthcare to increase patient confidence

Regulation can play a part in fostering public trust by establishing clearer benchmarks and standards for AI – though in many markets regulators are still struggling to keep up with the pace of technological development.

"[Regulators] are really trying to get acquainted with the technology and see that there's a future ahead," says Joris Wakkie, Chief Medical Officer at Aidence, a company that develops AI solutions for medical imaging analysis. "They want to understand it better, and they want to see a lot of validation from the start."

"My hope is that as they get more comfortable with [AI] it will be easier to generalize to larger populations and physical parameters … but it's good for a regulatory body to question [AI] and get me to show them that what I'm saying is actually true."

The patient **perspective** must be at the heart of AI in healthcare

3

The positive effects of AI should be quantified and effectively communicated to encourage engagement

To reassure patients and regulators, as well as drive AI adoption, there needs to be more evidence that draws direct lines between the use of AI and enhanced patient experiences and outcomes.

"There needs to be better public understanding that medical experience comes from exposure," explains Bryan Williams, Chair of Medicine at University College London and Director of the NIHR University College London Hospitals Biomedical Research Centre. "Having access to thousands of previous data points and insights from AI provides that experience faster. Patients should feel happier that their diagnosis is based on multiple cases."

Similarly, Wu Ji, an Associate Professor at Tsinghua University in Beijing, believes use cases will clearly demonstrate to patients that AI improves, rather than takes over, interactions with healthcare professionals.

In China's large hospitals, "there are too many patients, so doctors can spend only maybe three minutes with each one on average, and the patient feels like they can never get enough information," says Wu, who helped develop the first machine in the world to pass a national medical exam. "The information and suggestions provided by AI will create more opportunities for discussion, and for patients to have better-informed talks with their doctors."

1. Statista Market Indicators. (2017) Percentage of U.S. patients that agree with select statements regarding the use of AI in healthcare as of 2017, by generation. 2. "What Doctor? Why AI and Robotics Will Define New Health." PwC, (2017), https://www.pwc.com/gx/en/industries/healthcare/publications/ai-robotics-new-health.html 3. "To Share or Not to Share." Deloitte United States (2017) https://www2.deloitte.com/insights/us/en/industry/retail-distribution/sharing-personal-information-consumer-privacy-concerns.html

6 AI: **Transforming** health organizations into **data organizations**

Introduction

AI projects often entail significant investments and the overhauling of established structures and processes. Without the buy-in of stakeholders at the most senior levels in healthcare organizations, it can be near-impossible for these projects to reach their potential.

Budgeting is one example. The decentralized way budgets are typically structured at healthcare institutions has been identified as one of the chief impediments to innovation in the sector.[1] It's difficult to change these kinds of processes without a concerted push from the top, yet many senior executives in healthcare and other industries remain unfamiliar with AI and ambivalent about some of its possible implications.

Ready or not, there is no question AI is already **reshaping** the medical sector

Learnings

An unstoppable force?

In a recent poll by IT services giant Infosys, nearly two-thirds (64%) of C-level executives said the leadership team in their organization is hesitant to invest in AI technologies because of privacy or security concerns. About half (49%) reported being unable to deploy the AI technologies they want due to insufficient data resources.[2]

Ready or not, there is no question AI is already reshaping the medical sector. Research firm IDC expects healthcare providers worldwide to invest US$1.7 billion in cognitive and AI systems this year, making healthcare the fourth-largest spender on AI as an industry after retail, banking and manufacturing.[3]

More than half (51%) of respondents in the Infosys survey said healthcare is already experiencing disruption due to AI technologies, and 71% of respondents at healthcare and life science companies said AI adoption opportunities would inform their future business strategies.[2]

Yet just as healthcare institutions brace for the wider adoption of AI, they face a shortage of the infrastructure and human capital needed to steer effective implementations. Well over half (61%) of healthcare organizations are struggling to find qualified staff to lead the integration of AI, according to Infosys.[2] The lack of relevant skills has frequently been identified as a significant barrier to the effective use of AI systems in healthcare.[4]

There has to be a major push from the top in order to **implement AI**

Recommendations

1

Healthcare institutions should increase the technological and entrepreneurial presence in senior management

To encourage fresh thinking, experts see the need for a change in the administrative makeup of the typical healthcare institution.

If they truly have the ambition to become more data-driven, "why are there mainly doctors and accountants on the boards of healthcare organizations?" Radboudumc REshape Center's Lucien Engelen points out. "Why not a technologist or an entrepreneur? We need doctors and accountants on the board, but we have tons of them already. As soon as those at the top realize that health will play out exactly the same [in terms of AI adoption] as music, travel and other industries, that's when things will start to move."

2

Healthcare executives should increase interaction with other sectors and draw lessons from AI deployments in different industries

To cultivate the skills, mindsets and organizational structures needed for AI to play a greater role in care, Engelen believes healthcare organizations (and their senior executives) should regularly step outside their comfort zones.

"When we gather in our own groups, we don't learn that much," he says. "Engage with people from other sectors. And change the model of healthcare education – because if we don't, every year new physicians and nurses will step into healthcare and run it in the exact same way."

Bryan Williams says UCLH's AI capabilities have benefited from these kinds of exchanges, with data scientists from the Alan Turing Institute embedded in the hospital. "This needs to happen so they [the data scientists] understand the context hospitals are operating in, and so outputs are practical and likely to be adopted."

3

Technology skills need to be reinforced with effective governance frameworks and solid infrastructure for AI to flourish

Beyond the people, AI deployments also need to be built on firm technological and cultural foundations.

According to Williams, "the right governance framework" must include data security practices that are robust without being overly restrictive.

Establishing an AI-ready institutional culture, meanwhile, often requires a certain amount of internal marketing. "For there to be cultural acceptance, there has to be a reiteration of AI not replacing the human role and everything being human-gated; of change being for the better," Williams explains. "You have to make the operational efficiencies resonate with all members of staff."

Demonstrating rapid progress in areas that naturally lend themselves to AI-driven efficiencies – such as emergency care – can help with this process, Williams says.

4

Senior leadership needs to be convinced of the financial case for AI through concrete demonstrations of its value

Ultimately, senior executives need to be convinced of the financial case for AI to foster support and adoption – and that means demonstrating return on investment, whether in terms of costs or other forms of value, such as faster diagnoses or lower readmission rates.

"We've entered an area where everyone understands that the buzz is good, but we now have to show people how well [AI] performs," says Aidence's Joris Wakkie. "Show them based on valid data that the algorithms are much better than previous algorithms. I think everyone is eager to try [AI], but we need to prove our value before someone is going to pay for it."

1. "Traditional hospital budget systems are holding back innovation, experts say". Healthcare IT News (2018), www.healthcareitnews.com/news/traditional-hospital-budget-systems-are-holding-back-innovation-experts-say 2. "Leadership in the Age of AI". Infosys (2018), https://www.infosys.com/age-of-ai/Documents/age-of-ai-infosys-research-report.pdf 3. "Worldwide Spending on Cognitive and Artificial Intelligence Systems Will Grow to $19.1 Billion in 2018, According to New IDC Spending Guide". Business Wire (2018), https://www.businesswire.com/news/home/20180322005847/en/Worldwide-Spending-Cognitive-Artificial-Intelligence-Systems-Grow 4. "AI skills shortage stunting healthcare". HealthManagement.org (2018), https://healthmanagement.org/c/it/news/ai-skills-shortage-stunting-healthcare

7 AI: Freeing healthcare professionals to **focus on value**

Introduction

AI solutions are designed to store, process and analyze vast amounts of data quickly, translating the information into functional tools or a basis for decision-making. Used in the right way, they can reduce the time healthcare professionals spend managing and interpreting data, freeing them up to concentrate on higher-value activities and enhancing the capacity of the entire institution – and by extension, healthcare systems as a whole.

AI has been shown to be **30** times faster than humans in reviewing and interpreting mammograms
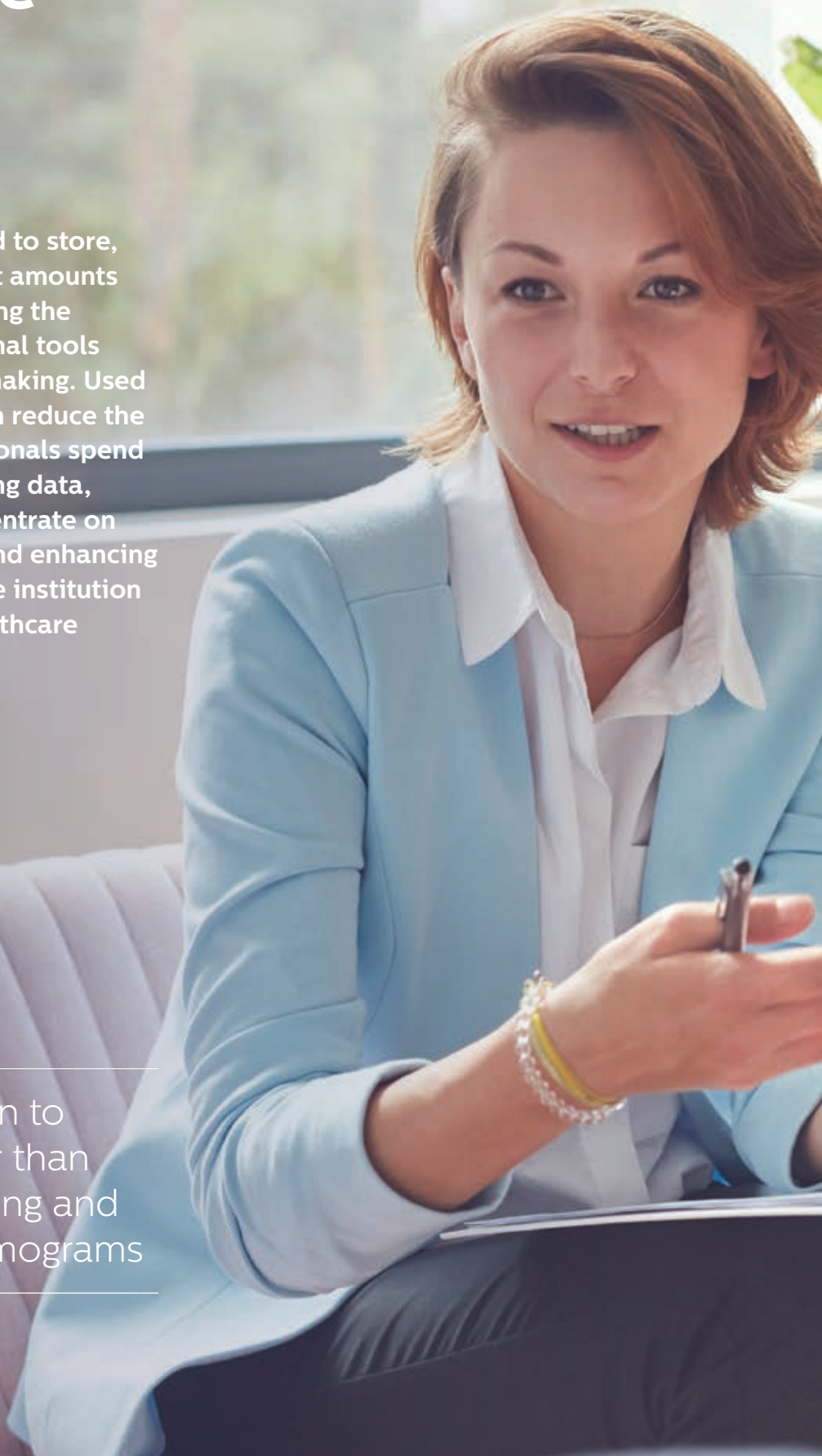
Learnings

Hope, and cynicism

Diagnosis, for example, often depends on time–consuming, but relatively simple, tasks like analyzing scan results. AI has been shown to be 30 times faster than humans in reviewing and interpreting mammograms, enabling the earlier detection of breast cancer.[1] In China, an AI solution recently bested a team of elite physicians in the diagnosis of brain tumors, achieving a higher accuracy rate in just half the time.[2]

However, even AI advocates admit healthcare professionals' views on the technology vary widely – perhaps not surprisingly given indications it is already replacing doctors and nurses in some contexts.[3]

At one end of the spectrum are doctors who "think AI will solve everything for them; not necessarily overtake their job but transform it and help them," says Joris Wakkie of radiology AI company Aidence. On the other are those "who just don't believe in it; who think it's rubbish."

In China, doctors also demonstrate sharply different attitudes, according to Tsinghua University's Wu Ji. "Some recognize they are very busy, that some tasks cost too much of their time and energy, that they can't deal with so many problems, and need to be assisted by new technologies. But some still don't believe AI can really help them and don't trust AI systems."

AI in healthcare

Country	Per capita spend on AI (preliminary diagnosis) – 2016, USD millions
Australia	0.03
Brazil	0.01
China	0.00
France	0.04
Germany	0.03
India	0.00
Italy	0.02
Netherlands	0.05
Russia	0.01
Saudi Arabia	0.01
Singapore	0.04
South Africa	0.01
Spain	0.02
Sweden	0.07
UK	0.03
US	0.06

0   0.10
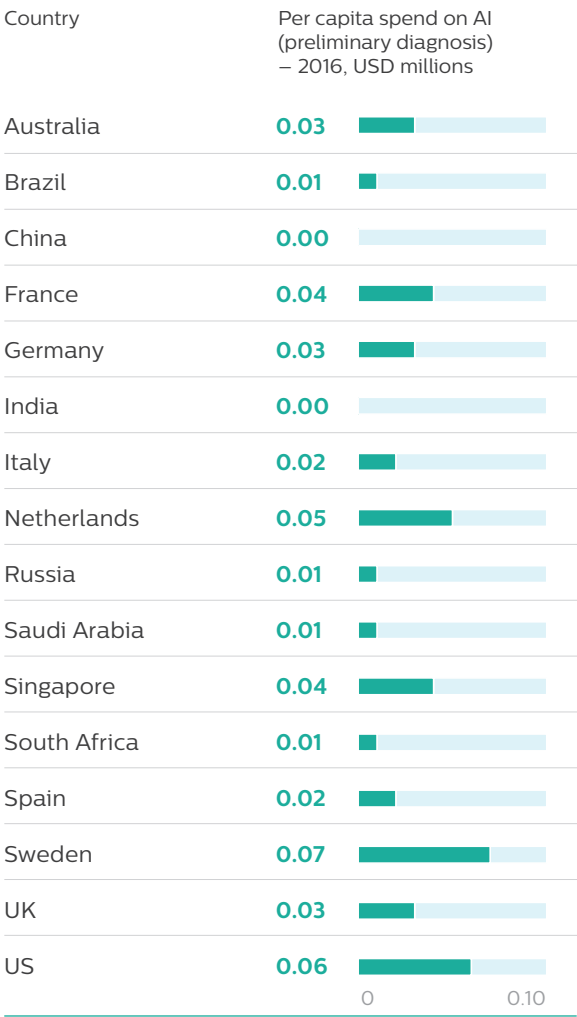
Recommendations

(1)

Institutions and technology providers must better communicate AI results to win healthcare professionals over

As AI is still a relatively new field, experts believe there are no real shortcuts to overcoming resistance in the healthcare professional community. "It might take a long time to change people's minds, and even more proof," Wu says. "What we're trying to do first is get more doctors actively involved in the field. More time and more practice that will convince them AI can do something great."

The more evidence there is of AI adoption producing efficiency or other gains, the more healthcare professionals are likely to be convinced – yet in the eyes of some experts building this case history doesn't seem to be a priority for the industry as a whole.

"Operational excellence is a great way to bring [healthcare professionals] onboard to the notion [of AI]," says University College London Hospitals' Bryan Williams. "In any other industry you have efficiency levels mapped out. Retailers know when they are likely to get the biggest footfall, and airlines know when they are likely to fill their seats. That just doesn't exist in healthcare yet."

2

Change management programs – and sensitivity – are needed to address healthcare professionals' concerns about their future roles

Though the FHI makes it clear people still value the human touch in healthcare, and that connected care technologies will enhance rather than take over the roles of healthcare professionals, professionals themselves are not necessarily convinced. There's a need to tackle worries about obsolescence and job losses – especially in areas where AI is making significant early headway, like in radiology.

"We must change the culture inside our medical organizations," says Lucien Engelen. "You have people that trained as medical specialists for 17 years and now all of a sudden someone comes by and says 'get out of the way, I'm better than you are.' That's not going to work. With all the perspectives that we have, showing the doubling of healthcare demands that would probably need to be managed with the same budget or less, it's vital also to make sure we have a change management system in place to let our colleagues know their careers are not at stake."

The message needs to be "you're going to face double the interventions you have to do now with fewer colleagues, so you will need technology," Engelen continues. "It's not an easy transition and it doesn't involve the typical easy answers like money or evidence or legislation. Those are decoys from the real problem, which is us."

AI tools have to be **easy to use** and fit into current ways of working

3

AI providers and institutions should concentrate on ease of use and seamless integration to minimize the 'pain' of adoption

Finally, as with any technology, ensuring AI is designed with the end-user in mind and deployed in a way that minimizes disruption to existing systems and processes will go a long way to promoting its use.

"In our domain of radiology, it's essential that the software is embedded in the workflow of the radiologist," says Wakkie. "Everyone in our space knows that radiologists don't want to be slowed down. It's a barrier for AI software, because it means we have to integrate with current systems. But that's what we do – we offer a back-end application programming interface (API), completely integrated within the current system of the customer, and that's how we introduce it to the market. We have to show that they can use it instantly, so they try it out and quickly see if it's something they like."

Learning the workflows and needs of the user base, and developing solutions to match, involves engaging that base early. Aidence, for example, conducts extensive testing with radiologists, while Wu and his team at Tsinghua University "gravitate towards doctors who are active in the field and work together to develop access to AI solutions for them."

And because technology and the needs of the user base change, AI solutions will need to be constantly refined to secure loyalty for the long term. "We're always soliciting feedback from the market and building out new versions based on that feedback," says Wakkie. "It's a constant process."

1. https://www.weforum.org/agenda/2018/05/four-ways-ai-is-bringing-down-the-cost-of-healthcare/ 2. http://en.people.cn/n3/2018/0702/c90000-9476770.html 3. See e.g. https://www.theguardian.com/society/2018/may/21/london-hospitals-to-replace-doctors-and-nurses-with-ai-for-some-tasks

8 Consumer wearables: **Contributor to improved healthcare,** or complication?

Introduction

Of all the categories of connected care technology, wearables — a constantly evolving domain that spans everything from consumer products like smart watches to portable blood pressure monitors and patches that monitor the body temperature of infants — have won the most acceptance among the general population.

The promise of real-time, readily accessible health-related data is clearly resonating with consumers around the world. By one estimate, the global market for wearable consumer fitness trackers will enjoy a near 20% compound annual growth rate to exceed US$60 billion in 2023, driven by a rising focus on health, improvements in technology (including data security) and an "exponential" surge in demand in Asia-Pacific.[1] According to a recent Accenture survey in the US, around three-quarters of consumers view wearables as beneficial to understanding their health conditions (75%), engaging with their health (73%) and monitoring the health of loved ones (73%).[2]

Just **9%** of primary care physicians in the US have integrated data from wearables

Learnings

Welcomed, but not embraced

There are also positive views on the potential of wearables within the healthcare sector. Among insurers polled for the 2017 FHI, half said they are using wearables and other connected care devices to customize insurance plans.[3] Trackers and remote monitoring devices could prove transformative for home and elderly care, reducing the need to check symptoms or deliver services within healthcare institutions.

However, these views don't necessarily mean wearables are being integrated into health systems – and indeed there is evidence to the contrary. A study by Deloitte showed just 11% of primary care physicians in the US have implemented remote care management and coaching at their organization and 9% have integrated wearables data. Only a small proportion of physicians whose organizations have not adopted virtual care technologies plan to begin using them in the next one to two years (15% remote patient monitoring at home and 20% wearables data).[4]

Fitness wearables in healthcare

Country	Number of fitness wearables users per capita, 2016
Australia	0.04
Brazil	0.02
China	0.08
France	0.05
Germany	0.04
India	0.01
Italy	0.03
Netherlands	0.03
Russia	0.02
Saudi Arabia	0.03
Singapore	0.04
South Africa	0.02
Spain	0.03
Sweden	0.05
UK	0.07
US	0.07

0   0.10
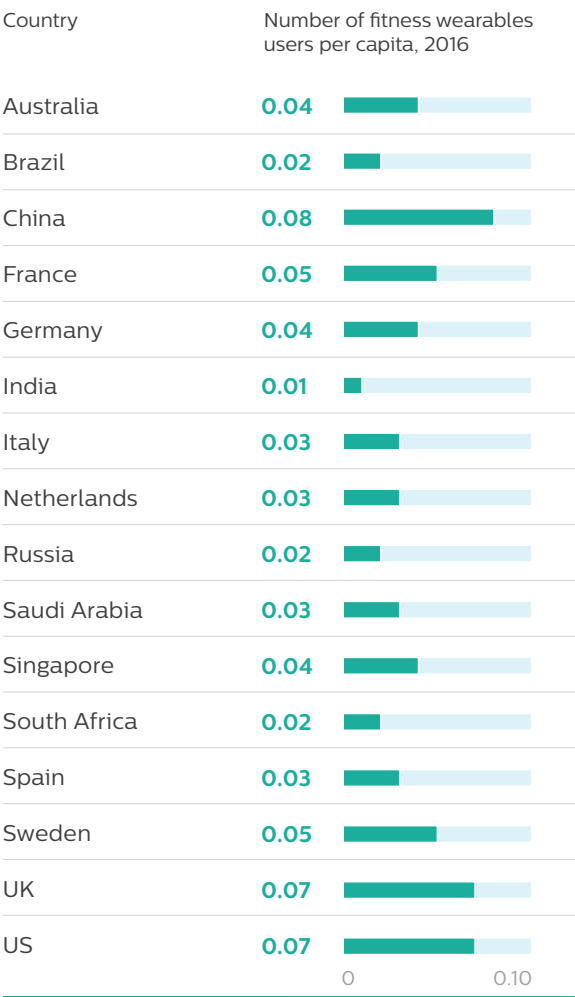
Recommendations

1

Healthcare professionals and the general population should be aware of the weaknesses of consumer wearables

The appetite for the adoption of consumer wearables would seem to argue for their role in more connected, value-based health systems. But some experts believe significant changes are needed for this role to be consistently positive.

Consumer devices run on various standards and formats, and studies have indicated the data they generate is not always consistent or reliable.[5] This means using them as a basis for medical decisions could be problematic – even dangerous.

Research published in 2012 by Hawley Montgomery-Downs, a Professor at West Virginia University specializing in sleep-related issues, showed the popular Fitbit tracker did not function accurately as a sleep monitor because it tended to misidentify some periods of wakefulness, overestimating the quantity and quality of sleep as a result.[6] Since then, according to Montgomery-Downs, there has been no conclusive indication that the data produced by Fitbits or other devices has improved.

"There's potential for major harm because we know not getting enough sleep is very much like the impact of alcohol [on a person]," she says. "One of the first things to go is your insight into how impaired you are. So to give someone something that tells them they're sleeping better than they actually are – and having that device marketed as something that is accurate and trustworthy – is very much like giving someone who's legally intoxicated a breathalyzer that says they're okay to drive. That's a very dangerous situation."

Another issue is that while consumer wearables can raise awareness, they can also give people a false sense of empowerment, convincing them they have a more accurate picture of their health than they actually do and heightening the chances of conflicts with their physicians.

Healthcare professionals have been "very open about the problems they're having with patients coming in and handing them printouts or showing them devices, and having a difficult time challenging [that data]," Montgomery-Downs says. "The colleagues that are speaking out about this are describing almost confrontational interactions with patients and an adversarial situation, where the patient thinks the doctor can't be trusted because he or she is dismissing information from this device they paid money for."

2

Regulation and standards are needed for consumer wearables to play a more constructive role in connected care

Regulation of the consumer wearables market is currently minimal to non-existent in most countries. Rather than banning specific devices, a better approach could be a labelling system that makes the accuracy levels of any given device abundantly clear to a potential buyer.

"[With labelling] two things would immediately happen," Montgomery-Downs says. "Many companies would go out of business as their product labelling would show poor accuracy. At the same time, a lot of existing companies that are positioned to do more in R&D would get on it really quickly, and we'd see a new generation of devices. After that initial triaging of quality, if the quality of the devices improves – and I do believe the potential is there, [manufacturers] just don't have the motivation – product labelling would allow the free market to do what it does best."

Consistent professional standards for the data generated by wearables would also enhance accuracy and transparency – while making it easier to integrate information from wearables with EHRs, and hence health systems.[7]

Groups like Health Level Seven International are taking steps in this direction, but Montgomery-Downs sees little likelihood of significant progress in the short term, given the conflicting interests of the sector's many stakeholders.

Official standards could help increase patient **empowerment** when it comes to consumer wearables

1. https://www.prnewswire.com/news-releases/global-fitness-trackers-market-expected-to-reach-62128-million-by-2023---allied-market-research-679869143.html 2. "Accenture Study Finds Growing Demand for Digital Health Services Revolutionizing Delivery Models: Patients, Doctors + Machines". Accenture (2018), https://newsroom.accenture.com/news/accenture-study-finds-growing-demand-for-digital-health-services-revolutionizing-delivery-models-patients-doctors-machines.htm 3. Future Health Index (2017) 4. "What can health systems do to encourage physicians to embrace virtual care?". Deloitte (2018), https://www2.deloitte.com/insights/us/en/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html 5. "Fitness trackers accurately measure heart rate but not calories burned". Stanford Medicine (2017), See e.g. https://med.stanford.edu/news/all-news/2017/05/fitness-trackers-accurately-measure-heart-rate-but-not-calories-burned.html 6. "Movement toward a novel activity monitoring device". NCBI (2012) https://www.ncbi.nlm.nih.gov/pubmed/21971963 7. "4 questions every healthcare provider should ask about fitness wearables". MedCityNews (2016), https://medcitynews.com/2016/07/questions-fitness-wearables/

Making change happen

This report has focused on the barriers to the adoption and effective use of universal EHRs and AI, which will underpin the transition to more integrated health systems capable of delivering greater value. Yet our research has also highlighted many reasons for optimism that these issues can and will be resolved.

It is clear that experts and practitioners from various parts of the healthcare spectrum are virtually united in recognizing the potential of connecting people, data and systems to create a network that allows information to flow seamlessly across care providers, locations and systems. They see how it can address pressing systemic constraints and deliver more effective care, and they are working to advance these technologies both within their own organizations and more broadly.

Importantly, there is also a high level of agreement on the steps needed to drive change and make integrated care a more universal reality — and these steps are broadly applicable regardless of the technology or solution in question. They are:

- **Improving the regulatory backdrop.** Clearly defined policies around the use and exchange of data, as well as robust data privacy and security standards, allow healthcare professionals and the general population to collect, share and analyze data with greater confidence, and help build trust in the healthcare system as a whole. Establishing such rules at the national level also creates an important benchmark for healthcare institutions developing their own data codes of practice. Countries should re-examine their regulatory frameworks to gauge whether they are adequate for the big data era, seeking to strike a balance between protecting the rights of the data owner and permitting information to flow freely enough to enhance decision-making.

- **Educating future end-users.** With technology playing an ever-greater role in care, it must be an equally significant presence in medical school curriculums and professional training. Integrating connected care technology into education will increase understanding of how EHRs and AI are applied and used in the everyday healthcare context and ultimately underline to healthcare professionals that such technologies are designed to support their needs, rather than replace them altogether.

- **Advancing the harmonization of standards.** Integration will only be possible, and healthcare information only truly portable, when devices and institutions can speak a common language. Universal EHRs may be a starting point, but interoperability will ultimately have to extend to a range of devices used in the clinical environment. This will require the industry to reach a degree of consensus on data formats and protocols, an effort in which companies, healthcare professionals and even governments may need to be involved.

- **Developing solutions for real-life situations.** New technologies are too often presented to healthcare professionals (and the general population) as a fait accompli rather than created in coordination with the end user, which would do more to ensure they are optimized for use in a real-world environment. Healthcare professionals should be at the very least consulted, and ideally deeply involved, in the development of the technologies that they are expected to embrace in their daily working lives.

- **Proving value at every opportunity.** For all the progress made in the adoption of EHRs and AI in healthcare in recent years, these technologies are still relatively new. Establishing a track record of their successes in boosting efficiency and patient experience is important to building credibility among healthcare professionals and the general population they serve. The outcomes that these technologies support should be constantly measured and communicated to create this body of evidence.

These steps will require a great deal of collective will. But as the experts consulted for this paper and initiatives like the Fast Healthcare Interoperability Resources (FHIR) protocol make clear, in many respects they are already in motion. All that is needed is for momentum to grow.

As adoption of EHR and AI solutions gains pace, the next task will be to develop consistent and replicable models of how these technologies fit into the delivery of care at the practical level, allowing healthcare professionals, institutions and systems to square the difficult circle of increasing access to cope with growing demand without an unsustainable rise in costs. These models will be the focus of the next part of the 2018 FHI.

Research
methodology

Research overview and objectives

The Future Health Index (FHI) is a research-based platform designed to help determine the readiness of countries to address global health challenges and build sustainable, fit-for-purpose national health systems. In the context of ever-growing pressure on resources and costs, the FHI focuses on the crucial role digital tools and connected care technology can play in delivering more affordable, integrated and sustainable healthcare.

In 2016 the FHI measured perceptions to produce snapshot of how healthcare is experienced on both sides of the patient-professional divide. In 2017 it compared these perceptions to the reality of health systems in each country researched.

In 2018, the FHI builds on the fast-growing consensus that the value-based healthcare model is the best approach to address the challenges posed by a combination of growing and aging populations with the rise of chronic diseases and healthcare costs. The 2018 edition of the FHI identifies key challenges that form a barrier to the large-scale adoption of value-based healthcare and improved population access; and assesses where connected care technology – data collection and analytics, and new care delivery models – can help speed up the healthcare transformation process.

16 countries (Australia, Brazil, China[1], France, Germany, India, Italy, Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, the United Kingdom and the United States of America) are analyzed based on several factors to provide actionable insights into the journey to value-based healthcare. For this purpose and based on our prior research, we believe the focus should be on the following digital enablers which have the potential to accelerate change:

· **Data collection and analytics:** the ability to share and collect patient-centric data and analyze it on a large scale

· **Care delivery:** technology developments which are bringing innovative ways to deliver better care

1. Each data source approaches data collection for China differently. Some include Taiwan and/or Hong Kong, others treat them separately. For the purposes of this research we have not adjusted the data from the way it was collected. As such the data is reflective of each source's approach to measuring China.

The 2018 **index**

In the first chapter of the Future Health Index in 2018, we analyzed 45 different metrics and grouped them together in key pillars:

1. Value Measure

2. Current State (of Data and Care Delivery)

The **Value Measure** is a new indicator of the value delivered by healthcare systems of developed and developing markets. It combines factors associated with value-based healthcare and access to care, arguably the ultimate goals of modern healthcare. It consists of three parts:

1. **Access** (i.e. how universal, and affordable, is access to healthcare in the designated market?)

2. **Satisfaction** (i.e. to what extent do the general population and practitioners in the designated market see the healthcare system as trustworthy, and effective?)

3. **Efficiency** (i.e. does the system in the given market produce outcomes at an optimum cost?)

The second pillar, Current State measures current levels of adoption of key digital enablers:

1. **Data (collection and analytics)** (including wearables, Electronic Health Records (EHRs), Intelligent Care)

2. **Care Delivery** (Telehealth and Diagnostic & Treatment Solutions)

Each pillar consists of several sub-metrics (see graphic on page 44). Within each pillar, the metrics are normalized to ensure comparability across countries and are scored to fit onto a 0 to 100 scale. Specifically, metrics related to market size are normalized per capita, per hospital bed or per physician in each country. The market size metrics were scored relative to the highest scoring country (with a population over 1,000,000) among the available dataset. For other metrics, including those for the Value Measure and technology infrastructure metrics, scoring is either relative to the highest scoring country (with a population over 1,000,000) among the available dataset, or, based on any optimal baseline number set by global authorities e.g. standards/goals set by the United Nations Sustainable Development Goals (SDGs). By excluding countries with less than 1,000,000 population, we exclude outliers which may create unrealistic potential to reach 100.
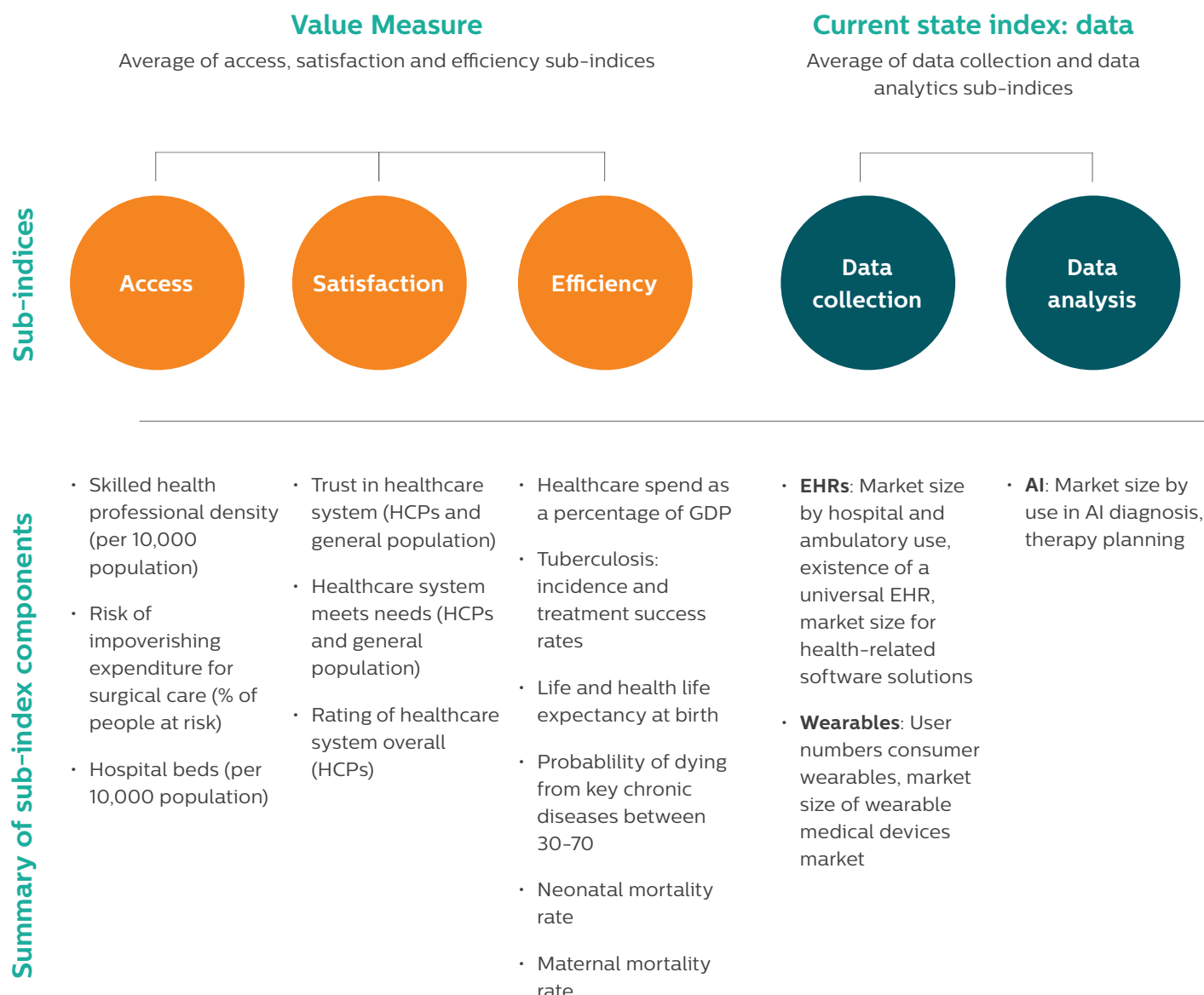
A metric which does not follow this pattern of normalization is:

- The risk of impoverishing expenditure for surgical care – this metric is reported as a percentage, so it is simply inversed and no further normalization is needed

In a next step, the scores for each metric are then averaged to calculate each sub-index score and those sub-indices averaged to create each pillar.

Research framework:
summary of metrics

Report One – Exploring the relationship between value and connected care technology adoption

Value Measure
Average of access, satisfaction and efficiency sub-indices

Current state index: data
Average of data collection and data analytics sub-indices

Sub-indices

| Access | Satisfaction | Efficiency | Data collection | Data analysis |

Summary of sub-index components

Access
- Skilled health professional density (per 10,000 population)
- Risk of impoverishing expenditure for surgical care (% of people at risk)
- Hospital beds (per 10,000 population)

Satisfaction
- Trust in healthcare system (HCPs and general population)
- Healthcare system meets needs (HCPs and general population)
- Rating of healthcare system overall (HCPs)

Efficiency
- Healthcare spend as a percentage of GDP
- Tuberculosis: incidence and treatment success rates
- Life and health life expectancy at birth
- Probablility of dying from key chronic diseases between 30-70
- Neonatal mortality rate
- Maternal mortality rate

Data collection
- **EHRs**: Market size by hospital and ambulatory use, existence of a universal EHR, market size for health-related software solutions
- **Wearables**: User numbers consumer wearables, market size of wearable medical devices market

Data analysis
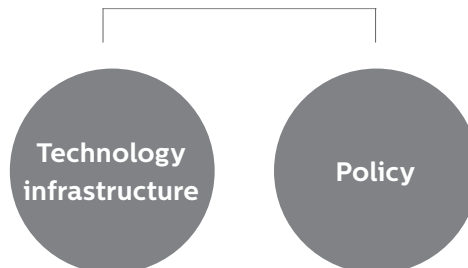- **AI**: Market size by use in AI diagnosis, therapy planning

Current state index: Care delivery

Average of telehealth and diagnosis & treatment solutions sub–indices
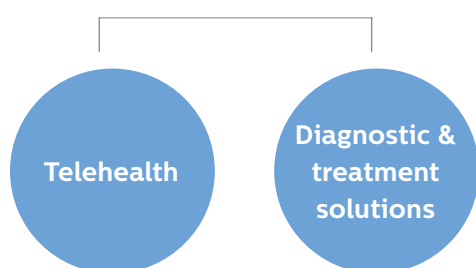
Discussion point: infrastructure

No score, but the importance of these factors will be discussed

Telehealth **Diagnostic & treatment solutions**

Technology infrastructure **Policy**

- **Telehealth**: Number of users of pay-to–use apps for connected medical devices, market size telemedicine, market size remote monitoring devices market by home use and ambulatory use

- **Imaging**: Digital X-ray technology market, advanced CT market, MRI high field strength market, SPECT digital market (nuclear), PET digital market (nuclear)

- **IGT**: image guided therapy systems market

- **Assisted surgery**: Global surgical robotics procedures market

- Internet penetration rates and speeds

- Secure servers per capita

- Mobile penetration and 3G+ connectivity

- Existence of regulation/ legislation or policy for: data protection, quality standards, data sharing

Survey and contributors

The 45 different metrics analyzed use a combination of third-party data and original research collected via a survey in partnership with a global market research firm.

The survey data was collected January 18, 2017 to March 3, 2017 for 15 of the 16 countries analyzed in 2018 (Australia, Brazil, China, France, Germany, Italy, The Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, UK and US) in their native language. The survey had an average length of 25–30 minutes. A combination of online, face-to-face (computer-assisted) and phone (computer-assisted) interviewing was used. Survey data for India was collected during February 16 to March 26, 2018 in a manner consistent with the other countries in 2017.

The total sample from the survey includes:

- 3,244 healthcare professionals (defined as those who work in healthcare as a doctor, surgeon, nurse practitioner, registered nurse, licensed practical nurse or nurse across a variety of specializations)

- 24,654 adults (representative of each country's respective adult population). Third-party data was sourced from a number of organizations including the World Health Organization, The Commonwealth Fund, and the World Bank. A full list of sources is listed below.

For the second chapter of the Future Health Index in 2018, a variety of third-party sources as well as original research from the 2016 and 2017 Future Health Index data was used. Additionally, data from chapter one of FHI 2018 was also referenced

A full list of third-party sources is included below:

- The full 2016 FHI methodology is available here: https://www.futurehealthindex.com/report/2016/chapter/325/methodology-overview/?lang=en

- The full 2017 FHI methodology is available here: https://www.futurehealthindex.com/report/2017/chapter/1145/research-methodology/?lang=en

Furthermore, 12 key opinion leaders (KOLs) across the Netherlands, US, UK, Australia, Germany, China, Sweden and Estonia were interviewed to provide recommendations and produce tangible guidelines as to how elements of healthcare can be improved and drive change.

KOLs were chosen on the basis of their industry expertise in relevant areas, including connected care technology and the general healthcare landscape, and were conducted from July 20, 2018 to August 9, 2018 via telephone or video-chat service (e.g. Skype, etc.).

A list of KOLs interviewed is included below:

- Lucien Engelen, Director of the REshape Center in the Netherlands, a department of Radboud University Medical Center

- Grahame Grieve, Principal at Health Intersections

- Madis Tiik, former CEO Estonian E-Health Foundation

- Mahiben Maruthappu, CEO and co-founder of UK-based social care startup Cera

- Volker Amelung, Specialist Professor for International Health Systems Research at Medical University of Hannover

- Christiane Grünloh, PhD student at KTH Royal Institute of Technology, Stockholm

- Dean Sittig, Prof of Biomedical Informatics at University of Texas Health Science Center

- John Moore, Director – Customer Lab at Bupa

- Joris Wakkie, Chief Medical Officer at Aidence

- Wu Ji, Associate Professor at Tsinghua University, Beijing

- Bryan Williams, Chair of Medicine at University College London

- Hawley Montgomery-Downs, Professor at West Virginia University