future health index 2018

Telehealth:
Delivering value across **institutional** and **geographical borders**

Contents

# Dismantling the barriers to **telehealth** adoption

With a more data-driven and connected approach, healthcare delivery will no longer be tied to particular locations or structures. Telehealth — the provision of healthcare remotely through telecommunications networks — can extend the reach of healthcare to places like the home, as well as remote or formerly underserved areas. It can also connect physicians with each other, allowing for faster diagnosis and expertise to break free of organizational or geographical binds.

In the words of Dave deBronkart, a former cancer patient and noted advocate of connected care known as 'e-patient Dave', "from the provider perspective, [telehealth] opens up vast new markets and audiences for the consultant's expertise. It's possible today to have consultant networks in real time that would have been impractical a generation ago."

Telehealth is directly linked to the three pillars of value-based care that the 2018 Future Health Index (FHI) has combined in the Value Measure. It enhances access by bringing care within the reach of more people. It boosts efficiency by reducing costs and promoting better outcomes through allowing care to be delivered quickly across distances and pooling healthcare infrastructure. And it supports satisfaction by enabling more patients to receive trustworthy care to fit a variety of needs on demand. Many of the countries covered in the FHI with above average Value Measures, such as Singapore, Australia and the Netherlands, have taken concrete steps to encourage the proliferation and adoption of telehealth services.[1,2,3]
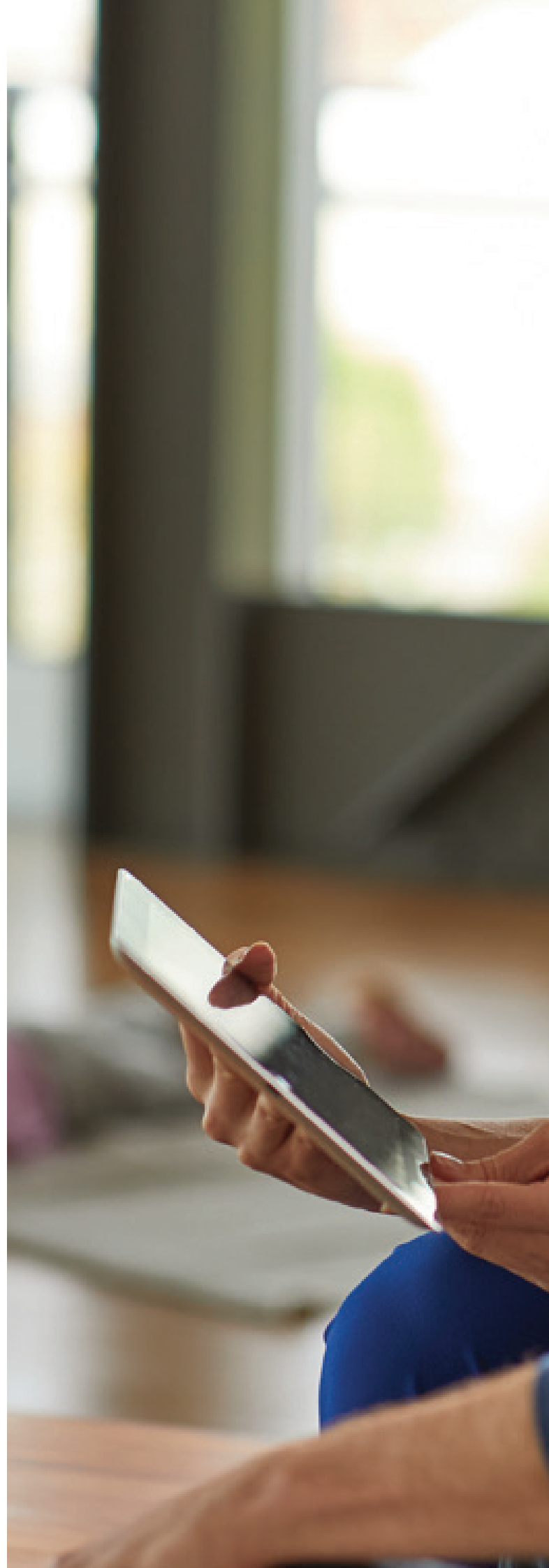
Early pace-setters

Telehealth has made some of its most promising early progress – and arguably demonstrates the most potential – in teleradiology, the transmission of radiological patient images between locations. Telepathology, or the transfer of pathology data to facilitate diagnosis and research, the tele-intensive care unit, and remote monitoring and guidance in primary care can soon become telehealth leaders.

According to research gathered for the FHI, overall expenditure on imaging technologies rose consistently across most of the countries covered from 2014-2016, with X-ray and computed tomography (CT) attracting the most spending.[4] Other studies show digital technologies will account for about three-quarters of the X-ray market by 2025.[5] Teleradiology, meanwhile, enables the burden of image analysis to be distributed more evenly among (remote) radiologists, which could partially attenuate the high rates of burnout in this professional group. Together with adaptive intelligence technology, teleradiology can free radiologists to concentrate on more valuable or fulfilling activities.[6]

Despite this, and the growing number of studies linking telehealth to more effective care and lower costs,[7] the adoption picture is mixed. The FHI, for example, has found that 39% of radiologists use connected care technologies in their practice.[8]

Hospitals with tele-intensive care units can monitor patients remotely in near real-time and practice early intervention via advanced audio-visual technology. Physicians can communicate with bedside healthcare professionals live via video, and advise on the best course of treatment from any location.[9]

In general practice, telehealth has the potential to resolve many of the problems healthcare professionals and the general population find with the system. Travelling long distances to appointments and unnecessary visits could become a thing of the past, and physicians will be able to better anticipate changes to their patients' health.

A Deloitte study showed that only 32% of US physicians conduct virtual or video-based patient visits.[10] Obstacles to improving rates of telehealth adoption are manifold and varied. Infrastructure is one of the most important, given that the broadband networks required to support the fast transfer of vast amounts of data over distances do not yet exist in some markets. Furthermore, the very people in remote or underprivileged areas that telehealth promises to reach may lack internet access.

Culture and attitudes can be a problem – even in wealthy countries with state-of-the-art infrastructure. Many healthcare professionals are far from convinced telehealth will have a positive impact on their jobs. In fast-evolving fields like teleradiology, clinicians are excited about the possibilities, but also concerned about their roles being transformed or even rendered obsolete.[11] Patients also have misgivings about aspects of care losing the human touch.
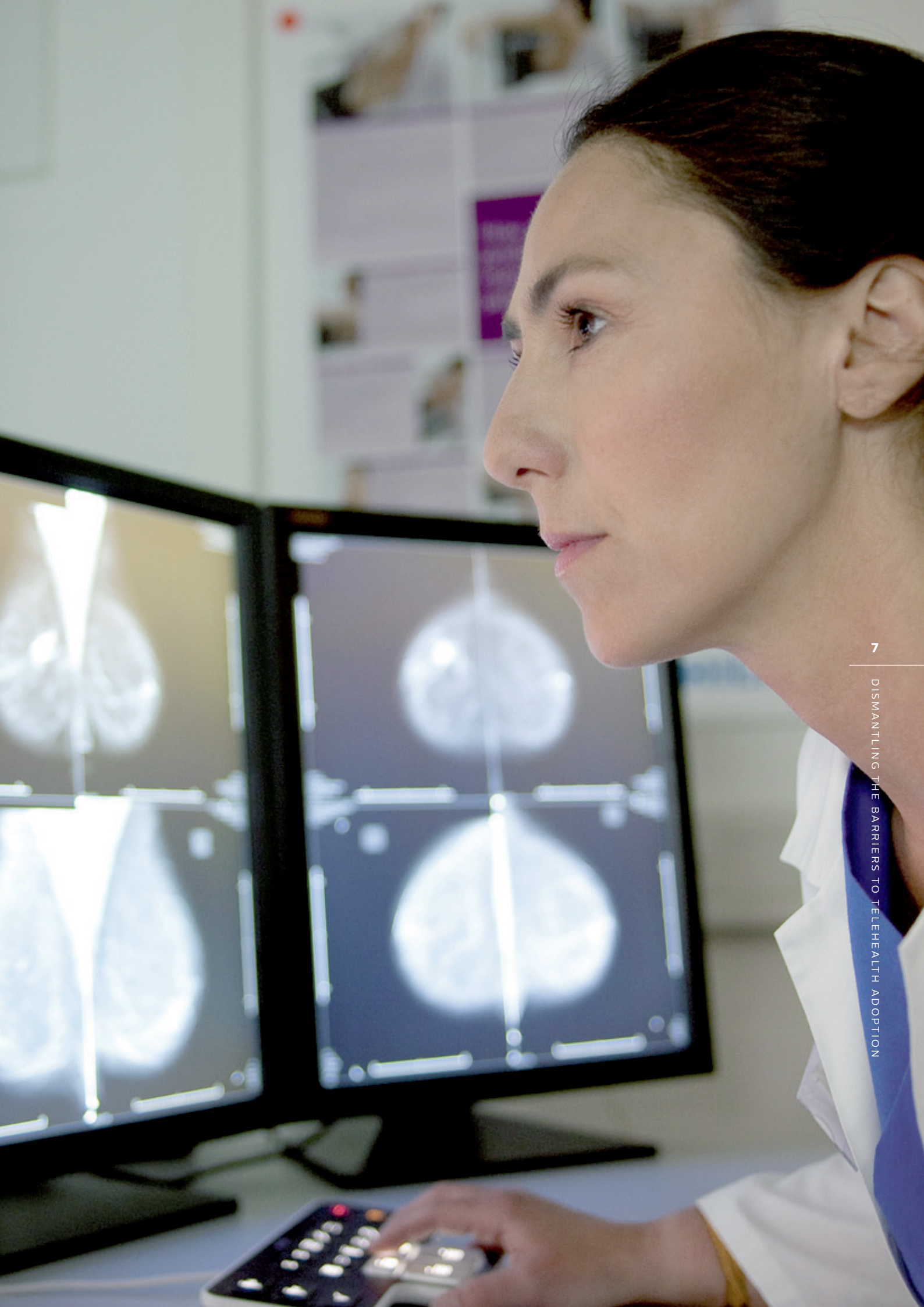
Importantly, reimbursement and payment models have generally been slow to change with the technology. This means the implementation of telehealth can have negative financial consequences in the short term for institutions and healthcare professionals that should count among its champions. "Healthcare is still very much in the paradigm of the 1970s," says Leonard Witkamp, director of the Netherlands' KSYOS Telemedical Center. "It's running 50 years behind."

The 2018 FHI focuses on bridging this gap, examining the major barriers to telehealth and sharing the views of some of the sector's leading voices on how they may be dismantled. With technological advances constantly creating new possibilities in telehealth – and healthcare systems globally beginning to buckle under financial and demographic pressures – there is little time to waste.

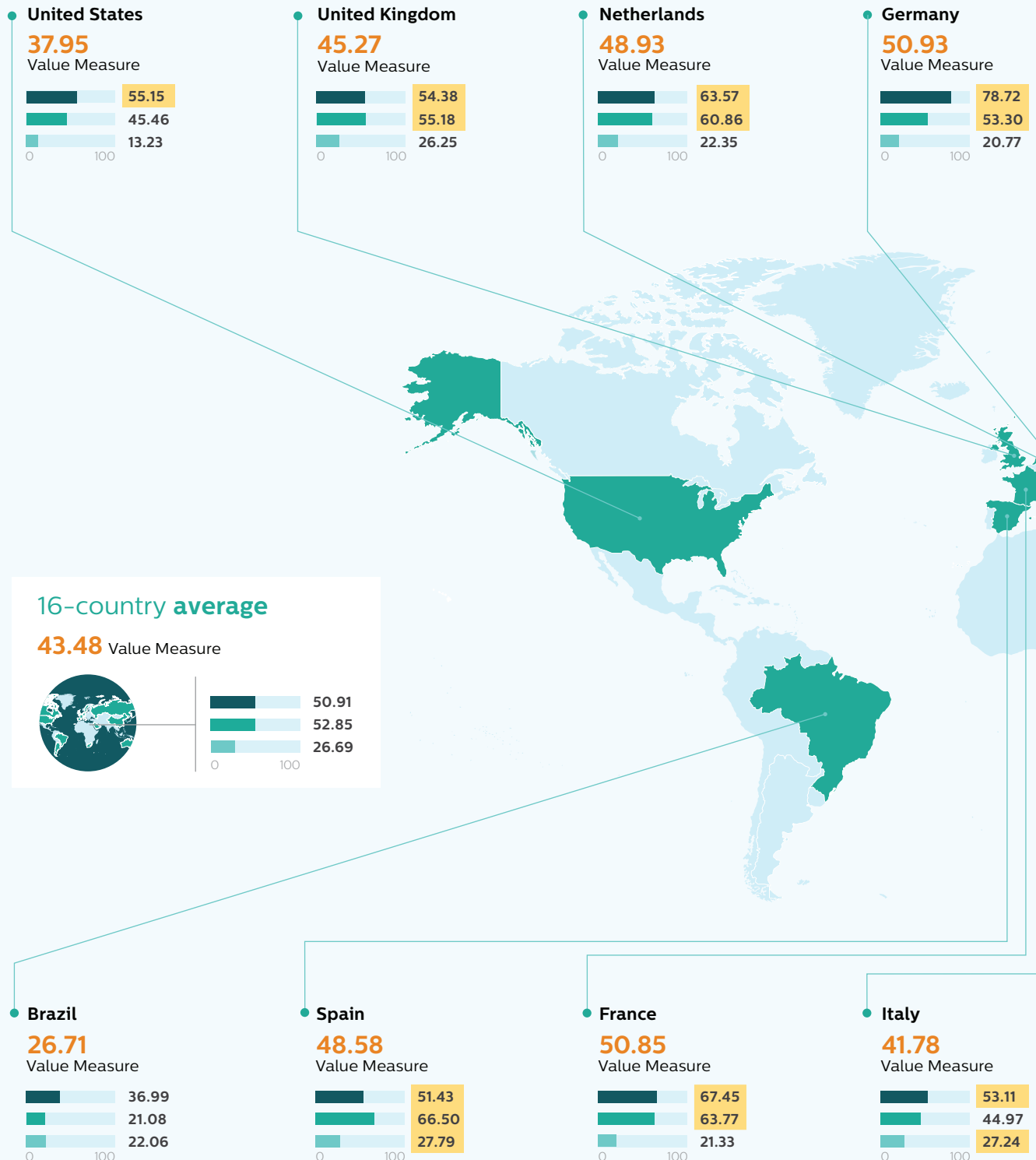**Less than half of radiologists use connected care technologies in their practice**[8]

39%

Radiologists that use connected care
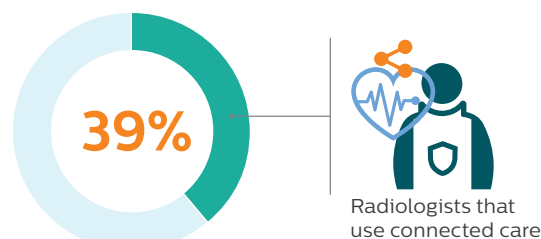
1. Government encouraging use of eHealth. https://www.government.nl/topics/ehealth/government-encouraging-use-of-ehealth 2. Telehealth. (April 7, 2015). http://health.gov.au/internet/main/publishing.nsf/Content/e-health-telehealth 3. TeleHealth: Integrated and Seamless Healthcare Services at Home – See more at: https://www.smartnation.sg/what-is-smart-nation/initiatives/Health/telehealth 4. "Research Methodology and Sources." Future Health Index, 2018, www.futurehealthindex.com/report/2018/chapter/3808/research-methodology-and-sources/?lang=en. 5. Grand View Research. 6. The Future is Here. (2018). https://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/us-lshc-future-of-work-health-care.pdf 7. Telemedicine can lower costs for health systems by $24 a patient, study finds. (September 19, 207). https://www.healthcarefinancenews.com/news/telemedicine-can-lower-costs-health-systems-24-patient-study-finds 8. Future Health Index. (2017) Small base size, findings should only be used directionally. 9. Philips powers first tele-intensive care eICU program in Japan. (July 3, 2018). https://www.philips.com/a-w/about/news/archive/standard/news/press/2018/20180703-philips-powers-first-tele-intensive-care-eicu-program-in-japan.html 10. What can health systems do to encourage physicians to embrace virtual care? (July 18, 2018). https://www2.deloitte.com/insights/us/en/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html#physicians-and-consumers-see-vir 11. Adapting to AI: 4 key takeaways from a survey of attending radiologists, trainees. (February 23, 2018). https://www.radiologybusiness.com/topics/artificial-intelligence/adapting-ai-4-key-takeaways-survey-attending-radiologists-trainees

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 five 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

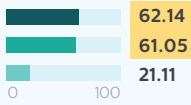|	
	53.11
	44.97
	27.24
0 100	

Measurement

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

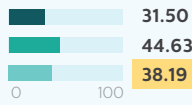- ▢ Above 16-country average

Sweden
48.10
Value Measure

	62.14
	61.05
	21.11

0   100

Russia
40.90
Value Measure

	63.58
	31.75
	27.38

0   100
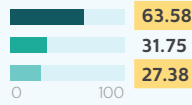
China
38.11
Value Measure

	31.50
	44.63
	38.19

0   100

Singapore
54.61
Value Measure

	45.46
	68.27
	50.11

0   100
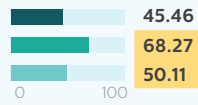
South Africa
26.61
Value Measure

	29.21
	39.53
	11.09

0   100
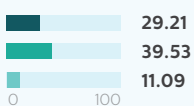
Saudi Arabia
50.17
Value Measure

	43.59
	62.75
	44.17

0   100
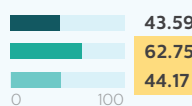
India
33.64
Value Measure

	13.23
	59.67
	28.02

0   100
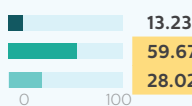
Australia
52.59
Value Measure

	65.05
	66.85
	25.87

0   100
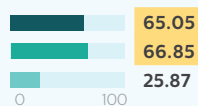
1 Building **reimbursement models** that work

Context

There may be a general understanding in the healthcare industry that telehealth can make care more efficient and less expensive over the long term. But in many cases, before this understanding translates into actual adoption, it runs into difficult financial realities.

As many healthcare reimbursement models were developed long before connected care was even thought of, they may not apply to services delivered remotely, especially across institutional or regional borders. The American College of Radiology Task Force on International Teleradiology, for example, sees significant potential for connected technology to "improve the quality and timeliness of radiology services by providing interpretations when local physicians performing those services are unable to provide immediate coverage." Yet the organization also notes that in the US, federal law prevents Medicare from reimbursing physicians who interpret radiologic studies outside the country.[1]

Issues like these can leave providers that offer telehealth services with a lack of financial incentive to drive use and adoption. This can mean making the difficult choice between losing money or passing on costs to patients — which can also lead to problems with governments and regulators. Addressing the reimbursement challenge is essential to health systems reaping the full benefits of telehealth.

One problem is that legacy reimbursement models typically reward volume

Learnings

Signs of change

Singapore has the highest Value Measure among the 16 countries surveyed for the 2018 FHI, due to its high scores in satisfaction and efficiency.[2] However, the recent proliferation of telehealth services has raised concerns about the way fees are levied and split among patients, healthcare and platform providers.[3]

Reimbursement has therefore emerged as one of the most prominent barriers to wider-scale telehealth adoption – indeed, reimbursement is cited by the World Economic Forum as one of the four enablers that will drive greater value in healthcare.[4] In a 2017 survey of US healthcare organizations by law firm Foley & Lardner, lack of third-party reimbursement was viewed as the top challenge to implementing telehealth practices, cited by 59% of respondents.[5]

As telehealth adoption has gained momentum – and the global teleradiology services market alone is estimated to reach US$21.9 million by 2026, up from US$4.6 million in 2017[6] – there are signs that the tide is beginning to turn. More countries (including Singapore and the US[7]) are seeking to expand telehealth coverage and clarify the rules and procedures around telehealth payment. In the Foley & Lardner study, 76% of respondents said they were reimbursed for some or all telemedicine services – a contrast from 2014 when 41% said they received no reimbursement for a telehealth visit.[8]

The question is how to build on this early momentum and develop reimbursement frameworks that make telehealth a viable path for more healthcare institutions and patients.

Experts interviewed for the 2018 FHI believe a range of new approaches to the issue are needed. As Rafael Bengoa, co-director of the Institute for Health & Strategy in Bilbao, Spain, and a senior leadership fellow at Harvard University, notes: "unless a country has started moving towards a deeper reimbursement model, it's a lot to expect that a technology can become more deeply embedded on the ground."

Recommendations

1

Reimbursement models need to incorporate value, not just volume

One of the main issues is that legacy reimbursement models typically reward volume (e.g. the number of patients served) rather than the value delivered by a healthcare interaction. Value can be more difficult to define and measure, and in some cases this runs directly counter to standard reimbursement methodologies.

A telehealth solution, for example, may reduce hospital costs and ease the burden on a healthcare institution's infrastructure by enabling more patients to monitor conditions or receive consultations at home. However, models that reimburse the institution by number of patients making physical visits would fail to capture this value.

"What this means is we have to explore how we can move volume-based service arrangements to embed them quickly in value-based and integrated reimbursement models," Rafael Bengoa says.

2

Major payers need to take the lead in changing reimbursement frameworks

According to Rafael Bengoa, the impetus for this shift will need to come from each country's major payers. This means change may come more quickly where there are fewer parties involved.

"Sending the right signals to the providers is easier when there are just one or two payers," he says. "And unless top management is sending that signal, why would any provider rally and try to embed [telehealth] technologies? It might be very expensive across institutions where there's no incentive to do so."

Breaking out of old reimbursement models will need to happen "top-down, with some government involvement," agrees Leonard Witkamp, a former clinician and director of the KSYOS TeleMedical Center, the Netherlands' first virtual hospital. "I believe this more and more. Tesla is successful in the Netherlands because of subsidies for electric cars; you can really accelerate this process from the government. [But] we have a liberal government in the Netherlands and they say leave it to the field."

The percentage of healthcare professionals that said they were reimbursed for some or all telemedicine services[8]

100%

59%

76%

0%

2014   2017
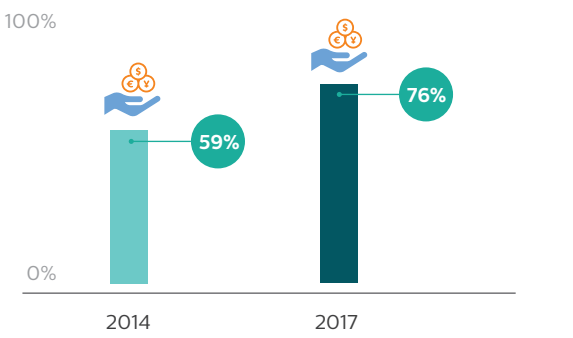
3

Payers and institutions need to develop and test new value indicators

In order for reimbursement frameworks and healthcare systems to be based on value, this value must be tracked and measured. This will require the development of new indicators of value that may differ depending on the country, institution and local context. In the UK, for example, there has been some success with efforts to gauge value by incidences of readmission, which most experts would agree is a more accurate measure of a system's effectiveness than the sheer number of patients treated.[9]

According to Rocco Friebel, a former senior data analyst at the Health Foundation and Assistant Professor of Health Policy at the London School of Economics, reducing readmission rates is one means by which the value of telehealth – in both a hospital and general practice setting – could be more clearly demonstrated.

"The argument is that there are a lot of patients that don't have to be treated at the hospital, and if you could use technology to treat them at home or in the community, you'd save a lot on resources," he says.

Under the policy in England, "the money that wasn't provided for reimbursement of readmissions was reinvested into other parts of the system," he explains. "A large proportion went into re-enablement services. It's all locally-driven. [Institutions] need to make better use of the resources that are currently deployed. Demand is going to rise and funding is not really picking up – so we're relying on productivity gains from existing staff."

1. Report of the ACR Task Force on International Teleradiology. https://www.acr.org/Practice-Management-Quality-Informatics/Legal-Practices/Teleradiology 2. Future Health Index (2017). 3. Telemedicine to be regulated: Health Ministry. (January 26, 2018). https://www.todayonline.com/singapore/medical-watchdogs-urge-caution-doctors-practising-telemedicine-issuing-e-mcs 4. https://www.weforum.org/reports/value-in-healthcare-laying-the-foundation-for-health-system-transformation 5. 2017 telemedicine and Digital Health Survey. (2017). https://www.foley.com/files/uploads/2017-Telemedicine-Survey-Report-11-8-17.pdf 6. Teleradiology Services Market: Global Analysis, Size, Share, Growth, Trends and Forecast, 2018-2016. (2018). https://www.reportlinker.com/p05442916/Teleradiology-Services-Market-Global-Industry-Analysis-Size-Share-Growth-Trends-and-Forecast.html 7. Telehealth, Telemedicine Reimbursement Score Big in New Budget Deal. (February 9, 2018). https://mhealthintelligence.com/news/telehealth-telemedicine-reimbursement-score-big-in-new-budget-deal 8. 2017 telemedicine and Digital Health Survey. (2017). https://www.foley.com/files/uploads/2017-Telemedicine-Survey-Report-11-8-17.pdf 9. What do changes in readmission rates tell us about quality of care in the NHS? (April 27, 2018). https://www.health.org.uk/blog/what-do-changes-readmission-rates-tell-us-about-quality-care-nhs

2 Embedding telehealth in the **care environment**

Context

In addition to traditional reimbursement systems, telehealth implementations must contend with perception barriers among both healthcare professionals and the general population.

There is a mounting body of evidence that telehealth solutions can deliver value by lowering costs and offering high levels of patient satisfaction,[1] or promoting equality of care in remote or underserved areas.[2] But this does not necessarily mean it is embraced by all end-users. According to experts interviewed for the 2018 FHI, the drive for large-scale telehealth deployments will often require engagement with consumers and healthcare professionals on multiple fronts.

Healthcare professionals may require convincing when it comes to telehealth

Learnings

Confidence and misgivings

Recent studies, including data collected for previous editions of the FHI, illustrate the extent of the concerns and the relative lack of knowledge that continue to surround telehealth.

A survey of healthcare professionals for the FHI found connected care technologies such as telehealth gaining a foothold, with 65% of healthcare professionals reporting the use of connected care in some aspect of their practice. Another 63% said they communicated online with peers to discuss patients' care.[3]

Home care was identified by 55% as the area that would benefit most from connected care technology, with significant potential also seen in diagnosis (50%) and treatment (48%).[4] This bodes well for teleradiology, telepathology and tele-intensive care unit adoption.

These findings indicate a clear understanding of how telehealth could be used and applied. Yet just 47% of healthcare professionals claimed to be knowledgeable about connected care technologies.[5] Another study by Deloitte of US physicians showed only 14% had implemented technology to enable virtual visits, and of those who had not, just 18% planned to add it in the next two years.[6] Physicians' concerns about medical errors (36%) and data security (33%) have contributed to this slow adoption.[7]

Some countries suffer from a lack of will to change the status quo. "There's not the slightest financial pressure on the German healthcare system – physicians don't go bankrupt," says Volker Amelung, Professor of International Health Systems Research at the Hannover Medical School in Germany. "There's no pressure, no transparency and a status quo that is a great situation [for many involved]. That's a difficult environment for innovation to flourish."

The picture among the general population is similarly mixed; many people have positive experiences with telehealth yet still prioritize the 'human touch'. A 2018 study by Accenture showed a full three-quarters of those polled had received virtual healthcare services and 54% found the associated reduction in costs a major advantage. However, 64% of respondents listed quality care as an advantage of in-person care, and only 13% cited quality as an advantage of virtual services.[8]

Physicians' concerns have contributed to slow adoption[7]

Proportion of US physicians concerned about telehealth's potential to cause medical errors

36%

Proportion concerned about telehealth's potential to cause data security errors[7]

33%

Recommendations

1

More tracking and dissemination of data is needed to demonstrate the potential of telehealth to healthcare professionals

Experts interviewed for the FHI agreed that while there may be more evidence emerging that telehealth makes a positive impact in a number of ways, this 'truth' is still far from self-evident to many healthcare professionals, who may require more convincing.

"There's insufficient evaluation of how [telehealth] is helping people," says Rafael Bengoa. "Not just in terms of outcomes, but in how it's doing things like avoiding clinical errors. Just seeing the information about what has happened in a hospital, or when someone has been in hospital and has been sent home – all that needs to be evaluated in a much more robust way than it is. We're all assuming that it's good but the evaluation isn't sufficiently robust."

In Leonard Witkamp's experience, healthcare professionals are willing to embrace telehealth solutions, with one caveat – "you need to prove that you're good." In addition, "everyone involved in the telemedicine process needs to benefit – doctors, GPs, paramedics."

The KSYOS Telemedical Center has worked to establish this credibility. "We've been able to prove – and we've published a lot about it – that [in particular medical disciplines] once a GP decides to work with KSYOS, there's a 75% chance that the patient does not need to go physically to the hospital," Witkamp says. "It reduces waiting times from 12 weeks to literally zero – and because we have no waiting lists, everyone is handled within five hours. This way of delivering healthcare is a proven concept."

This kind of data can help make the ability of telehealth to reduce clinical workloads and address spiraling resource shortages clearer to healthcare professionals. Telepathology, for example, may help health systems cope with rising numbers of cancer patients by facilitating remote diagnoses in the many geographical areas that have a shortage of pathologists.

One survey by the Royal College of Pathologists in the UK found only 3% of NHS histopathology departments had sufficient staff, leading to significant delays in diagnoses and treatment.[9] Faster, more accurate diagnoses that help identify cancer in its early stages could also relieve pressure on oncologists, who are in high demand in many markets.[10]

One UK survey found only 3% of NHS histopathology departments had sufficient staff, leading to significant delays in diagnoses and treatment[9]

3%
NHS **histopathology** departments with sufficient staff

2
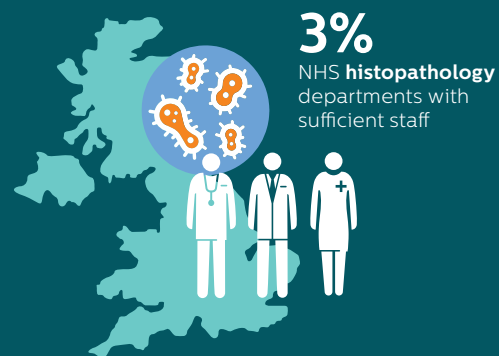
Telehealth fee and billing structures need to be transparent and cost-effective

Healthcare professionals and the general population also worry about telehealth's financial implications. While many studies point to telehealth ultimately reducing costs, these savings may only be realized at the institutional or system level, creating little motivation for adoption by patients or the professionals who treat them. Other research has indicated that telehealth can in some cases create more out-of-pocket costs for patients, who may be more inclined to seek medical advice when they otherwise would not have felt the need to see a doctor.[11]

Telehealth solutions must also be at least cost-neutral to consumers. "I didn't want the patient to pay more than they'd usually pay – for me it was a no-no," explains Franck Baudino, founder of French telehealth company Health for Development (H4D), which specializes in general practice consultations.

"We have a B2B subscription model," Baudino says. "This means it's the same price every month and you can add similar options. The patient pays either via their national or private health insurance."

3

Training and education are needed to encourage telehealth use to reach its full potential

Training is an important but often overlooked element of telehealth deployment. A lack of relevant education can be a major barrier to the adoption and effective use of telehealth by healthcare professionals.[12] Experts have also noted the importance of developing a 'core curriculum' for telehealth that enables clinicians from different disciplines to communicate and collaborate using connected technologies as an integrated team.[13]

In the view of Dave deBronkart, telehealth will only be truly effective when consumers have a clear understanding of what it is and how it applies to their treatment.

"When people don't understand something, they'll think it's less valuable," he says. "Sophisticated patients have come to understand what they need out of the system and what the system should be giving them."

Telehealth demands a more rigorous assessment of patient comfort and knowledge. Tools like the patient activation measure (PAM) are important in fostering engagement.

"You need to help people realize that they can take some action that could be useful," deBronkart says. "Like anything else, when people first start to dabble in something they're a bit clumsy and inexperienced – too often the patient or provider concludes too early that it's a waste. But when you have mentoring and you help someone develop confidence it's much easier, and they can see the use for it."

1. Telemedicine can lower costs for health systems by $24 a patient, study finds. (September 19, 2017). https://www.healthcarefinancenews.com/news/telemedicine-can-lower-costs-health-systems-24-patient-study-finds 2. Telehealth Helps Close Health Care Disparity Gap in Rural Areas. (December 6, 2016). https://news.aamc.org/patient-care/article/telehealth-health-care-disparity-gap/ 3. Future Health Index. (2017). 4. *Ibid*. 5. Future Health Index. (2017). 6. What can health systems do to encourage physicians to embrace virtual care? (July 18, 2018). https://www2.deloitte.com/insights/us/en/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html 7. *Ibid*. 8. 2018 Consumer Survey on Digital Health. (2018). https://www.accenture.com/t20180306T103559Z__w__/us-en/_acnmedia/PDF-71/accenture-health-2018-consumer-survey-digital-health.pdf 9. Pathologists shortage 'delaying cancer diagnosis'. (September 16, 2018). https://www.bbc.com/news/health-45497014 10. Telemedicine and Remote Cancer Care. (September 6, 2018). https://telecomreseller.com/2018/09/06/telemedicine-and-remote-cancer-care/ 11. Telehealth Doctor Visits May Be Handy, But Aren't Cheaper Overall. March 26, 2017). https://www.npr.org/sections/health-shots/2017/03/26/519543337/telehealth-doctor-visits-may-be-handy-but-arent-cheaper-overall 12. Widespread Telemedicine Adoption Blocked by Training, Payment Barriers. https://www.graham-center.org/rgc/press-events/press/all-releases/011516-telemedicine-blocked.html 13. A model for mHealth skills training for clinicians: meeting the future now. (June 15, 2017). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5505927/#__sec10title

3 Convincing institutions **to invest**

Context

Reimbursement models better reflecting advances in telehealth, and interest and acceptance growing among healthcare professionals and institutions are just a start. It is ultimately the budget-holders and payers and healthcare institutions who must be convinced to make the typically substantial initial investments in telehealth.

In many cases these investments are unlikely to produce immediate results. They may even be disruptive to well-established systems and processes. This means the decision to invest and commit to reaping longer-term gains is not an easy or clear-cut one. Better use of data and more disciplined efforts to measure outcomes will be essential to accelerating investments in telehealth technology by payers and healthcare providers – and ultimately advancing value-based care.

There needs to be a certain amount of patience from institutions

Learnings

Limited ROI vision

Many healthcare organizations face serious cost pressures, yet efforts to measure return on telehealth investments are surprisingly sporadic. The Foley & Lardner survey found just 46% of healthcare organizations track telehealth ROI.[1]

This is all the more unfortunate considering those organizations that do assess performance of their telehealth investments typically report positive outcomes that could build the case for future deployments. In the Foley & Lardner study, more than half of the organizations tracking ROI realized annual savings of 10% or more through their telehealth platforms, and 29% reported annual savings of 20% or more.

Returns may also come in non-financial forms, such as the reduction of patient readmission rates,[2] which is increasingly becoming a measure by which organizations are assessed (and penalized). It can also extend an organization's reach by enabling it to treat patients in different countries or regions. Telehealth has also been linked to increased patient satisfaction and loyalty due to factors such as reduced waiting times. One survey of US medical consumers by Software Advice found that 77% were more likely to choose a doctor who offered telemedicine over one who did not.[3]

The measurement of telehealth's impact on healthcare professional satisfaction has much room for growth. Technologies that are being implemented in the tele-intensive care unit space allow daytime clinicians in Australia, for example, to provide critical night-time support to patients in the US.[4] This has the potential to reduce the burden of night shift work that has traditionally dominated the lives of healthcare professionals. Measuring the impact of that change on satisfaction and motivation levels could be important in providing institutions with an evidence base for the success of telehealth.

Recommendations

1

Data needs to be more integrated – and available – to support telehealth investment

Research and anecdotal evidence shows that data is not consistently being collected, presented to or absorbed by healthcare organizations. This is why Rachel Binks, consultant nurse for acute care at Airedale Foundation Trust in the UK and clinical lead for the Immedicare telehealth initiative for care homes, still sees data integration as vital in building support for telehealth among payers and providers. However, this can't just be data on telehealth systems themselves – it must include the institutions they are designed to change.

"In the NHS we're really bad at collecting data," Rachel Binks explains. "[Immedicare] asks for data on baseline visits of indicators such as GP or district nurse visits to care homes, or admissions to hospital from care homes. Commissioners and GP practices don't routinely collect this data, so we don't have a baseline and can't show the difference we've made. When we win a contract it's because they can see anecdotally what we can do, but what they can't then tell us is how well it's worked and whether it's saved them money."

2

Institutions need to view telehealth investments with a long-term mindset – and take leaps of faith

Because it may take time for the real value of a telehealth implementation to become apparent, payers and providers will likely have to leap before they look – at least to some degree – and approach the drive for ROI with a certain amount of patience. Experts say, however, that a willingness to do this is still relatively uncommon, particularly in countries where a small number of powerful payers see little need to overhaul the status quo.

According to Leonard Witkamp, health insurance companies and health institutions don't have the mindset to invest in the future in the same way as a 'regular' business. "They say we can only pay for innovative costs if it's been proven that costs for 'old' care have been reduced," he says. "Whereas in a normal business you would accept having double the costs for a time if you know that you will have a reduction of cost in the long term. That long-term thinking is not yet there in government and in insurance agencies."

3

Starting small and scaling up can encourage further investment – but needs to be approached carefully

If uncertainties leave payers reluctant to make large investments in telehealth solutions, one possible answer is funding limited test implementations or trial runs to convince them.

Experts like Leonard Witkamp acknowledge the role these experiments can play, yet warn against seeing them as sure thing. "[KSYOS] is a scale-up company, and when you're still a startup, you need to prove your concept," he says. "But I'm always amazed that even with all the proof that we have, it's difficult to scale up."

According to Rafael Bengoa, it is critical that even small telehealth deployments – on both the clinician-to-clinician and clinician-to-patient side – keep the bigger picture in mind. "Bottom-up pilot projects need to incorporate what they'll do to scale up from the start," he says. "Otherwise a lot of money is lost and there's a lot of frustration. The innovation can happen from the bottom, but it does need more in the way of facilitation from the top."

1. 2017 Telemedicine and Digital Health Survey. (2017). https://www.foley.com/files/uploads/2017-Telemedicine-Survey-Report-11-8-17.pdf
2. Scaling Telehealth Programs: Lessons from Early Adopters. (January 2013). https://www.integration.samhsa.gov/operations-administration/Telehealth_Commonwealth_fund_Report_1654_Broderick_telehealth_adoption_synthesis.pdf 3. Should You Offer Telemedicine Services? Patients Weigh In. https://www.softwareadvice.com/resources/should-you-offer-telemedicine-services/ 4. Philips, Emory Healthcare and Royal Perth Hospital in Australia partner to launch new remote intensive care monitoring program. (May 11,2018). https://www.philips.com/a-w/about/news/archive/standard/news/press/2018/20180511-philips-emory-healthcare-and-royal-perth-hospital-in-australia-partner-to-launch-new-remote-intensive-care-monitoring-program.html

4 Making regulation a **telehealth enabler**

Context

Access to healthcare services is one of the main ways in which the value of a healthcare system is defined — and also an area where telehealth shows incredible promise to drive change. A survey for the FHI found that among healthcare professionals in 13 countries, 38% felt making sure people were able to access healthcare services when needed should be a top priority for the national government.[1]

Many governments are turning to telehealth to help achieve this goal. In 2012, Western Australia launched an Emergency Telehealth Service (ETS) to extend emergency care to nursing posts and small hospitals in 78 remote and rural locations. It has since addressed more than 58,000 cases.[2] In the US, the CHRONIC Care Act, passed in 2018, seeks to extend home care to patients with chronic illnesses, expand telehealth coverage to rural areas and provide greater reimbursement for telehealth services.[3] The Saudi ministry of health launched an app, Seha, to provide visual medical consultations in 2018 as part of its wide-ranging 2020 National Transformation Program.[4]

Countries where progress has historically been slower are starting to liberalize their laws. Russia, for example, passed legislation in early 2018 that made clinician-to-clinician and clinician-to-patient telehealth legal for the first time.[5]

Regulations can help provide some all-important clarity

Learnings

Frameworks in progress

Despite the success of these efforts, in many cases the regulatory infrastructure needed to support telehealth is not fully in place. According to the World Health Organization, only 22% of countries have national telehealth strategies.[6]

For patient records and information to be transmitted and shared seamlessly and in confidence, there must be clearly defined rules governing the collection, protection and sharing of data. Yet of the countries covered in the 2018 FHI, only 31% have instituted regulations across all three areas.[7]

It is easier in some countries than others for telehealth organizations to successfully implement their products. The benefits that the mass adoption of telehealth could bring to a country like China are clear. But US telehealth companies typically encounter regulatory and investment barriers when trying to enter the space.

In many senses, telehealth initiatives start from a strong position, as the healthcare sector enjoys relatively high levels of trust and many people understand they stand to benefit by sharing their health data. The FHI found 44% of the general population trust the healthcare industry with their personal data, versus 35% for banks and 20% for insurers.[8] Similarly, a Pew Research survey found that although about one in four US healthcare consumers has experienced some kind of breach of their healthcare data, over 52% still find sharing that data acceptable.[9] This openness extends to healthcare professionals. In the FHI, 75% said they were willing to share patient information with other healthcare professionals, and 68% reported often or always doing so.[10]

Recommendations

1

Policymakers need to ensure data regulations protect the public, without being overly restrictive or punitive

Data-sharing regulations are developing rapidly. The European Union's General Data Protection Regulation (GDPR), for example, requires certain conditions to be met before data can be collected by a healthcare organization. The data owner's explicit consent must be obtained and the data has to be necessary to the "vital interests" of a patient or provider.[11]

For telehealth to flourish, emerging regulations will need to provide clarity for institutions, healthcare professionals and the general population. Policymakers must strike a balance between security and the free exchange of vital information among patients and healthcare professionals, and different healthcare institutions. As Rafael Bengoa says, policymakers "can tend to micromanage and create conditions that aren't so constructive for innovation and integration."

Based on Rocco Friebel's research into penalties tied to readmission rates in England, any sanctions for healthcare professionals or organizations that break data regulations will also have to find a middle ground. "When the penalties are too low, they don't cause any change," he says. "But when they're too high, they can actually lead to a negative impact – it might be that hospitals have to take money away from other services. So it's quite a fine balance for policymakers to set the right levels of penalties to instigate positive change."

2

The regulatory agenda should promote interoperability of telehealth solutions

The movement of patient records and information between institutions will inevitably be limited if these are not based on standard formats or protocols that allow them to be used and interpreted by different systems. Looking at the teleradiology space, a study published by the US National Center for Biotechnology Information (NCBI) found that sharing images from patients among radiologists was difficult if they were subject to different domains or workflows. In some cases metadata was lost when images were converted from one format to another.[12]

Interoperability is also crucial to encouraging the general population to use telehealth solutions in general practice, according to Rafael Bengoa, as people will only see these solutions as effective if it makes their health data truly portable.

"The learning from the Spanish model – where all the [regional] systems are using different health records – is that interoperability issues emerged when people wanted to see the information when they went from one part of Spain to another," he says. "But the agenda of how to make all that come together is both politically and technically on the table."

3

Policy must incorporate patient as well as professional and institutional views

Experts believe embedding patient 'co-creation' in the development of policy and dissemination of connected care technology is key to encouraging adoption and engagement.

Co-creation is "something that needs to be driven hard," says Simon Spurr, co-founder of HealthCloud, a South Africa-based digital health group. "Legislative change is coming in this area. There are two approaches we've seen – one, where a technologist comes in and builds solutions for a gap in the market. Then there's a growing wave of healthcare professionals that want to build platforms and digital tools where they need solutions. Not a lot has been driven from the patient side in South Africa and that has to come if [telehealth] is going to be driven forward. Consumers want freedom of choice. So [development] has to be a hybrid and we need to be driven more by patient use."

"[Co-creation] is happening in areas where people are keen to bring the patient voice into whatever clinical activity they're doing," Rafael Bengoa says. "We're beginning to understand how to measure that, and it's beginning to filter into hospitals and primary care centers. But is it a policy intervention, or is it a nice thing to do? At the moment it's the latter, and it should be the former. You need policymakers that think the voice of a patient is a key variable."

1. Future Health Index. (2016). 2. WA's Emergency Telehealth Service: global leader in virtual emergency care. http://www.wacountry.health.wa.gov.au/index.php?id=ets 3. S.870 – Creating High-Quality Results and Outcomes Necessary to Improve Chronic (CHRONIC) Care Act of 201. (2017-2018). https://www.congress.gov/bill/115th-congress/senate-bill/870 4. https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/news-2018-03-06-006.aspx 5. http://www.ewdn.com/2018/02/09/telemedicine-becomes-legal-attracts-more-investment-in-russia/ 6. World Health Organization. (2016). Global diffusion of eHealth: making universal health coverage achievable 7. "Research Methodology and Sources." Future Health Index, 2018, www.futurehealthindex.com/report/2018/chapter/3808/research-methodology-and-sources/?lang=en 8. Future Health Index. (2017). 9. Scenario: Health information, convenience and security. (January 14, 2016). http://www.pewinternet.org/2016/01/14/scenario-health-information-convenience-and-security 10. Future Health Index. (2016). 11. Europe's GDPR privacy law is coming: Here's what US health orgs need to know. (March 21, 2018). https://www.healthcareitnews.com/news/europes-gdpr-privacy-law-coming-heres-what-us-health-orgs-need-know 12. Towards Social Radiology as an Information Infrastructure: Reconciling the Local With the Global. (Oct 3, 2014). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4288079/

5 Designing infrastructure for more **equitable healthcare distribution**

Context

With many focused on the policy, cultural and financial changes needed to drive adoption of telehealth, it is important not to lose sight of a more fundamental factor — infrastructure. At a minimum, telehealth requires broadband internet to support the exchange of audio and video.[1] More sophisticated solutions — such as AI models that analyze medical images — involve advanced systems capable of supporting on-demand access to massive volumes of data.[2]

In a world where some 3.9 billion people still lack internet access,[3] even the most basic infrastructure can't be taken for granted in many countries — especially in the remote or rural areas that could benefit from telehealth the most. Building out the infrastructure backbone for telehealth will be critical to its wider adoption and success, particularly in the developing world.

Public-private partnerships have begun to make considerable progress

Learnings

A pressing need

Those countries in the FHI with the highest rural populations – India (66%), China (42%) and South Africa (34%)[4] – also rank below the average in terms of technology infrastructure. Just 54% of South Africans are connected to the internet, while in India, the internet penetration rate stands at 30%.

China enjoys relatively robust mobile networks, but a mere 0.02 secure internet servers per capita, versus 2.91 in the Netherlands and 1.78 in Sweden, the two highest-ranked countries in this regard.[5]

According to one academic study, about 80% of chronic disease deaths occur in low- and middle-income countries, which are also projected to be home to the bulk of global cancer cases over the next 20 years.[6] Yet according to the Journal of Global Oncology there is fewer than one pathologist for every 500,000 people in sub-Saharan Africa, compared to one per 15,000 to 20,000 people in the US and the UK.[7] Telehealth networks can rectify this shortfall by enabling healthcare professionals that may lack the requisite capabilities to obtain reliable and comprehensive diagnoses remotely from qualified pathologists or lab professionals.

The inequitable distribution of infrastructure – and hence healthcare resources – is not exclusively a problem for low-income countries. The Federal Communications Commission (FCC) estimates that 53% of rural Americans lack access to high-speed broadband.[8] According to the FHI, 77% of the German population and even more healthcare professionals (82%) see a significant difference in access to healthcare depending on area, with care generally perceived as better in big cities than the countryside or suburbs.[9]

It is in lower-income countries, therefore, that solutions such as telepathology can accelerate and enhance cancer diagnoses and treatment through offering broadened access to specialists and clinical trials. The technology could pave the way for the pooling of information and resources among clinicians across the world.
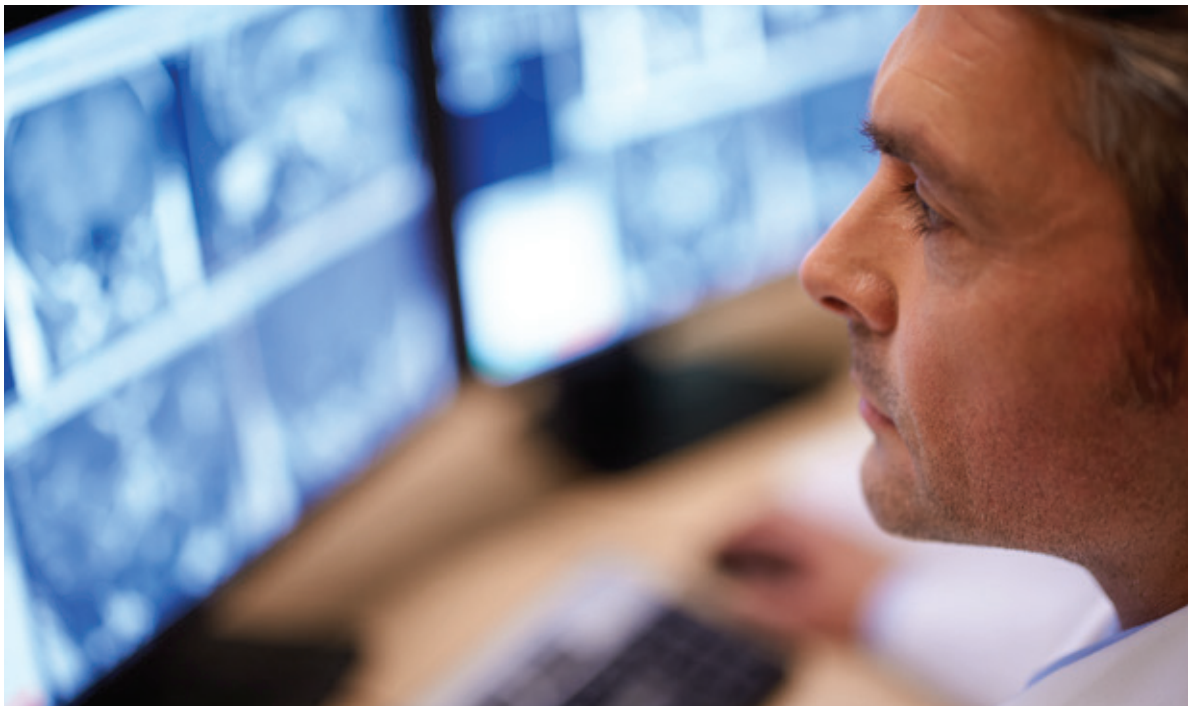
Recommendations

1

Telehealth infrastructure should serve access before advancement

In the race to update the infrastructure supporting more connected health systems, some experts believe that countries and institutions can lose sight of the ultimate goal of enhancing access to care. Instead, they can find themselves prioritizing the adoption of cutting-edge infrastructure or technology that may not be the best fit for the local context. The most advanced servers or telepathology solutions, for example, will generate few positive outcomes if there is no reliable data to work with, or network of diagnostic expertise to connect to.

Often lower-income countries "have not yet finished the access agenda," says Rafael Bengoa. "That means when you start talking about electronic health records (EHRs) or telehealth, you fall into a conversation that will only be for 10% of the population. Some poorer countries are not investing the minimum that you need to invest in healthcare. Others tend to invest quite a lot in technology, but may not be doing so in the right way. The investment may be wasteful, or not extendable nationally when they're thinking about scaling it up."

2

Infrastructure must adapt to the local environment

The nature of the infrastructure itself can and should take different forms. Broadband, for example, doesn't have to mean a fixed-line service in countries where those networks are lacking. "Today even in emerging countries you can communicate by satellite if needed," says Franck Baudino of H4D. "So we can use our technology almost everywhere."

Emerging countries are starting with a 'cleaner slate'. In many respects, they have more choice in terms of what can be deployed than developed markets that have a large amount of legacy infrastructure to contend with.

"We live in an interesting space," says Simon Spurr. "[South Africa] is very much a mobile-first environment. Even the lowest-skilled workers are comfortable with mobile technology."

Christoph Wald, chairman of the Department of Radiology at Lahey Hospital & Medical Center and professor of radiology at Tufts University Medical School in the US, points to a program in Uganda to equip ambulance technicians with hand-held CT scanners. These devices allow healthcare professionals to communicate with hospitals to choose the right course of action and lay the groundwork for treatment on the road, prior to the patient entering the institution.

The success of the initiative is based on recognition of local realities, including the rapid proliferation of hand-held devices in remote communities. The scanners have also been designed for low-bandwidth use and can be powered by batteries or generators, important in places where electricity supply can be sporadic.

"It's a prime example of leveraging equipment redesign, digitization and communications infrastructure," Wald says. "The disruption is where the technology is and not the CT scanner [itself]. It's about understanding the use case."

3

Efforts to build out infrastructure should collaborate with the private sector

While infrastructure in many markets is primarily a government responsibility, private companies have been a driving force in areas including the proliferation of mobile networks. Governments and healthcare institutions should not hesitate to build on the foundations they have laid, or involve private firms in plans to extend telehealth, experts say. Public-private partnerships to roll out infrastructure have made progress in countries such as India, where the government is extending broadband to rural areas by providing funding and network bandwidth to private telecom operators at preferential rates.[10]

In South Africa "there's a big drive from the mobile network operators to create network ubiquity," Spurr says. "Medical and technology companies are also looking to develop their own solutions, either working from the connectivity the mobile operators have or creating their own. What I see as a very interesting space right now is to build connectivity for devices, partnering with networks so that a data-driven model can be run off dedicated infrastructure."

1. What are the technical infrastructure requirements of telehealth? (September 11, 2014). https://www.healthit.gov/faq/what-are-technical-infrastructure-requirements-telehealth 2. Medical Imaging is Healthcare's Artificial Intelligence Bellwether. (March 29, 2018). https://healthitanalytics.com/news/medical-imaging-is-healthcares-artificial-intelligence-bellwether 3. United Nations Publishes Global Broadband Progress Report for 2017. (September 14, 2017). https://www.ispreview.co.uk/index.php/2017/09/united-nations-publishes-global-broadband-progress-report-2017.html 4. Rural population (% of total population). (2018). https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS 5. "Research Methodology and Sources." Future Health Index, 2018. www.futurehealthindex.com/report/2018/chapter/3808/research-methodology-and-sources/?lang=en 6. Teleoncology: Current and future applications for improving cancer care globally. (August 18, 2011). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3157842/ 7. Providing Pathology Support in Low-Income Countries. (October 1, 2015). http://ascopubs.org/doi/full/10.1200/JGO.2015.000943 8. "Federal Communications Commission." Federal Communications Commission, www.fcc.gov/ 9. Future Health Index. (2016). 10. Govt starts BharatNet Phase 2, aims 100% connectivity by 2020. (November 13, 2017). https://timesofindia.indiatimes.com/india/govt-starts-bharatnet-phase-2-aims-100-connectivity-by-2020/articleshow/61633671.cms

A work in **progress**

In assessing the state of telehealth, this report has shown that there are grounds for cautious optimism. The technological and legal infrastructure that supports telehealth solutions is proliferating worldwide. From US-based Emory Healthcare and the Royal Perth Hospital's international tele-intensive care unit project to India's National Cancer Grid, the number of high-profile (and highly successful) telehealth initiatives is constantly growing. These initiatives are also producing measurable results, building buy-in and momentum for future implementations.

Growing numbers of healthcare professionals are incorporating telehealth into their workflows, and an ever-more-connected general population is increasingly more prepared to embrace technology in healthcare. Above all, telehealth represents the first clear path to addressing the growing imbalance between rising demand and shrinking healthcare resources. It can extend high-quality care and in-depth expertise to populations and places where access to both were once unimaginable.

But this report is also clear that this path will not be straightforward. The healthcare systems that telehealth is designed to improve may lack the financial frameworks or human resources needed to put it to effective use. Perceptions still exist of telehealth being largely a tool for wealthy countries or institutions, or a threat to traditional jobs and professional-patient relationships.

There is a significant risk that a few bold and prosperous countries and institutions will seize on the benefits of telehealth while the remainder are largely left behind. Taking the following steps will help ensure telehealth overcomes these challenges, and promote the efficiency and equality of care that it promises:

- **Build the financial case for telehealth implementations.** Telehealth solutions not only represent a substantial initial investment, they can be expensive to run and maintain. In some cases – such as when reimbursements are tied to the number of patients physically visiting a healthcare professional or institution – they may even have negative impacts on income. Would-be adopters need to recognize that many of the primary concerns surrounding telehealth are financial. These can be addressed by updating reimbursement models to connect them to the positive outcomes and value telehealth solutions can deliver, and collecting data on financial or performance improvements to justify telehealth spending.

- **Ensure telehealth implementations go beyond the technical.** Simply investing in and rolling out a telehealth solution – even one with a clear use case that's been proven in other environments – will not necessarily result in its acceptance or optimal use. Implementations should also factor in training and education for the end-users to ensure these technologies are understood and successfully integrated into everyday practice.

Healthcare professionals need to see exactly how telehealth will make a process more efficient or error-free, and patients must understand how it will contribute to a more convenient or cost-effective experience. Engaging healthcare professionals and the general population in the creation of telehealth solutions and policy can encourage broader adoption and ensure that telehealth is built to fit their needs.

· **Develop a common language.** In areas where telehealth already has an established track record, evidence is beginning to suggest that the proliferation of different solutions and data formats has made it difficult for clinicians to share patient information. This could even have contributed to data loss. Even the most cutting-edge solution or infrastructure will not promote the exchange of information if that information is not understood or designed for use by all parties involved. Standardization of data formats, at least at the level of individual specialties/practice areas, will be needed to realize the network effects that telehealth promises by seamlessly connecting experts in multiple physical locations.

· **Base telehealth on recognition of differences.** More standardization may be needed in areas like data formats, but telehealth will not look the same everywhere. Telehealth infrastructure and solutions should be tailored to the local environment. Developers must take into account limitations and seize on opportunities where they exist, such as the 'mobile-first' mindset that persists in much of the developing world. This means the most advanced or expensive solution will not always be the best, and that technology proven to deliver results in one market may need to be modified heavily for appropriate use in another.

As with other aspects of connected care, success in telehealth will ultimately be based on the involvement of multiple actors — healthcare professionals, the general population, payers, regulators and the private sector — and the recognition that, no matter the level of technology involved, healthcare is at heart a human endeavor.

Telehealth is also in many ways a moving target that will need to be constantly reassessed. With this in mind, it is vital that we do not let adherence to traditional ways of industry thinking hold us back from enabling change. With areas like artificial intelligence advancing and changing the picture so quickly, it is critical not to lose sight of these realities and the end goal of delivering increased value in healthcare systems anywhere in the world.

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 of healthcare to produce a 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 care 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 care 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.

Sixteen 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 care. 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 care 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 34). 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.

The 45 individual metrics analyzed use a combination of third-party data and original research collected via a survey conducted in 2017 and 2018 in partnership with a global market research firm (see survey details overleaf).

Research framework:
summary of metrics

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

Value Measure			Current state index: data	
Average of access, satisfaction and efficiency sub-indices			Average of data collection and data analytics sub-indices	
Access	**Satisfaction**	**Efficiency**	**Data collection**	**Data analytics**

Sub-indices

Summary of sub-index components

| Access	Satisfaction	Efficiency	Data collection	Data analytics
• 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)	• Trust in healthcare system (HCPs and general population) • Healthcare system meets needs (HCPs and general population) • Rating of healthcare system overall (HCPs)	• 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	• **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	• **AI**: Market size by use in AI in diagnosis, therapy planning

Current state index: care delivery

Average of telehealth and diagnosis & treatment solutions sub-indices

Telehealth

Diagnostic & treatment solutions
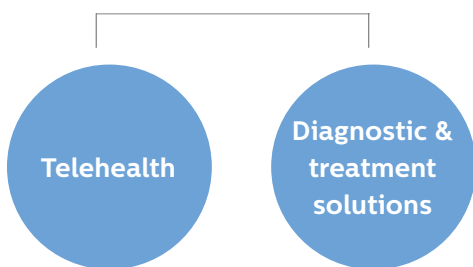
Discussion point: infrastructure

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

Technology infrastructure

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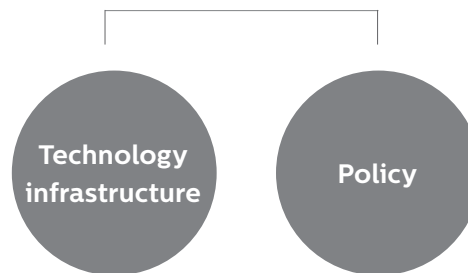
- **Telehealth**: Number of users of pay-to-use apps for connected medical devices, market size telemedicine, market size remote monitoring devices market by home use and ambulatory use

- **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

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 (see survey details below). Additionally, data from chapter one of FHI 2018 was also referenced. A full list of third-party sources is available at https://www. futurehealthindex.com/report/2018/chapter/3808/ research-methodology-and-sources/?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, Professor of International Health Systems Research at Hannover Medical School
- 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

For the third 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. Please see below for a full list of third-party sources and further details on the survey methodology.

Furthermore, nine key opinion leaders (KOLs) across the Netherlands, US, Spain, France, South Africa, UK and Germany were interviewed to examine the major barriers to telehealth and provide recommendations 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, such as telehealth and the general healthcare landscape, and were conducted from March 2018 to September 2018 via telephone or video-chat service (e.g. Skype, etc.).

A list of KOLs interviewed is included below:

- Volker Amelung, Professor of International Health Systems Research at Hannover Medical School
- Franck Baudino, CEO and founder of French telehealth company H4D
- Rafael Bengoa, co-director of the Institute for Health & Strategy in Bilbao, Spain, and a senior leadership fellow at Harvard University
- Rachel Binks, consultant nurse for digital and acute care at Airedale Foundation Trust in the UK and clinical lead for the Immedicare telehealth initiative for care homes
- Dave deBronkart, a former cancer patient and noted advocate of connected care known as 'e-patient Dave'
- Rocco Friebel, a former senior analyst at the Health Foundation and Assistant Professor of Health Policy at the London School of Economics
- Simon Spurr, co-founder of HealthCloud, a South Africa-based digital health group
- Christoph Wald, chairman of the Department of Radiology at Lahey Hospital & Medical Center and professor of radiology at Tufts University Medical School in the US
- Leonard Witkamp, director of the KSYOS Telemedical Center in the Netherlands

Survey methodology

2017 data

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. Survey data for India was collected during February 16 to March 26, 2018 in a manner consistent with the other countries in 2017. 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.

The total sample from the survey includes:

1. 3,254 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)

2. 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.

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

2016 data

The survey data was collected February 24, 2016 to April 8, 2016 in 13 countries (Australia, Brazil, China, France, Germany, Japan, the Netherlands, Singapore, South Africa, Sweden, UAE, 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.

1. 2,659 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)

2. 25,355 adult patients (defined as those 18–years–old or older who have visited with a healthcare professional in the last three months)

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