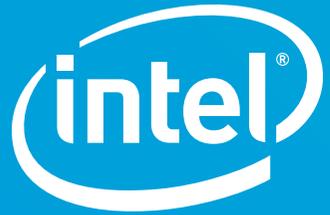


vmware®

The Future of  
Healthcare



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A photograph of a doctor in a white coat using a stethoscope to examine a young child. A woman is standing behind the child, looking on. The scene is set in a bright, clinical environment. A large, semi-transparent purple and blue graphic overlay is positioned on the left side of the image, containing the text '1. Foreword'.

# 1. Foreword

Due to the rise of the number of patients with several chronic conditions; the globally rising shortage of 5 million healthcare workers; and the financial discrepancies of care, healthcare has been facing unprecedented challenges that require new solutions. The revolution in advanced technologies, the widespread access to them as well as information further deepened these challenges in the 21st century.

The major consequence of these is the ivory tower of medicine breaking down. Information, knowledge, studies and technologies had only been accessible within the ivory tower, only medical professionals were granted access. However, with the expansion of the internet and information technologies, patients started to get access too.

When personal computers became widely available in the 1990s, e-health emerged. When such computers could be connected to networks, telemedical services appeared. The rise of social media networks made room for medicine 2.0 and health 2.0; while the advent of mobile phones and later smartphones summoned mobile health. But in the 2010s, the rate at which disruptive technologies appear is becoming overwhelming for both patients and their caregivers.

This cultural transformation that changes the essence of the doctor-patient relationship and the basics of healthcare is called digital health. It is defined as “the cultural transformation of how disruptive technologies that provide digital and objective data accessible to both caregivers and patients leads to an equal-level doctor-patient relationship with shared decision-making and the democratization of care.”

It might seem that new technologies drive this transformation, but in fact, it's patient empowerment. Technologies and the access to them made patients proactive and they wish to have an equal-level partnership instead of a hierarchical dependence on their physicians. They want to take part in the decisions that affect their health or medical condition; and contribute to that with data they measure at home.

The point-of-care has been shifting from facilities to wherever the patient is. The biggest promise of digital health is that if patients become the point-of-care, diagnostics and treatments can be offered from a distance; patients could be involved in their care to release the burden on medical professionals; waiting times and costs could be reduced while in general, improving patient satisfaction and the main features of a care of good quality: personalized, accessible, affordable, preventive and humanistic.

However, when discussing the future of technologies in healthcare, it makes sense to have a clear distinction between issues regarding IT and digital health as the two are often intertwined while their nature and the solution they require are different on many scales.



Here is an example of an IT issue: anti-virus software started running on a computer that monitored a patient who was undergoing heart surgery and thus the equipment failed during the operation. An investigation by the Food and Drug Administration found that anti-malware software was responsible for the failure of the equipment. This problem can be instantly resolved by turning off the scanning function of the software.

Digital health issues are different in nature. Patients bring data they measure with sensors for their health or medical condition to their medical professional and expect their caregivers to address technological questions in addition to medical questions. Implementing such data into medical records require a lot of stakeholders and many high-level changes in the system. It involves the whole medical team.

Besides being able to make this distinction, healthcare leaders today face at least four major challenges.

1) They have to implement new technologies properly as healthcare must be as efficient and cost-effective as possible to care for patients and there is not much time to do that as patients reach out to technological solutions if they exist without the help of a third party which is simply unprecedented.

2) They also have to comply with a myriad of regulations and as healthcare becomes a global system, complying with all the rules will be even more complex in the near future. The era of digital health brings in the era of losing privacy as the more data healthcare uses to provide me with the best possible care, the higher my risk becomes for losing parts of my privacy.

3) Leaders must deal with a new stakeholder in healthcare: the proactive patient. The e-patient who has new needs, manages their own data and bring that along with many targeted questions to the doctor-patient visit. This poses a new level of security threats to every healthcare organization. It's not enough anymore to build strong and safe health IT systems in healthcare facilities when patients become the facility themselves.

4) Advanced technologies become available so fast that it's practically impossible to have a clear understand of all the trends and directions. The guide that can help make sense of all the changes lies in the fundamental basics of practicing medicine: using technologies that allow patients and medical professionals to spend quality time together with attention and empathy.

I hope that this report will help healthcare leaders orientate themselves in this new era of digital health technologies. I am confident in the impact these technologies will have in supporting the journey towards more effective and personalised healthcare for all.



**Dr. Bertalan Meskó**  
**Director of The Medical Futurist Institute**

A group of healthcare professionals are gathered around a table in a meeting. A woman in a white lab coat and glasses is looking at a tablet computer. Other people are visible in the background, some gesturing with their hands. The scene is set in a modern, brightly lit environment with geometric wall panels in shades of orange and red.

**2.** The traditional approach to IT security needs a rethink – not just a plaster over the wound

With a range of digital initiatives taking place, from intelligent devices and monitors to telemedicine, there's a new landscape opening in healthcare, providing physicians, caregivers and more importantly patient real-time access to data, as well as connecting patients directly to clinicians and organisations.

Traditional IT security strategies are no longer fit for purpose against a background of increasing infrastructural complexity, and a threat landscape that is becoming exponentially more challenging year-on-year. In the absence of an obvious alternative security model, organisations are continuing to invest a greater proportion of their IT/Security budgets in existing security solutions in a largely futile attempt to address the problem. This is resulting in most organisations experiencing a very significant loss of confidence in their ability to address modern cyber threats.

At the same time, new data-sharing schemes are continually being proposed and introduced within the healthcare sector - designed to improve and extend the services offered by the healthcare provider, satisfying demand for a 24/7 service and providing a more joined-up approach to healthcare that brings greater benefits to patients and providers.

Lastly, patients are bringing their data, apps and sensors to the practices and expect caregivers to manage them. It's opening up the game, but also bring with it different challenges, meaning wherever data goes, threats follow.

Whether it's personal data on people or information on ground-breaking research, data is an incredibly important asset in helping to deliver patient care. Yet healthcare organisations across Europe all have the same challenge - criminals have been quick to realise this and are willing to halt services to gain money or aim to sell the data themselves. After all, medical information can be worth ten times more than credit card numbers on the deep web.

While all the innovations and technology developments taking place in healthcare would claim to put the patient at the centre of the initiative, they will only ever come to fruition, and be accepted by patients, if the highest level of IT security and privacy can be guaranteed - and if the patient remains beyond doubt about that their data remains secure - at all times.

**“The healthcare industry is like no other - once patient data is put into the wrong hands, the effect is devastating.” - Carsten Kramschneider, Healthcare Manager, VMware Germany**

Beyond the reputational damage that a data breach can have on a healthcare organisation, the ability to deliver accurate data and diagnosis can be a matter of life and death. Inaccurate or inaccessible data can change patient lives.

As a consequence, healthcare organisations cannot afford to have their systems compromised for any length of time. With so much at stake what can healthcare IT teams do to immunise their environment against these attacks and still keep the complexity of defence at a certain level and still deploy the types of services that patients and healthcare organisations need?

## Automate processes and manual tasks

For many healthcare organisations, it starts with automation - and that's significant for a number of reasons. Firstly, it frees up people to focus on more valued-adding innovation tasks and moves them away from the security admin tasks that can take up a great deal of resource and labour.

Secondly, and perhaps more importantly - organisations cannot combat threats without automation in place - it's now become central to the whole discussion around security. The best security concepts are worth nothing if they cannot regularly patch the system and reboot machines.

## Move to a zero-trust policy for application behaviour, devices and access

Recent research commissioned by VMware, and conducted by Forbes Insights, revealed healthcare has the lowest adoption rate of all industries of zero-trust approaches to application behaviour. The research, based on a survey of C-level and IT practitioners in EMEA in the healthcare industry, showed that just 58 percent had adopted a zero-trust model, compared to an average of 66 percent in EMEA.

In addition, healthcare organisations rank lowest in their confidence in strategies to identify 'known good' application behaviour for an effective zero-trust application strategy (12 percent versus 26 percent overall). These findings demonstrate the alarming imperative for healthcare organisations to adopt zero trust across all applications and interfaces, which stipulates that systems should automatically verify all requests for connectivity or access, and not trust anything from inside or outside.



## Adopt intrinsic security to combat a growing threat landscape

The same research showed less than two thirds (60 percent) of EMEA healthcare organisations say IoT is built into their security infrastructures.

Devices—both personal and corporate—will continue to advance in healthcare settings, carried by physicians, nurses and allied health professionals, as well as by business-side administrators. In addition, patients are increasingly relying on health services delivered via the web and mobile apps for scheduling appointments and accessing online diagnostic services.

On the horizon are wearable and attached devices that will automatically stream or upload data to centralised systems.

But securing the data that sits on these devices requires a new approach to security. The existing thirty-year-old model for IT security – secure the network perimeter with an ever-higher and thicker firewall, then plug any holes that appear due to new technologies (such as mobility, cloud, new devices and apps, SaaS, etc) with point solutions – just doesn't work anymore.

In the modern world, traditional security is either ineffective, too complex, too expensive, or too difficult to manage, and usually all of these together. We need a new approach.

How do you make things intrinsically secure? By protecting the network, the common element that touches everything. Deploying virtual cloud networks gives enterprises a universal fabric – secure that and everything it touches is secure. It's more efficient, easier to manage. It's also automated, freeing up your people to focus on more valued-adding innovation tasks.

## Create a security framework that supports the flexibility staff and clinicians need

The majority of healthcare organisations face a similar challenge: they want fast, secure access to all applications and data as they look to increase the quality of both the patient and the clinician experience.

Yet at the same time, they are increasingly aware that with the wide attack surface and the complexities of digital interactions, end-users serve as the first line of defence. Most attacks in healthcare organisations arrive via phishing attacks and socially engineered malware—all preventable to a large degree through end-user awareness and education that comes from the very top of the organisation.

But what happens when the device itself is stolen? Robust tools like mobile device management, coupled with biometrics, provide water-tight security for physical devices and protect patient data. It enables organisations to roll out security profiles based on individual profiles, as well as the ability to remotely wipe data that resides on devices when the item itself is stolen.

Rather than adopting a “command and control” attitude, this approach allows security to be balanced within the organisations. It allows employees to work from a range of devices, applications and locations without feeling the need to bypass traditional security rules.

Cybersecurity is an ongoing challenge that affects every part of the organisation. This requires processes and work habits be constantly examined and adjusted to meet security needs. The enhanced attention to processes that occurs within a robust and holistic cybersecurity strategy can help streamline and improve the way business is conducted.



## Ensure patient data remains in the hands of patients

GDPR and the regulatory impact it's had across Europe, has created a reasonable framework to help ensure data, in any sector, remains in the hands of the individual.

In healthcare, the general consensus has equally been that the patient's data belongs to the patient. But the patient must also retain the right to determine which doctor, which pharmacy, which hospital and not least which health insurance company they want to provide certain information to. The industry needs to help ensure patients can exercise their right to share data with those whom they trust.

Only then can we credibly convey to patients and society that what happens to their data is exclusively for their own benefit and lies in their hands. Data-driven healthcare services will only find social acceptance under this condition. The industry can ill afford scandals and data leaks.

**“While the goal of every healthcare organisation is to develop a strategy and deploy proven solutions that evolve with increasing threats, only a few technology companies provide comprehensive security and compliance support.” - Carsten Kramschneider, Healthcare Manager, VMware Germany**

While GDPR has been generating headlines, an equally important, and arguably more relevant piece of regulation for healthcare seemed to slip almost completely under the radar. You'd be forgiven for not being aware of the Network and Information Systems (NIS) Directive, despite the fines it can incur being on the same level as those of GDPR and having been fully adopted across the EU as regulation.

As the Directive is focused on service resiliency and security for national critical infrastructure, it immediately puts healthcare organisations in the spotlight. There is an expectation that healthcare providers need to be able to demonstrate that investments are being made that minimise the impact of service downtime due to a cyber-attack (e.g. ransomware).

With a landscape characterised by more voluminous and more sophisticated threats, the modern-day technologies healthcare organisations are using require a modern-day approach to security – one that is anchored in the basic concept of an IT infrastructure.

We help protect our customers secure their critical infrastructures, ensuring they stay ahead of regulation and compliance because we know security is more than running a firewall with the latest anti-malware tools and associated signatures.

We have been working as a bridge builder for secure infrastructures for years with stakeholders and policymakers. Be it hospitals, doctors, health centers or the manufacturers of medical software devices - such as practice and hospital information systems or apps that collect health data from patients using wearables – we work to ensure every stakeholder has a responsibility to ensure patient data remains as secure as possible.



### 3. How CIOs will define the future of healthcare

In twenty years, cancer and diabetes could be seen as less life threatening and more manageable diseases. The onset of other diseases, in some cases, could be delayed or eliminated entirely. With more personalised and targeted therapies, sophisticated tests and tools could mean most diagnoses (and care) takes place at home – making the patient the point of care.

The future of healthcare is revolutionary, with new technologies being deployed in a rapidly evolving healthcare sector.

It's an industry on the cusp of rapid change. Aging and increasing populations, higher quality medical services, advances in medical treatments and processes and the rising cost of labour are all driving, global health care spending to increase at an annual rate of 4.1 percent in 2017-2021, up from just 1.3 percent in 2012-2016, according to Deloitte. Ageing infrastructure and managing legacy IT systems are also adding to the cost equation.

The current model of balancing IT maintenance costs against innovation cannot continue. It will be beneficial for all to shift from volume-based to value-based models – moving from fee-for-service to low-cost, high quality care. It is a concept that began in the US, dominated as it is by private medical insurance, and is now gaining increasing ground in Europe.

In countries with a public health system, this unburdens stretched hospitals and ancillary services. In those without universal coverage, it means less emphasis on limiting financial risk and more on coordination between insurance providers, health organisations and other bodies.

A growing number of European countries are already adopting this strategy in an attempt to maximise the value of their health technology investments. According to a report by the Economist Intelligence Unit, a project is already under way in the Netherlands with six hospital groups where their focus is on measurable patient outcomes and eliminating unnecessary medical procedures. Similar initiatives are also taking place in the likes of the UK, Sweden and Denmark.

As part of this, technology is seeing huge investment – based on Transparency Market Research numbers, the opportunity in digital health is anticipated to rise at a compound annual growth rate (CAGR) of 13.4 percent between 2017 and 2025, an increase to US\$536.6 bn by the end of 2025. Whether it's robotic arms performing surgeries with surgeons controlling them from miles away, AI-driven clinical trials or better digital tools for home-visit nurses, new technologies and discoveries are changing the face of medicine and care provision beyond all recognition.

It isn't just on the new, sparkly technologies that investment is being lavished, however. Electronic Health Records (EHR) continue to require significant budgets, despite what one commentator called 'their well known lack of user friendliness'. Having access to patient records quickly remains a fundamental tenet of modern healthcare provision – the challenge lies in being able to integrate a user-friendly platform with existing legacy IT systems at a time when budgets are restricted, and investment is required in a huge number of areas.

“[Siza’s] goal is to enable people with disabilities to live the life they want, with the support of people and technology.”

Jorrit Ebben, Chief Strategy and Innovation Officer, Siza



For technology leaders in the healthcare industry, the shifting situation represents an immense opportunity. The CIO's role is evolving from IT gatekeeper to strategic organisational asset.

**84 percent of CIOs from a variety of industries (13 percent of which were from healthcare organisations) agreed with the statement: “The CIO’s role has increased in importance in our company over the last five years”. – The Challenges for Tomorrow’s CIO, Forbes Insights report**

While this shift away from simply keeping the lights on should be welcomed, it does place an expectation on CIOs to provide the vision of what healthcare should look like and deliver the tools with which the organisation can be driven towards it.

It's about understanding how the likes of AI, IoT and other new technologies can be acquired, integrated and ultimately used effectively to deliver a completely new approach to healthcare. At the heart of it all is data – patient data undoubtedly, but also medicinal and machine data.

One example of this integration of new technologies and data comes from the Netherlands. Siza provides medical and technology support to more than 3,500 people living with physical, mental or multiple disabilities, non-congenital brain injuries or autism-related impairments so they can live more freely, safely and independently.

For Siza, an independent wheelchair user is very much the reality. For instance, a client of Siza who uses a wheelchair and heavily depends on his breathing equipment must always stay close to a medical facility in case things go wrong with his equipment or his physical condition.

If problems occur, the nursing staff must be able to respond quickly. With IoT-based monitoring and alerting capabilities, Siza can observe the patient's medical condition with wearable sensors and monitor his supporting equipment. As a result, Siza can predict in advance if the patient might need help and then proactively send a nurse to his current location. This enables the patient to move around more freely and live more independently.

This application of new technology delivers a better standard of care for the patient, which in turn can cut down on the number of interventions required. It also saves money by ensuring resources are deployed as required rather than on a fixed rota.

It is clear that there are huge opportunities available to CIOs. Yet at the same time, they need to be adept at navigating a complex landscape of security, privacy and regulatory concerns, whilst keeping the patient at the heart of their decision making. They need to be able to deliver the tools and infrastructure to allow clinicians, staff and patients to provide and access care as they want, without exposing either individuals or organisations to undue risk, all while maintaining budgets and operating with limited resources.

They need services that can be installed and used quickly with minimum disruption. They need scalable infrastructure, only paying for what they use and not what they might while also being able to cope with peaks and troughs of demand without hampering user experience. Most importantly, they need results quickly.

“As data is the new oil in healthcare, CIOs have an increasingly important role in designing better processes and technologies that enable the flow of data and information to stretch across the entire organisation. As patients become an equal partner in care bringing their own data to the doctor-patient meetings, and medical professionals being able to obtain myriads of new data about their patients and their decisions, CIOs have a unique chance to bring this all together.

The cultural transformation we call digital health only yields benefits for patients and their caregivers if the right systems are implemented and the cultural components of this transformation are being taken into consideration. This is the biggest challenge healthcare leaders have ever faced but CIOs can turn this situation to their advantage by adopting patient design; improving their own forecasting skills; and embracing digital health.”

**Dr. Bertalan Meskó**  
Director of The Medical Futurist Institute



## 4. Cloud – the foundation for healthcare innovation?



For healthcare to evolve effectively and deliver true patient-centric care, it needs its clinical CIOs to be innovative. It's a role many are already aware of: a Forbes Insight report found that 46 percent of CIOs say their function will be essential to fostering innovation within their companies.

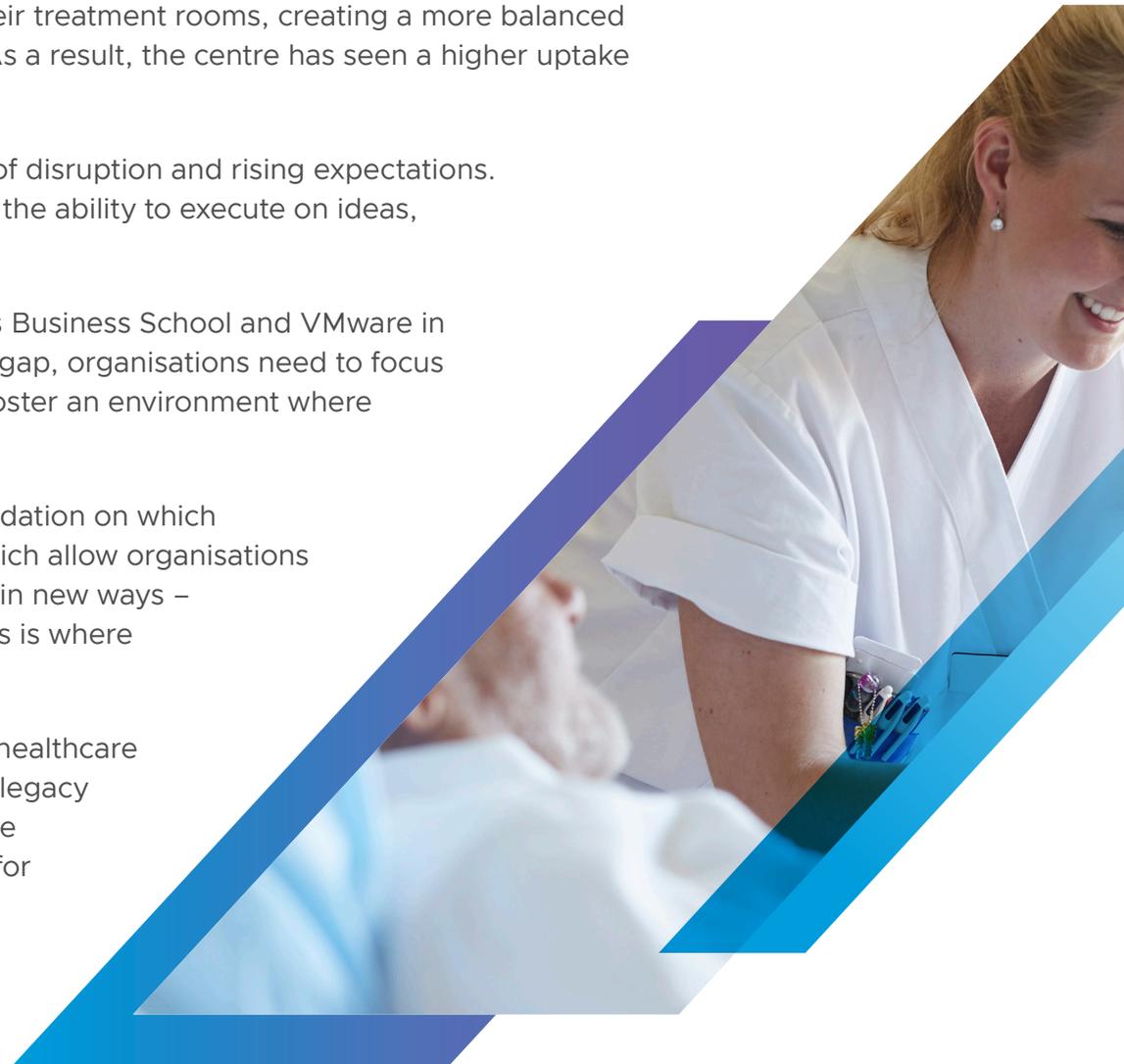
Patient design is critical when it comes to innovation. For example, at the Radboud University Medical Centre in the Netherlands, patients were brought in to advise on the design of their treatment rooms, creating a more balanced patient-doctor relationship and a space that would work for them. As a result, the centre has seen a higher uptake of their therapy.

Innovation is sometimes held up as a silver bullet to the challenges of disruption and rising expectations. In fact, to focus purely on innovation is misguided – what matters is the ability to execute on ideas, something many organisations in all sectors struggle with.

It's a challenge identified as the “innovation-execution” gap by Cass Business School and VMware in their ‘Innovating in the exponential economy’ report. To bridge this gap, organisations need to focus on putting the right people, process and technology into play and foster an environment where individuals can come up with ideas themselves.

Underpinning it all is technology. It's how we deliver the digital foundation on which everything is built: the infrastructure, apps, services and devices which allow organisations to experiment, to scale, to be nimbler; people to work smarter and in new ways – often at speeds and with lower risk profiles not available before. This is where cloud computing comes in.

So why is cloud not being more widely adopted? Particularly in the healthcare space, a lack of skills and understanding, difficulties migrating from legacy architecture and challenges around meeting security and compliance issues are often listed as some of the biggest barriers. In Germany, for example, there are strict regulations on preventing patient data to from being taken off the hospital site.





But, whilst there are challenges unique to this industry, the cloud can help ease the pain in five key areas:

**1. It is ‘sign up and go’ simple**

set up time is much faster than deploying on-premises, classic IT. For healthcare organisations needing to access a return quickly, this could prove decisive.

**2. It empowers users to be innovative**

the speed and simplicity allow access to cloud native applications and delivers the heightened, intuitive experience employees have come to expect from the digital tools they use outside of the workplace. Medical professionals can access patient records in real-time, rather than hunting for paperwork.

**3. It delivers financial freedom**

in some instances, hospitals have to make large investments upfront instead of using a pay-as-you-go model. Where this isn’t the case, cloud can alter that dynamic, giving healthcare organisations the full flexibility of both capital (capex) and operational (opex) expenditure models. In cash-strapped health services, this will enable them to deliver new levels of care.

**4. It scales rapidly**

organisations can scale up and down their resources according to operational demand, quickly and without a high cost of change. This means a wide spectrum of finite resources, including people and technology, can be aligned to shifting priorities on a daily basis. This is exactly why NHS Digital, the national information and technology partner for the UK’s health and care system, has adopted a cloud-first approach, leveraging multiple clouds as the best and fastest way to support the NHS as a whole deliver more services online.

**5. It offers shortcuts**

that might be prebuilt platforms or X-as-a-service solutions – whatever it is, and whatever you need, it’s likely that, a version already exists. If organisations only have to develop a part of their offering from scratch and can augment it with off-the-shelf components that have already been delivered and proven, they will have a much faster, and less risky, time to market.

**“It is for individual organisations to decide if they wish to use cloud...but there are a huge range of benefits in doing so, such as greater data security protection and reduced running costs when implemented effectively.” - Rob Shaw, Deputy Chief Executive, NHS Digital**

However, most organisations have a complex mix of legacy systems and applications, some of which are critical to their operations, but simply can't be moved wholesale.

**As Louise Fellows, Director, Public Sector UK&I at VMware, says, “To support all the ways of working now needed requires consistency between different environments and cloud platforms. That means deploying hybrid cloud environments, such as VMware Cloud on AWS, that can act as the digital foundation that allows healthcare organisations to place applications where they function best. At the same time, they provide the flexibility to move services around as circumstances change.”**

**“The uptake of digital services in the NHS is accelerating so the NHS and social care's IT backbone must be up to the job. With VMware Cloud on AWS, we're providing a resilient platform to support digitally enabled care today and in the future.**

**We now have a commercial framework in place to enable NHS and public-sector organisations to confidently use the cloud. Together we can benefit from the economies of scale and cost efficiencies of this model.” - Rob Shaw, Deputy Chief Executive, NHS Digital**

Cloud can help bridge the gap between innovation and execution by providing the technology processes people need to complete the innovation prism. Yet it cannot be a single cloud, but an integrated mix of environments with a consistency at its core to provide the digital foundation to unlock rapid results using the right technology, in the right location, at the right time. With this, the clinical CIO's hand is strengthened as they assume their role as the catalyst for transformative innovation in healthcare.



**5.** Enabling front line staff  
to make the patient the  
point of care

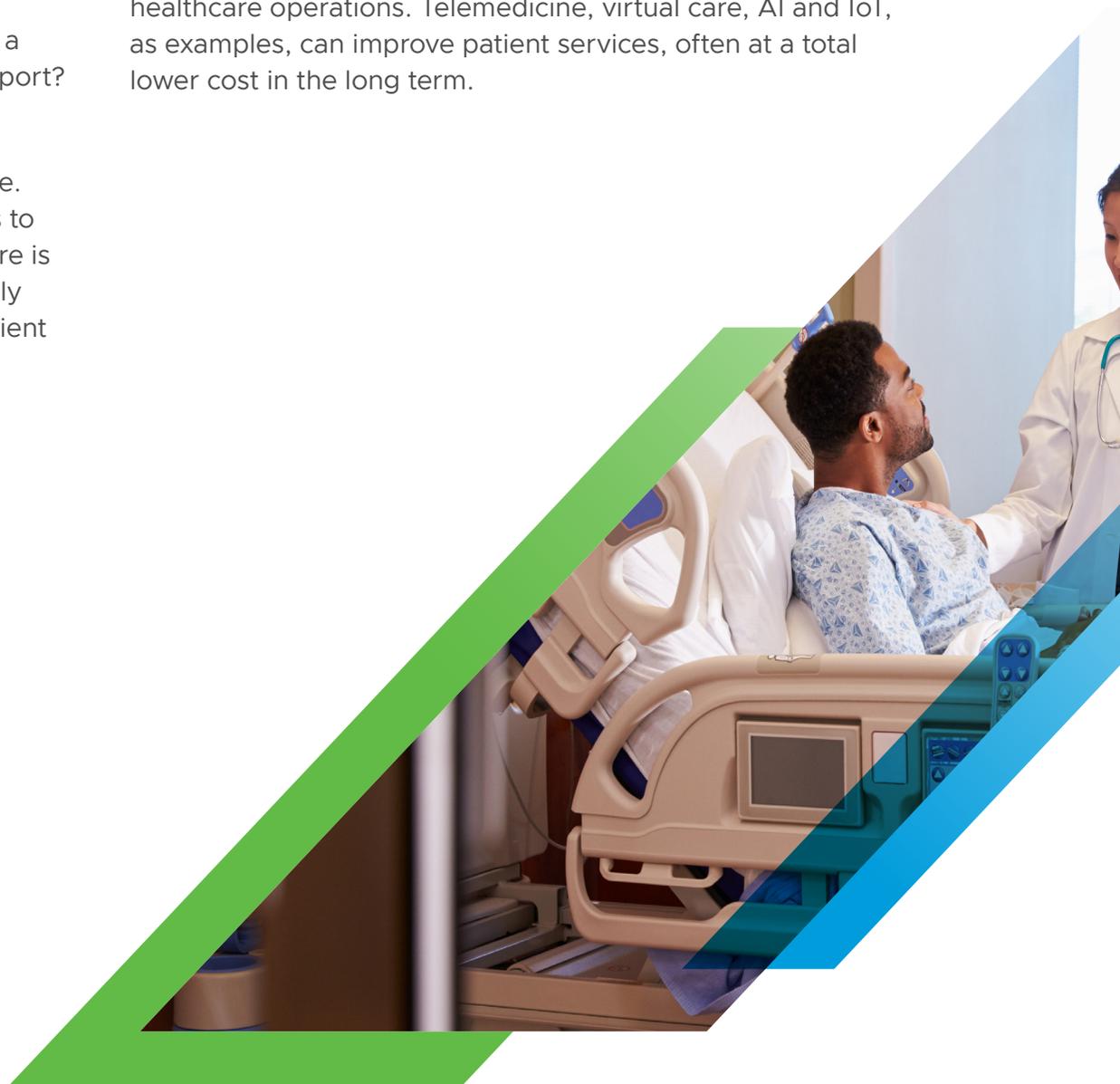


If we are to improve care for patients, we need to listen to those working most closely with them: The staff on the front line that have to deal with patients' day in/ day out. Their experience is vital, as it is often these individuals who have the best ideas on how to improve patient services – but they need to feel empowered to do so.

Do they have the tools they need? Is the culture conducive to a productive environment? Are they getting enough senior support?

Equipping staff with the right digital tools will make their lives easier and transform their ability to provide better patient care. We are in the middle of a cultural transformation with regards to medical innovation, and a shift in the basic structure healthcare is built on. Patients are now empowered vehicles that are directly engaged in their own treatment programme. Keeping the patient at the centre of care is key, but this cannot happen without delivering something useful to the staff who look after them. This is where technology can play a pivotal role.

Whilst Gartner has forecast that healthcare IT budgets are expected to increase on average by 8.9 percent in 2019, with the majority being spent on maintaining existing infrastructure, the European medical equipment technology market is estimated to be worth approximately €115 billion (2017). The digital age has opened an abundance of opportunities for more streamlined healthcare operations. Telemedicine, virtual care, AI and IoT, as examples, can improve patient services, often at a total lower cost in the long term.





**“France is a good example of some of the rapid changes we are seeing in healthcare across EMEA. In 2018, President Emmanuel Macron launched a reform called ‘My Health 2022’, with its central aim of putting patients at the centre of care. The region faces huge structural problems with not enough doctors and nurses to care for patients. The initiative hopes to focus on digitalisation and technology that will directly benefit patients and drive efficiencies, rather than spending time on operational changes.” Jean-Philippe Delaye, Strategic Account Manager, Public Sector, VMware France**

While fears that AI and automation will replace existing jobs arise, the nature of the healthcare industry suggests workers are less at risk of this happening. A successful healthcare worker has to be empathetic, caring, and have an eye for detail, all of which are very human traits. On the other hand, the monotonous tasks with which staff often find themselves burdened can be reduced with the right digital tools. Any solution that will reduce admin and allow staff to be creative and see and treat more patients without adding additional hours to their working day will only be a bonus. Medical outcomes will be improved with successful human-machine cooperation.

For example, using robots to deliver medical devices, drugs and lab specimens to various wards will allow nurses to spend more time with their patients rather than running up and down building floors. Or arming patients at home with an app that allows them to check skin abnormalities, like a mole, for risks of skin cancer. Apps like SkinVision will, in seconds, give patients a risk report they can discuss with their dermatologist, just by taking a photo of the skin spot that is concerning them.

Another example is the use of advanced technology in the field of telemedicine where patients at home are counselled virtually over the phone or computer screen. Whilst this doesn't involve any direct patient contact, it benefits patients who may not be able to easily visit a hospital and allows a healthcare practice to reach a larger number of patients without putting pressure on ward availability. This is exactly what City Clinic in Bulgaria has done. By adopting a general purpose remote medical examination solution that imitates an examination room, the patient and doctor can be, individually, anywhere in the world. Smaller and more rural communities can be served, resulting in productivity gains for doctors and reduced waiting time for patients.

Elsewhere, portable diagnostic devices are transforming the way in which patients experience different procedures. Whether it is an ultrasound or ECG test, the introduction of pocket-sized and portable, hand-held devices has given nurses the freedom to move from patient to patient more quickly, conducting tests without long waiting times.

These innovations are fantastic for the nurses and doctors on the front line, but the wider organisation will also reap their benefits. As global populations continue to age in conjunction with a rapidly expanding healthcare industry, the demand for those responsible for their care will only increase. This demand places even more importance on ensuring the industry has the tools which will not only encourage new staff to join - but also keep existing staff happy and engaged. This naturally puts pressure on senior management. According to a Vanson Bourne survey commissioned by VMware, 54 percent of EMEA employees within the public and private healthcare sector agree that the flexibility of tools (e.g. apps & devices) that they need at work, would influence their decision to apply or accept a position at a company.

It therefore becomes paramount for success that healthcare organisations prioritise the digital experience of staff on the front line by investing in the right technology. Change is already happening, with many healthcare organisations in EMEA prioritising digital employee experience projects in the next 12 months.

VMware and its partners have the platforms and tools to help guide clinical CIOs and their teams deliver a better and more cohesive digital experience for their employees, whether it's access to apps from any location, enabling various levels of security depending on the individual; or having the freedom to work from their own device. However, it's important for the CIO to maintain a balance between giving employees the freedom to choose their own IT and keeping an element of control in the hands of the IT teams. Avoiding shadow IT is a must to avoid the CIO losing responsibility and risk lines of business working in silos on their own technology.

The ultimate goal should always be to deliver the best patient care possible. There is an abundance of talent amongst front line staff working across the healthcare industry and technology is already ingrained in our day to day lives. It therefore seems logical to explore how we can use digital tools to empower healthcare workers to push the boundaries of patient care, reach more patients than ever before and help achieve wider business success.

The Royal College of Nursing is the world's largest nursing union and professional body, representing more than 435,000 members. It has a vision that by 2020 every UK nurse should be an e-nurse, effectively using information and digital technologies to deliver better health and social care.

Achieving that goal requires big changes in working practices and the College has a key role in helping nurses make that transition. Working with VMware, it built a digital platform from where it provides the training, advice and support required by the nursing profession. Nurses are now gaining the digital skills they need to improve treatment, patient safety and wellbeing.



A high-angle photograph of two healthcare professionals, a man and a woman, both wearing blue scrubs, walking down a modern staircase. The man is on the left, wearing a red stethoscope and a name tag. The woman is on the right, holding a clipboard and gesturing with her hands as they talk. The staircase has a metal railing and dark carpeted steps. A blue semi-transparent graphic overlay is on the left side of the image, containing the text.

## 6. Lessons learned from Digital Transformation: Balancing costs, security and innovation

It's impossible to miss how access to personal medical data is being interwoven into everyday activities. Any new smartphone or connected watch purchase offers the opportunity to share health data, whether heart rate, activity, blood pressure, respiratory rate or body temperature. Chat bot start-ups that help pre-diagnose patients are being valued at billions of dollars, while big tech AI is being used to reportedly save time, catch missed cases and reduce costs. Innovation is happening right across the care continuum.

This digital transformation of health offers huge potential and a major opportunity for IT teams to become true partners in the business of healthcare. As centers of technology excellence, IT staff can empower both clinicians and patients to diagnose, treat and care faster and in a more efficient manner, while expanding revenue streams.

However, a balance needs to be struck. At a time when trust in so many institutions and sectors is faltering, healthcare remains one in which retaining that trust is absolutely vital to the ongoing delivery of its services. Just as digital transformation projects in other sectors must marry the need for innovation with their security imperatives and restrictions of cost, so too must healthcare organisations.

This was exactly the challenge that Helse Nord, Norway's geographically largest health authority, faced when it wanted to evolve how it offered its services. Norway, like many countries, has an increasingly aging population, which will put pressure on its healthcare infrastructure. To manage that based on the current system, said Vegard Jørgensen, Senior Advisor at Helse Nord IKT, the authority's IT division, would require "a large workforce of health workers. That's why it is essential for IT and technology to handle some of these functions going forward."

To do that, and meet the demands of serving half a million patients and the working requirements of 19,000 employees, Helse Nord needed to upgrade its IT infrastructure for both today and the future.

It deployed a hybrid solution, based on a software-defined data centre, which married both cloud and on-premise to allow patients and clinicians access to data in a secure environment.

At the same time, employees were moved to a platform that provides all their services, from email to shift planning and personnel information.

**“Security has been part of the plan since day one. Patient data is now safe, secure and compliant with current regulations. We are now one of the first in the country to allow patients to easily access their own health data through a public website,” said Jørgensen.**

Of course, this sort of digital transformation is not the preserve of large organisations. Koningin Elisabeth Institute, a rehabilitation hospital in Belgium, has 130 employees and a maximum of 65 patients at any one time. Historically, its IT team consisted of two people, responsible for over 150 devices and the infrastructure they worked on. As the hospital became more connected, downtime started to have a significant impact, while trying to keep 150 devices updated and working optimally was proving time consuming and inefficient.

By switching to a digital workspace, the small IT team was able to centrally control each device, updating as required, while ensuring the entire network and, more importantly, patient data remained secure. All this without hampering the work of employees to treat patients or the overall patient care experience.

Improving efficiency to improve the patient experience, while remaining completely secure, was the foundation for The Christie’s digital transformation. A world-renowned cancer hospital, with multiple sites across Greater Manchester in the UK, The Christie was facing a host of challenges, from IT taking too much time out of clinicians’ day, to limited space for IT hardware, securing third party network access and a small core IT team.





By virtualizing much of its infrastructure and deploying digital workspace solutions, the hospital has not only been able to overcome its challenges, but future proof its technology. It is now safer, easier and faster for clinicians and staff to deliver outstanding patient care wherever and whenever needed, helping safeguard the trust cancer patients and their families put in The Christie and protect the hospital's world-renowned reputation.

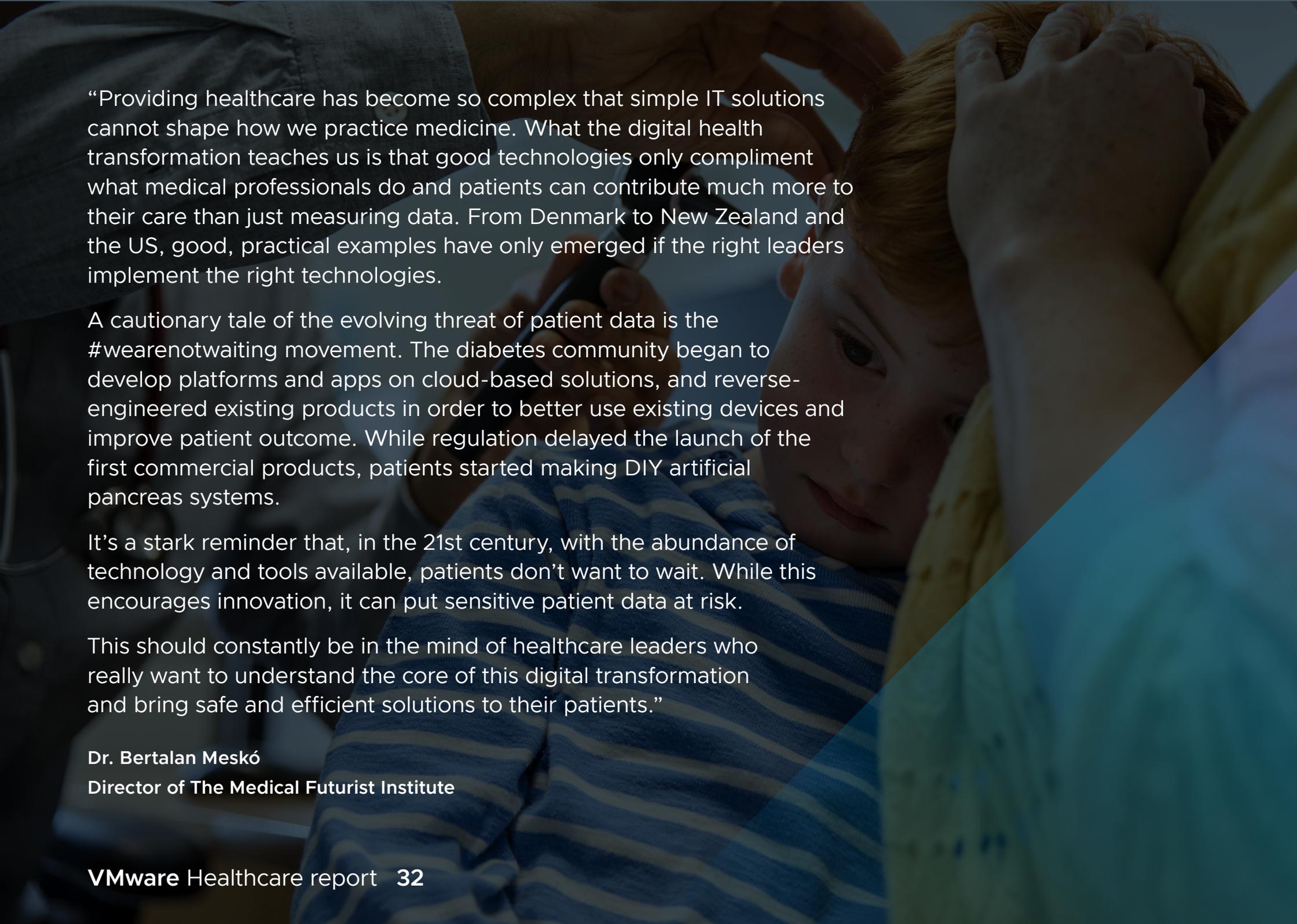
**Stuart Burton, ICT Infrastructure Architecture Manager said, “Here at The Christie, we continue to invest in a platform fit for the future of a pioneering hospital leading the way in cancer care. Cancer affects so many families, I’m proud our technology can make a difference to the care they receive. Understanding the positive impact our work has on patients, is very rewarding.”**

Finally, in Sweden, the county council governing the Västra Götaland territory knew that they needed to provide their staff with a better digital experience if they were to transform the healthcare services delivered to the population.

Region Västra Götaland (VGR) recognised that medical staff often considered IT as an inhibitor rather than enabler, with multiple passwords and complex systems to navigate. With some nurses reporting they spent up to 45 minutes each day to simply log in or switch between workstations, the IT team knew something had to change.

Striking the balance between efficiency and quality is always difficult. Using a solution that gave doctors and nurses single sign on and virtual desktops helped to reduce overall complexity of accessing IT systems increased the mobility of staff, saving the company thousands of wasted hours a day.

In each of these examples, healthcare organisations have had to balance innovation with the need for absolute security and manage it within restricted budgets. In doing so, they have reinvented how they deliver services to patients and employees, while future proofing their systems for future innovation.

A young child with red hair is being held by a person. In the foreground, a hand is holding a smartphone. The background is a soft-focus image of a person's face, possibly a doctor or caregiver, looking at the child.

“Providing healthcare has become so complex that simple IT solutions cannot shape how we practice medicine. What the digital health transformation teaches us is that good technologies only compliment what medical professionals do and patients can contribute much more to their care than just measuring data. From Denmark to New Zealand and the US, good, practical examples have only emerged if the right leaders implement the right technologies.

A cautionary tale of the evolving threat of patient data is the #wearenotwaiting movement. The diabetes community began to develop platforms and apps on cloud-based solutions, and reverse-engineered existing products in order to better use existing devices and improve patient outcome. While regulation delayed the launch of the first commercial products, patients started making DIY artificial pancreas systems.

It’s a stark reminder that, in the 21st century, with the abundance of technology and tools available, patients don’t want to wait. While this encourages innovation, it can put sensitive patient data at risk.

This should constantly be in the mind of healthcare leaders who really want to understand the core of this digital transformation and bring safe and efficient solutions to their patients.”

**Dr. Bertalan Meskó**  
**Director of The Medical Futurist Institute**



## 7. Where the industry should be investing next



It feels like we have reached a turning point in the journey towards improving quality of life. With a growing ecosystem, technology has the power to connect patient, doctor and community like never before, integrating healthcare into our daily lives from the very beginning to our twilight years.

While technology now augments our understanding of what care can deliver, blurring the lines of what is science fiction and what can be a reality, budget constraints and strict regulation often prevent healthcare organisations from investing in new technologies.

So, what areas should the senior management look to invest in? Which future technologies are the closest to maturity? How do patients feel about being the end-users of these technologies?

We've already seen the great strides that healthcare has taken in terms of keeping data relating to a patient's well-being easily accessible - not just to healthcare professionals, but to patients themselves. Before companies can answer where they're going to be investing next, they must first recognise that their patients must be sitting at the highest level of decision making within the company. With Gartner predicting the wearables market to grow 29 percent over the course of 2019, the ability for these devices to record health-related data will cause the amount of available patient data to grow exponentially.

To reap the benefits of the rapidly expanding availability of patient health data, two technological barriers must be overcome: access and analysis.

## Data access

In today's world, a crucial aspect of any technology is its ability to communicate with other systems and fit into already established networks. After all, patient data is only valuable when it is made visible to the healthcare providers diagnosing and treating the patient. Take, for example, how smart watches that can record a wealth of data could aid the diagnosis or treatment of heart conditions, such as average resting BPM, the variability of cardiac rhythm, as well as the heart's electrical activity. This data is only valuable when viewed in the context of a wider patient record held by medical establishments, making interoperability a fundamental concern. At the same time, the sharing of data relating to an individual's health must undergo the appropriate safeguards in order to conform to data privacy regulations.

This imperative to make patient data available, but only at the right place at the right time, means that healthcare providers will need to invest in highly-secure platform-based solutions that run on open APIs in order to allow the interoperability of patient-owned insights with hospital-owned infrastructure.

## Advancing data analysis

In terms of analysis, huge leaps forward are already being made in applying AI and ML-enabled systems to derive actionable insights from huge swathes of data. In late 2018, a medical study provided a proof-of-concept for an AI-based system of diagnosing Parkinson's disease by feeding a neural network with thousands of normal and abnormal tomography scans and teaching it the difference between "normal" and "abnormal" images.

This pivotal study is just the first step in the movement toward rapidly reducing the time needed for diagnosis, not only helping patients to be treated more quickly but also freeing up more time for healthcare workers to treat patients face-to-face. As already mentioned, expanding the scope for administrative tasks to be automated will help build patient-doctor time and create a more empathetic atmosphere for patients in healthcare organisations. Many modern medical institutions are already using modern tools to automate certain processes and systems, such as paperless patient administration and app-based patient-doctor interaction. Further ahead, developments in AI, IoT and robotics will enable a greater number of core medical practices to be automated at a lower cost, freeing up more facetime between staff and patients.

However, when we discuss AI in healthcare, we must remember it is artificial narrow intelligence (ANI) we're referring to. When algorithms running on powerful computers recognise patterns and trends, rather than a machine being able abstract concepts from limited experience or pre-defined knowledge. ANI, particularly when applied to computer vision, presents huge opportunities for diagnostics in healthcare as it is based on pattern recognition.

What other emergent technologies are likely to become a reality in healthcare in the near future? According to a new report by the Economist looking at what business leaders predict to be the next big innovation in healthcare, 61 percent see robotics and 76 percent see portable medical devices for professionals as a reality in the next five years, with 59 percent believing man made organs will be a reality in the next 25 years.

Whilst the idea of these technologies becoming staple tools in surgeries, hospitals and medical laboratories may be exciting for those in the healthcare industry, it is also important to understand the appetite for new technologies amongst their ultimate end-users: patients.

Last year, VMware polled over 5,100 consumers across the UK, Germany and France on attitudes and approaches towards the growing presence of technology (both present and future) in daily life. The results showed an important distinction when it comes to the aforementioned critical topic of patient data privacy: while almost 7 in 10 (69 percent) said they would be happy for healthcare professionals to have access to data related to their health whilst in hospital, less than half (47 percent) said they would be comfortable with the same for healthcare professionals to access accurate data about their daily lives, such as drinking habits, level of exercise, nutrition and diet.

With wearable tech making the above easier to imagine, the appetite for the increasing use of technology in healthcare seemed to drop with the more forward-looking the technology in question. Less than a third (30 percent) of respondents believed that AI-based healthcare, treatments and support would help expand their lifespan, while less than a quarter (23 percent) would rather have invasive surgery carried out by a robot than a human, even if it meant recovery time was quicker.

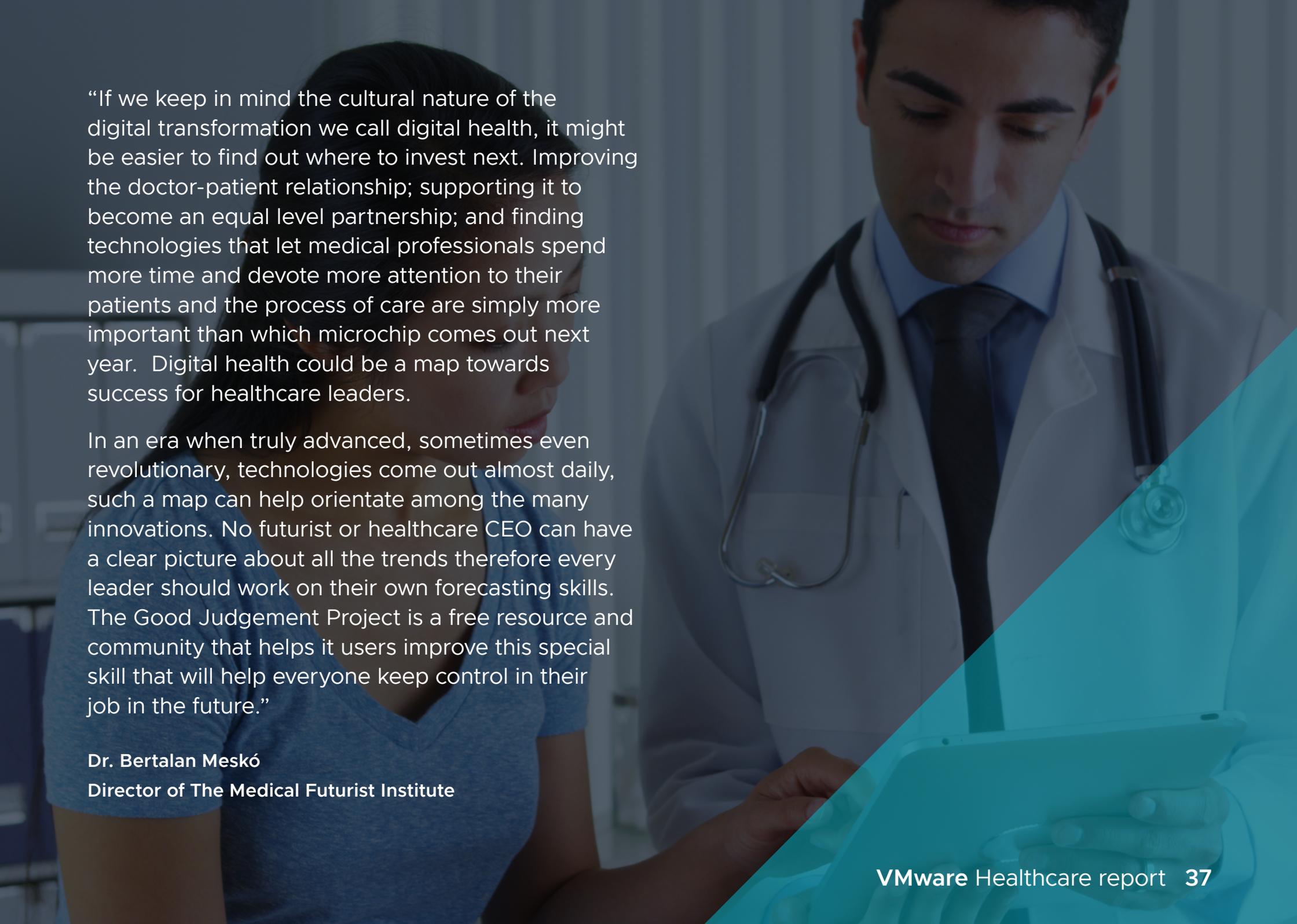
### **Investing today in the technology of tomorrow**

Aside from the obvious benefits of using technology to improve the quality of patient care and find new ways of treating illness & injury, medical establishments are also set to benefit from the holistic operational benefits of digital transformation. In addition to ensuring that surgeries and wards are sufficiently staffed, administrative staff are needed to handle a considerable amount of paperwork, making efficiency a core concern for medical establishments.

**“Whether investments are focused on new technologies which will allow better diagnosis and care for patients or help the staff to deliver a better patient experience – it starts with a secure and easy to manage foundation that is flexible and scalable to meet new requirements. At VMware, we see it as our task to create this foundation for smarter healthcare and to allow hospitals to use digital structures in the way that maximally benefits them” - Jens Koegler, Healthcare Industry Director, VMware EMEA**

Bradford Teaching Hospitals NHS Foundation Trust, for example, has launched a central “command centre” to provide its staff with a comprehensive, real-time overview of the 800-bed hospital. The NASA-style command centre utilises AI to analyse incoming streams of data which can then be used to make fast and accurate decisions on how best to manage patient care. Insights from the command centre are then instantly made accessible to staff on the ground via tablets and mobile devices. The system is a prime example of utilising technology to root out and eliminate time and money-wasting inefficiencies in hospital operations, generating value from the outset of deployment.

Identifying the right tools to invest in is crucial for any organisation looking to digitally transform. In the healthcare industry, this means not only finding the tools which will secure buy-in from the executive level (ROI, administrative efficiencies, patient turnaround, etc.) but those which patients will not find strange and unfamiliar. As a result, the implementation of emergent tech such as AI and robotics in the healthcare sector will likely align with its implementation in everyday life – becoming the norm as it fades out of the spotlight and into the background.



“If we keep in mind the cultural nature of the digital transformation we call digital health, it might be easier to find out where to invest next. Improving the doctor-patient relationship; supporting it to become an equal level partnership; and finding technologies that let medical professionals spend more time and devote more attention to their patients and the process of care are simply more important than which microchip comes out next year. Digital health could be a map towards success for healthcare leaders.

In an era when truly advanced, sometimes even revolutionary, technologies come out almost daily, such a map can help orientate among the many innovations. No futurist or healthcare CEO can have a clear picture about all the trends therefore every leader should work on their own forecasting skills. The Good Judgement Project is a free resource and community that helps its users improve this special skill that will help everyone keep control in their job in the future.”

**Dr. Bertalan Meskó**  
Director of The Medical Futurist Institute

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