

KIN+CARTA

Healthcare Digital Report 2020

The Healthcare Disconnect: Making Personalised Healthcare Happen



Executive Summary

In virtually every industry and facet of life, it's correct to say that we live in the most connected age in human history. But as technology has set a new standard for what the integration of data, customer experiences and technology can achieve, the healthcare industry has fallen behind. We have most of the parts: better data than ever before, targeted patient support, and cutting-edge platforms. We've just failed to connect the dots.

From a business standpoint, taking a holistic perspective on the future of healthcare has never been more critical. Innovation in isolation doesn't drive progress. We must look at our organisations, products and services through the lens of personalisation and unification. Less adding, more connecting. Every stakeholder in the healthcare industry is trying to drive better outcomes with greater efficiencies. Putting patients at the heart of what we do is undoubtedly the place to start. Engaging patients in a system that's focused on building connections, not adding complexity, is how we actually deliver on our promises as industry leaders.

As digital transformation partners for healthcare organisations around the globe, we know the questions facing the industry well: How can personalised medicine be realised faster? What will the future of personalised medicine look like? What are the barriers to a more connected healthcare system? And what are the top considerations for healthcare businesses as they move into this new world?

At Kin + Carta, we're excited about the future of healthcare because the technologies needed to answer those questions exist. The challenge lies in balancing the integration of those capabilities with the mandate of a patient-centred model of care and change management.

Key- Takeaways

- The future of personalised health will open up new possibilities and use cases. The potential is there for digital technology to create vast amounts of customer/patient and business value.
- Health and pharma businesses that invest in personalised medicine and better integration with user experience will succeed over those that don't.
- Building connected, personalised medicine experiences isn't easy, but it's possible thanks to changes in technology the market and the competitive environment—and more necessary than ever.
- The technological building blocks, changing customer expectations and the business performance imperative all mean that the future should be here.
- The new potential use cases and efficiencies offered by patient data will allow predictive medicine to evolve. First movers will have an advantage.

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Making Personalisation Possible

As the face of society evolves in the digital age, new tech-powered possibilities for personalised user experiences are playing a more significant part in everyday lives.

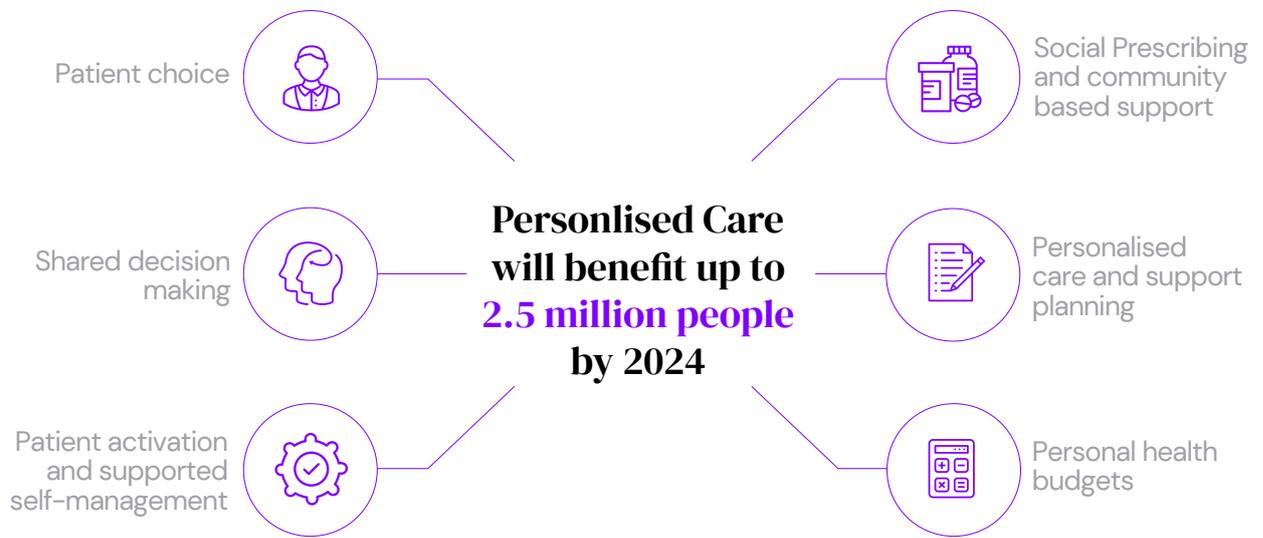
Netflix uses machine learning to personalise home pages with intent-based search and content suggestions .

Amazon developed collaborative filtering algorithms to recommend products you want at the exact moment that you may need them in 2002 and has since taken personalisation to the masses.

With brands in every industry making personalisation a core part of their strategy, personalisation at scale is becoming an expectation that businesses cannot ignore.

¹ Netflix Personalisation & Search, 2019

² Amazon, Item to Item Collaborative Filtering, 2002



Source: NHS³

The landscape is shifting, and that shift brings with it new opportunities and challenges that require a change in perspective. As the healthcare and pharma industry starts to make inroads into the possibilities that applied digital technologies such as sensors and wearables can offer for personalisation, there are varying degrees of success in execution. This variation is especially evident in the app space with 70 percent of healthcare applications achieving less than 1,000 downloads over the past four years.⁴

³ NHS, Personalised Care, 2019

⁴ Piori Database, 2019



Making Personalisation Possible

A recognised opportunity

Initially driven by the potential to increase consumer value and improve brand loyalty, the plethora of personalised experiences as we interact with the world around us are becoming commonplace. This level of personalisation leads to the expectation of unique experiences tailored to our needs, interests and preferences in every facet of life. Medicine is no different. The opportunities for personalised healthcare to improve our lives are vast, and we are starting to see the impact.

Today, patients have access to their data on all fronts. We've seen a surge in personal digital health investment, with 79 per cent of US patients leveraging online health information sources, such as Google and WebMD, and 24 per cent using wearables . This data not only helps track and plan health, medicines and logistics but also facilitates highly superior conversations with their healthcare professionals (HCPs). Both sides are coming to the table in a far more educated manner to have

⁵ Rock Health, 2017

⁶ Mercom Capital Group, Digital Health Funding and M&A Report, 2018

more comprehensive discussions, make more informed decisions and iterate treatment for more impactful outcomes. The industry is responding to the demand shift, and there is a global surge in funding for digital health start-ups seeking to optimise patient health, reaching over \$4.9 billion in the first half of 2018.⁶

The pharmaceutical industry has had its share of challenges over the past decade. No longer in an era of blockbuster drugs, the industry has struggled to translate clinical value into growth. The current environment of increased pricing pressures, demands for transparency and heightened regulatory scrutiny has proved challenging at a brand level, where hotly anticipated drug launches have underperformed. The industry is looking for ways to provide value “beyond the pill,”⁷ and all signals point to the need for a new business model, one that puts patients at the centre by engaging with them directly.

A genuinely patient-centred approach personalises the healthcare experience (diagnosis, medicine, support or otherwise) across the entirety of the patient journey. **To do so, it must connect the dots.**

The willingness of organisations in the healthcare ecosystem to adopt digital technologies has paved the way for increased dialogue on how innovation can improve and personalise medicine. Even regulatory bodies, once reluctant, are now collaborating with industry, tech, providers, payors and patients to improve outcomes. Once-risk-averse corporations are transforming their cultures to be agile and innovation focused. Yet there is still much work to be done.

Patients are aligning behind the need to unify disparate elements of care and support within a strengthened infrastructure. To realise their desired outcomes, however, a single-pane view of the patient is the critical starting point.

⁷ Colette Baalm, Delivering Value Beyond The Pill, 2019



Making Personalisation Possible

Developing a Single Pane View of the Patient

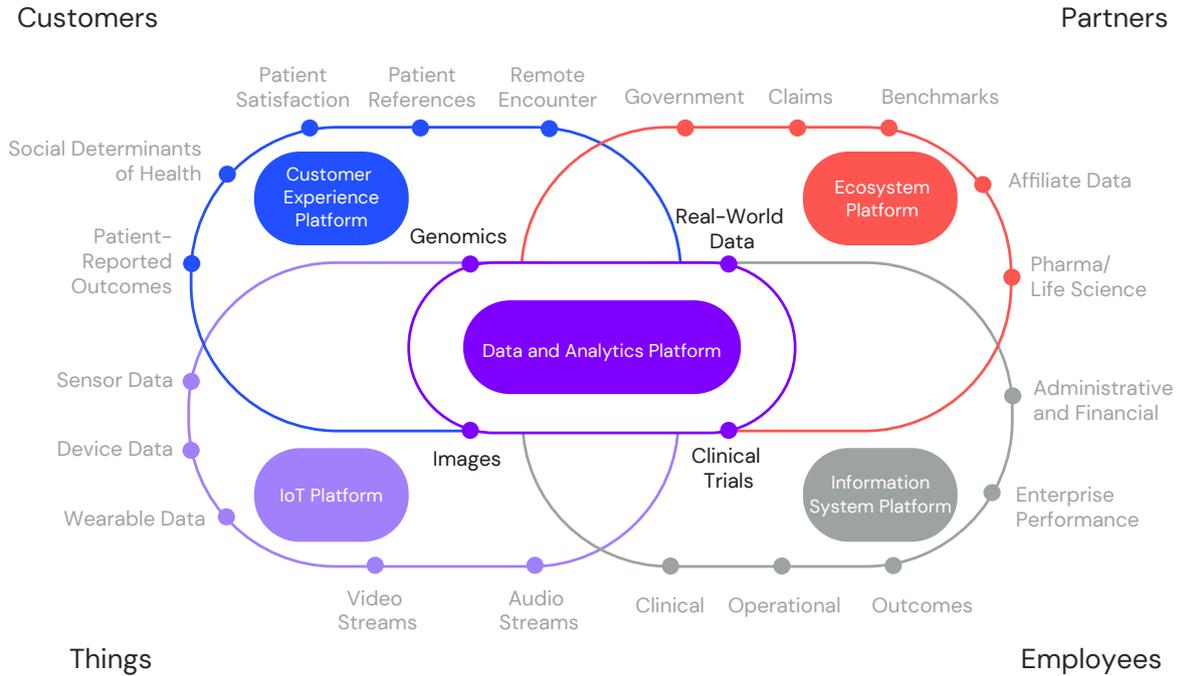
Treating the person and not just the condition is an ongoing struggle in the global healthcare ecosystem. All stakeholders, including hospitals, payors and pharma, are taking steps to leverage data to understand patients better and improve clinical outcomes. This data includes factors outside of the patient–pill relationship.

Social factors play a significant role in wellbeing because **only 20 per cent of health outcomes are determined by clinical care.**⁸ The remaining 80 per cent are determined by non-clinical factors that are greatly influenced by geographic and socioeconomic status. Understanding these factors, health literacy and access to services is key to unlocking areas of unmet needs in personalising healthcare.

The ability to better understand patients' lives is re-shaping drug research and development. Treatments are now being developed to meet patients' needs through the use of real-world data (RWD). This signifies the industry's desire to gather data that provides real-world context and to use it to improve patient outcomes.

⁸ National Academy of Medicine, Social Determinants of Health, 2017

Digital Care Delivery Data



Delivery care models are leveraging data to optimise patient experience and outcomes. For clinicians, navigating complex patient factors while meeting organisational priorities remains a challenge. Multiple patient data sources and lack of system integration present roadblocks to accessing information across the patient journey. Continuity of care is further challenged when a patient's journey weaves through both private and public health systems, highlighting the truly disconnected nature of a given health experience.

“We know that most of the data we care about is going to be captured and generated outside the walls of provider organisations, I care a lot about the contextual information that gives us better insight into the overall patient experience.”

Christopher Boone, VP Global
Medical Epidemiology and Big Data
Analytics, Pfizer

Making Personalised Healthcare Happen

Any technology-driven solution to these issues is effective only if it is well executed with an outlook that considers future requirements. Through the combination of deep industry experience, a patient-centred perspective, agile engineering and cloud-native computing, we can make change happen and deploy an infrastructure that allows for continuous evolution and development as new technologies unlock new opportunities.



Making Personalised Healthcare Happen

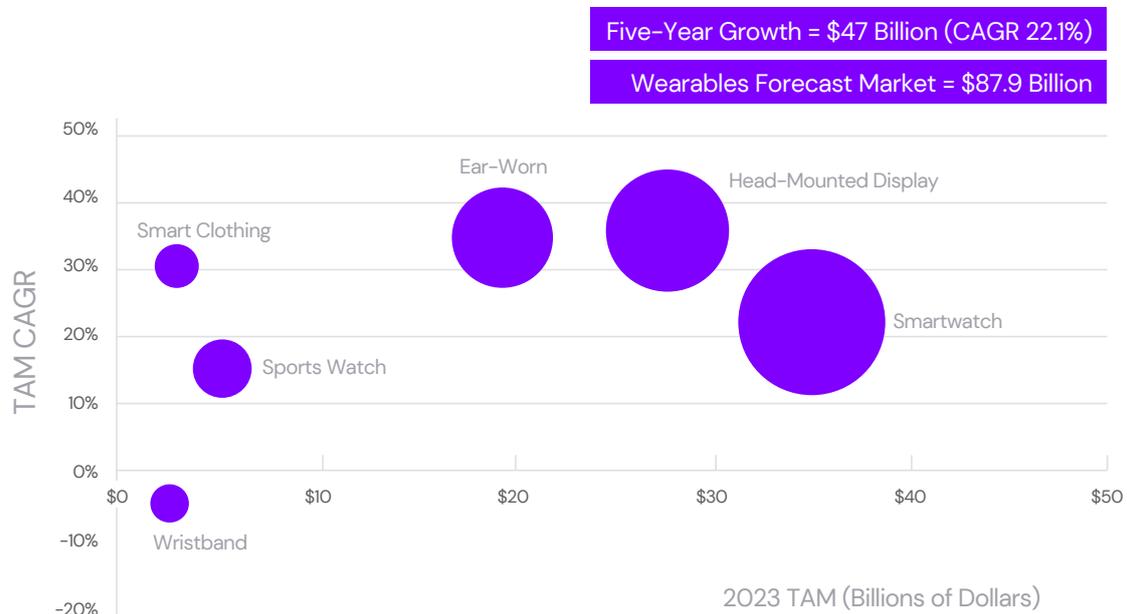
Sensors, Wearables and IoT

An increasingly sophisticated range of Internet of Things (IoT) sensors and health tech wearables can be used to gather and transmit patient health data. This means that reminders and prompts are based on the personal circumstances of the patient—there's no need to remind people to take pills they've already taken. The falling cost of IoT sensors and the increasing power of mass-market consumer-grade devices, such as Apple Watch, means that equipping patients with the tools to gather data is becoming more cost effective every day.

Sensor data isn't just valuable for understanding whether patients have taken medication or not. It can also be used to provide insight into the circumstances around why patients don't adhere—is a drug causing specific adverse reactions that mean that treatment has to be customised or adjusted? Freeing up time from self-reporting can enable patients to use real-time feedback tools to monitor their condition and give HCPs richer insight into the patient experience of using medication.

Wearables Forecast by Product Segment Through 2023

Wearable Forecast Revenue



Gartner Forecast: Wearable Electronic Devices Worldwide, 2017

Wearable devices can connect with each other and other devices to create an IoT network for performing highly personalised healthcare activities, such as diagnosis, monitoring and treatment. Increased data access and data sharing via these devices has the power to facilitate highly personalised care adapted to the individual patient's profile.

The market is vast and growing. Fitness trackers and smartwatches form a \$19 billion dollar worldwide market within the wearable technology category.⁹

These technology segments are rapidly evolving, and demand is being driven by an interest in the more robust features that device makers are offering. One in six consumers uses a wearable device, and, by current estimates, the next 25 years should see wearable technology save about \$200 billion for the healthcare sector globally.¹⁰

⁹ Gartner Forecast, Wearable Electronic Devices Worldwide, 2017

¹⁰ Forbes, Wearable Health Technologies And Their Impact On The Health Industry, 2019

Better Treatment Decisions

To make better informed, personalised treatment decisions, the ability to track multimodal symptoms in real-time and longitudinally is required to realise the opportunity for accurate and immediate intervention. Personal data collected by these devices is often supplemented with population-level data and processed on AI platforms. This generates insights to better inform diagnosis, predict patient outcomes and help HCPs select the best treatment for an individual patient.

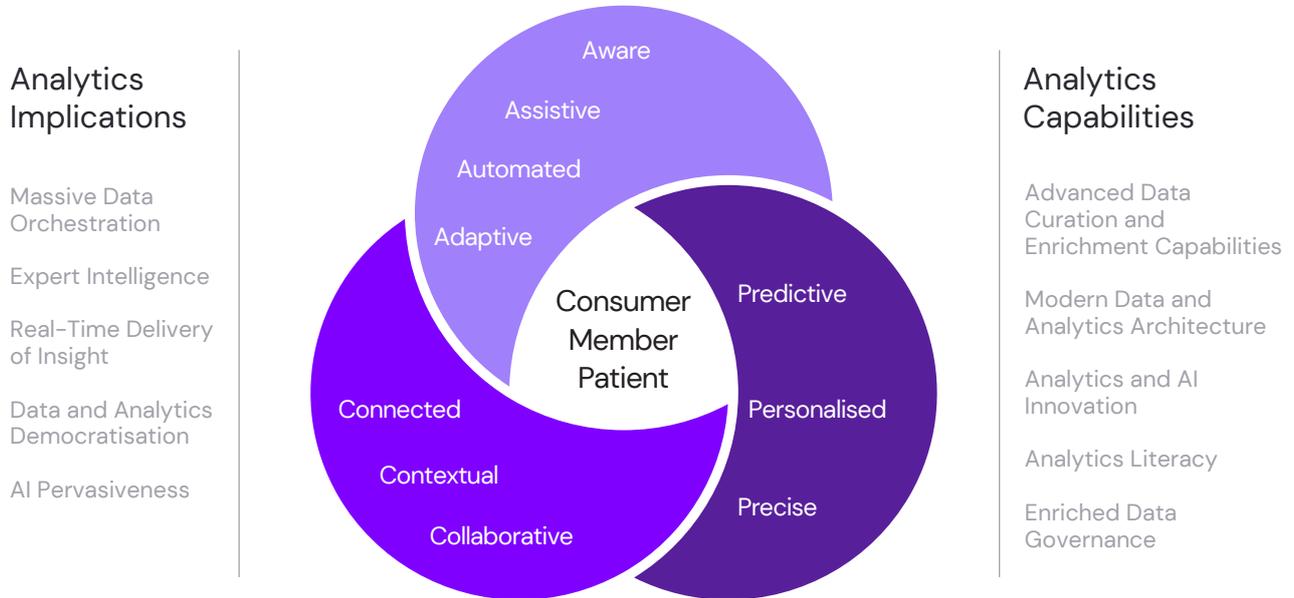
Fitbit was one of the pioneering wearables of the century, and even simple step-count data can have enormous benefits. One study of cancer patients, conducted by the Institute of Cancer Research (ICR) and the Royal Marsden Hospital, found that a higher step count was linked to a lower mortality rate. Professor Johann de Bono, who was involved in the study, said: 'This [the data gathered by Fitbit] can help doctors know how well they [patients] will be able to cope with treatments. It can also give us an idea of how long they have to live.'¹¹

Data can be captured and transformed into insights on the individual patient experience, making these insights accessible and actionable for HCPs to support patients in making the best decisions for them personally.

The recent acquisition of Fitbit by Google is set to accelerate innovation in the wearables category further and make health even more accessible. This is a testament to the impact technology will have. That said, grave concerns remain about the security of vast volumes of personal data and how Google will wield that power.

¹¹ The Telegraph, Fitbits Prescribed to Cancer Patients, 2019

Creating a New Era of Insight-Driven Healthcare New Era of Insight



Source: Gartner, Healthcare Innovation Trends: Creating a New Era of Insight-Driven Healthcare, 2019

A prominent example of wearables impacting treatment decisions is Technology Integrated Health Management (TIHM) for dementia, a pioneering study that aims to transform support for people with dementia and their caregivers. The study uses a network of digital devices installed in a person's home in combination with artificial intelligence to enable clinicians to remotely monitor the health and wellbeing of the person with dementia. If the technology identifies a problem, an alert is triggered and followed up by a centralised monitoring team.

Improving Efficiencies for Health Care Professionals

Access to rich, personalised data improves not only the accuracy of treatment decisions but also convenience for the care provider. HCPs can make quick, informed decisions, reducing time spent physically assessing the patient and searching through qualitative health records. It is estimated that 15 hours/week could be saved by doctors whose patients use wearable technologies . Experts predict that the use of digital health apps in five patient populations exhibiting reduced utilisation of acute care (preventative health, diabetes, asthma and cardiac and pulmonary rehabilitation) would save NHS £170 million per year and improve health outcomes.¹³

“It is estimated that 15 hours/week could be saved by doctors whose patients use wearable technologies.”

Business Insider 2019

¹² Business Insider, Wearable Technology and Medical Devices, 2019

¹³ IQVIA Institute for Human Data Science, 2019

Patient Empowerment

Continual monitoring of their data helps patients to feel a stronger sense of ownership and control over their health. This encourages their engagement and interest. Personal data collection through sensors and wearables means that patients can work more effectively and closely with their HCPs to manage their current health conditions and predict future conditions. This tracking and shared decision-making could yield better adherence to treatment plans and the adoption of preventative measures to avoid future health complications. For example, the humble pedometer has been associated with increases in physical activity and decreases in blood pressure and body mass index.¹⁴

The first FDA-approved pill with a packaged sensor for tracking patient usage debuted in 2017 under the name of Abilify MyCite. The tracked pill packet allows patients and HCPs to monitor daily dosage and consumption actively. It is expected to be especially useful to patients with diabetes and those on mental health medications, where strict compliance with dosage regimens is critical for successful management.

“71% of millennials expect to use mobile apps to manage their healthcare, yet most healthcare systems aren’t equipped to provide this option.”

Salesforce “State of the Connected Patient” Report, 2015

¹⁴ Diet and Exercise in Cystic Fibrosis, 2015

Better Tracking for Corporate Health Plans

Today, interest is growing in the use of wearables not only for individual self-tracking but also within corporate health and wellness programs. Access to up-to-date, detailed personal health data as well as mounting evidence to support the positive health implications of wearable devices means that insurance companies are integrating wearable tech into their insurance plans.

Apple has recently partnered with Aetna health insurance on a new app leveraging personal health data from its Apple Watch. The customer benefits from personalised goal setting, rewards and a tailored insurance plan. The advantage for Aetna is data access for more accurate forecasting, predictions and business improvements.

The link between personalised healthcare and improved health is another reason for the uptake in this sector. A global study found that users who wore an Apple Watch and participated in the Vitality benefits program averaged a 34 per cent increase in physical activity compared to patients without the Apple Watch. It equated to roughly five extra days of working out per month, which could lead to healthier clients and, by extension, fewer claims.¹⁵

One of the health-focused subsidiaries of Google's parent company, Verily, is developing a smart shoe that can help track weight and movement. This could provide another avenue for how corporate companies might want to track their clients' weight and activity.

¹⁵ Rand, 2019



Making Personalised Healthcare Happen

Healthcare Analytics

Data Analytics in Healthcare

Analytics can be understood as the link between data and effective decision-making within an organisation.

An unprecedented amount of personal data is being generated, stored, analysed and consumed in healthcare. Wearable devices and sensors are just one of many methods for collecting personal data. IBM Watson have estimated that HCPs would have to read 29 hours per day to keep up with the new literature that is published every day, making it impossible to keep up with the latest professional insights. The challenge for pharma is the manipulation of large amounts of unstructured, heterogeneous, non-standardised and incomplete healthcare data to unlock its potential to reveal the differences between patient profiles with unprecedented scale and resolution.

¹⁶ Health IT Analytics, Big Data to See Explosive Growth, Challenging Healthcare Organizations, 2018

This challenge has never been so great. A recent International Data Corporation report predicts a 36 per cent growth rate for healthcare data over the next five years, faster than in any other industry.¹⁶ As a result, the global market for technologies that can quickly and cheaply process high volumes of data is booming; next-generation sequencing is expected to grow by 21 per cent annually from 2017 to 2022. In this environment, data use is exploding across all dimensions. Half of all drug submissions for health technology assessments (HTAs) now use real-world evidence (RWE), and payer spending on data and analytics has grown 20 per cent annually in recent years.

Further data exists on the customer relationship management side of the business. Interactions between sales representatives and medical liaisons are captured in a host of ways. Unfortunately, data is infrequently leveraged to more effectively tailor support to HCPs based on their and their patients' exact needs. More streamlined and advanced analytics can significantly improve current interactions through greater personalisation. This nurturing improves relationships, particularly from an educational standpoint, and furthers the ability of HCPs to deliver the level of personalised treatment desired by the patients.

Prediction & Prevention

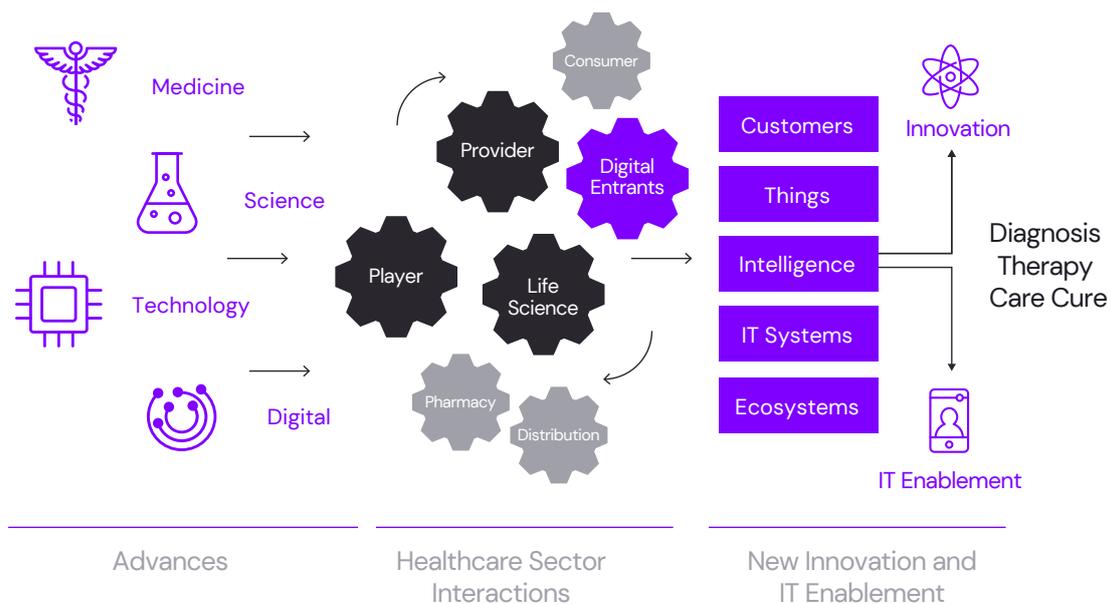
The ability to combine behavioural, psychosocial and biometric datasets with the existing sciences of epidemiology and clinical medicine can uncover insights about the relationship between a patient profile and the health risks associated with it. In turn, this allows for more accurate forecasting of health events as well as preventative interventions to be put in place.

23andMe provides a direct-to-consumer genetic testing service in which customers provide a saliva sample that is laboratory analysed to generate reports relating to the customer's ancestry and genetic predispositions to health-related topics.

¹⁷ NHS, Diabetes Prevention Programme, 2019

Elsevier Health Analytics mines an enormous dataset for disease trajectories using the temporal disease trajectory model. An individual patient's data can be inputted into this system to estimate the statistical probability of the de-novo occurrence of 1,600 diseases within the next four years. The NHS in the UK is pioneering a Diabetes Prevention Programme supplying wearable tech to those most at risk, with 5,000 patients initially in the pilot.¹⁷

Advances are Driving Innovation and New IT Demands in Therapy, Diagnosis and Care



Source: Gartner, Medical Innovations in Therapy, Diagnosis and Care Delivery, 2018

¹⁸ Roche Advanced Cancer Profiling, 2019

Personalised Diagnosis

Digital health allows vast amounts of data to be consolidated into one platform to create a 360-degree patient profile for physicians and other healthcare professionals to use in making faster, more informed decisions.

Foundation Medicine uses a combination of precise DNA sampling and sophisticated algorithms to provide a comprehensive genomic profile for each patient, isolating the genetic alterations of interest and leading to a more accurate diagnosis. Using this genetic profile, the published literature is then audited to match the profile with the best-known treatment option or clinical trial for that individual patient.¹⁸

Personalised Treatment

Delivering personalised healthcare requires high-quality, high-quantity data that matches patients to targeted treatments. But guaranteeing that patients receive the best treatment for them requires infrastructure to facilitate the match.

Roche's NAVIFY Tumour Board software solution helps HCPs manage and interpret all the diverse information available for a patient, from medical history to biomarkers, tumour information, radiology images, pathology reports and treatment notes. The software helps standardise the process, allowing tumour board members to explore more options for each patient, and facilitates collaboration with experts in remote locations. It also informs the physicians of clinical trials that a patient may qualify for, highlighting options in cases where no approved medicines are available.

“For healthcare professionals, the complexity and sheer amount of data and information they are expected to absorb and utilize is only **increasing.”**

Penelope Wood, Global Head for Personalized Healthcare Diagnostics Strategy at Roche Pharmaceuticals

Personalised Education and Communication with HCPs

For true personalisation of care, HCPs need the same attention as patients. The wealth of information on treatments and their regimens is expanding at an incredible pace, making it incredibly challenging to keep up with nuances and shifts in personalised treatment suggestions as new information is made available.

This means that medical drug and device companies, alongside insurers, are a critical part of the education puzzle when it comes to optimising the setting and delivery of personalised treatment. Data analytics provide a pivotal tool in the efficiency of this necessary information and education transfer.

Most recently, this lens has been employed to optimise communications with HCPs through the sales, medical education and CRM process. The concept of appropriate capture, collation and enrichment of data is gaining traction.

The idea behind this is to generate a detailed data dossier for each HCP, and this information can then be used more effectively to focus touchpoints and interactions. This in turn helps to facilitate the sharing of the most needed information at the right time and in the right format to meet the exact needs of that 'customer'. As the HCP sees the benefit of more personalised communications and support, greater collaboration around treatments and regimens can be achieved, supporting improved patient outcomes.

“The more data, the more you can enrich your knowledge of the customer journey and understand where the customer is within their nurture journey (i.e. ladder of adoption). The deeper that personalised journey becomes, whereby meaningful data can be captured, the more readily this can be turned into actionable insights that enable relevant experiences across multiple channels. Data science builds personas to help inform how the automated programme should behave in terms of what communications are sent and when.”

Joshua Hull, Kin + Carta Edit¹⁹

¹⁹ Joshua Hull, Data-Driven Marketing in Pharma, 2019



Making Personalised Healthcare Happen

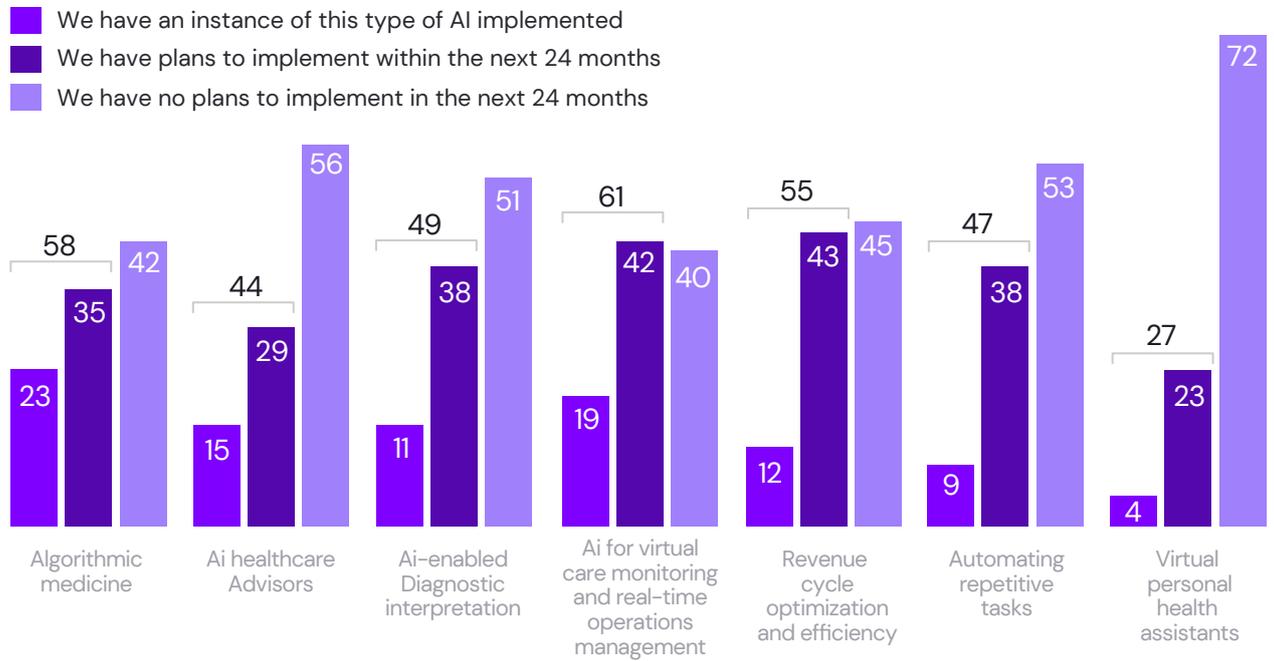
AI in Healthcare

Application for AI in Healthcare

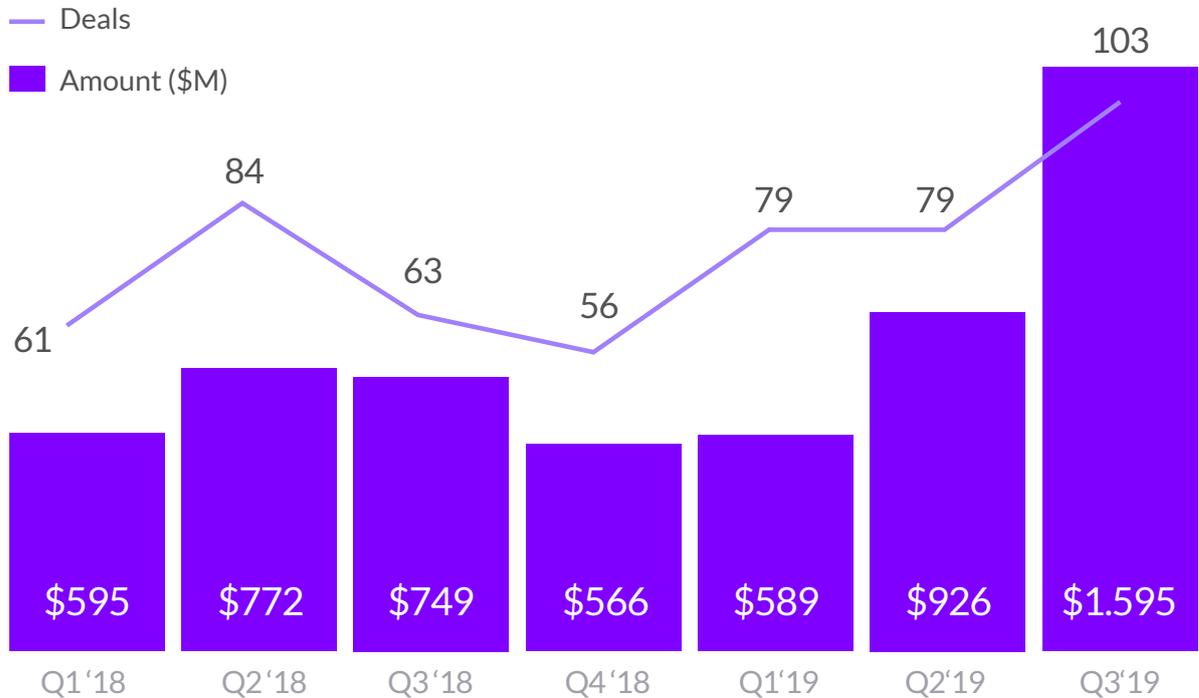
AI aims to move medical treatment away from general, one-size-fits-all options to more personalised solutions. Machines are inherently better than humans in some areas such as probabilistic, computational or data-heavy tasks needed for diagnosis and clinical triage, behavioural and data monitoring and remaining up to date with the most recent treatments.

The AI industry is booming. Healthcare AI is projected to be an almost \$200 billion industry by 2025.²⁰ Startups using AI technology have raised \$4.3 billion across 576 deals in the past six years, and healthcare providers are projected to save almost \$150 billion by 2026 with the help of AIs that can prevent medication dosing errors.²¹ Just in the last few months, Healthcare A.I. companies raised nearly \$1.6B across 103 deals, with a newly minted unicorn, Babylon, driving up the quarter's funding.²² It is clear that AI-powered technologies are gradually supplementing traditional healthcare methods to drive the delivery of more accurate and personalised treatment decisions.

Implementation Plans for AI Use Cases Percentage of Respondents %



Source: Gartner, Get Ahead of AI Innovation With Strong AI Governance, 2019



²⁰ Forbes, AI Trends in Healthcare, 2019

²¹ CB Insights, AI Healthcare Startups 2019

²² CB Insights Healthcare Report 2019

Source: CB Insights Healthcare Report 2019

“The industry as a whole is still trying to understand how best to utilize, and adopt, technologies like digital and AI. Investing in new technologies requires a willingness to take more risk than the industry is used to. I think you have to evaluate technologies through the lens of ‘can this make a difference to patients and can we play a role in helping it get to a point where that impact is a reality’.”

Penelope Wood, Global Head for Personalised Healthcare Diagnostics Strategy at Roche Pharmaceuticals

Personalised Diagnosis

The number of start-ups offering AI-powered platforms for the assessment and diagnosis of certain health conditions has been increasing.

Babylon offers its users a self-triage service via chatbot interaction (Ask Babylon), which suggests the appropriate next step towards treatment for that specific patient. Supplementary diagnosis services like this are hoped to significantly reduce cost and time pressures in the healthcare sector.

Healthy.IO was the first company to turn the smartphone into a regulatory approved clinical device. The AI-powered software uses computer vision to analyse urinalysis dipsticks through smartphone cameras to diagnose patients and help manage conditions. This empowers patients to test themselves at a time and place convenient to their personal needs, with no quality compromise, and securely share the results with a clinician. The technology boasts a usability rate of 95 per cent in FDA clinical trials covering 500 patients across demographics.

Personalised Treatment

Most AI-powered interfaces will provide advice and management for existing treatments rather than the treatment itself. However, some advanced AI platforms have the capacity to offer treatment for certain conditions, such as mental health and sleep management.

Ieso claims to be the world's first AI-enabled mental health treatment platform. Its therapists in the UK and US receive advice based on data analysed from tens of thousands of online CBT sessions, enabling data-led insights about each patient during the assessment stage of

treatment, providing the therapists with personalised predictions of patients' presenting conditions, the severity of presentation and the likelihood of completing a full course of therapy.

Personalised Disease Management

AI software has the capacity to store and learn from a patient's health data, building a unique medical profile to provide personalised care, particularly to those with chronic conditions. The democratisation of access to electronic health records (EHR) and smartphone apps for at-home health solutions is changing the landscape of healthcare. As that process this data are making it easier for people to receive more relevant advice for disease management, treatment adherence and a better overall standard of care.

Some platforms recommend tailored care plans, including exercise and nutrition targets, based on personal data and RWE from similar patients. Ada Health has a core system that connects medical knowledge with intelligent technology to help all people actively manage their health.

Some AI-powered apps provide a 'digital journal' feature where patients can log their symptoms. My COPD provides a self-management plan and inhaler diary so patients know when and how to take their medication. As well as the benefits of increased patient engagement, AI-based analytics can predict unfavourable outcomes and provide early warnings as well as advise on corrective measures to patients and their care providers. For example, Sentio Solutions' Feel wristband learns patients' mood state profiles and can deliver personalised advice and interventions to wearers according to their mood. This fascinating technology is based on a proprietary neural network model that can accurately detect 70 to 75 per cent of relaxed, anxious, excited and fun moods, using heart rate.

Personalised HCP Training

Some specialised AI-platforms provide HCPs with training specific to their needs in a way that simple computer-driven algorithms cannot. AI computers can draw instantly on an extensive database of scenarios, enabling fast and effective responses to questions, decisions or advice for a trainee in the most revolutionary way. Additionally, the training programme can learn from previous responses from trainees, meaning that the challenges can be continually adjusted to meet their learning needs. Training can be done anywhere and anytime. The power of AI on a smartphone enables quick catch-up sessions after a tricky case in the clinic or while travelling.



Making Personalised Healthcare Happen

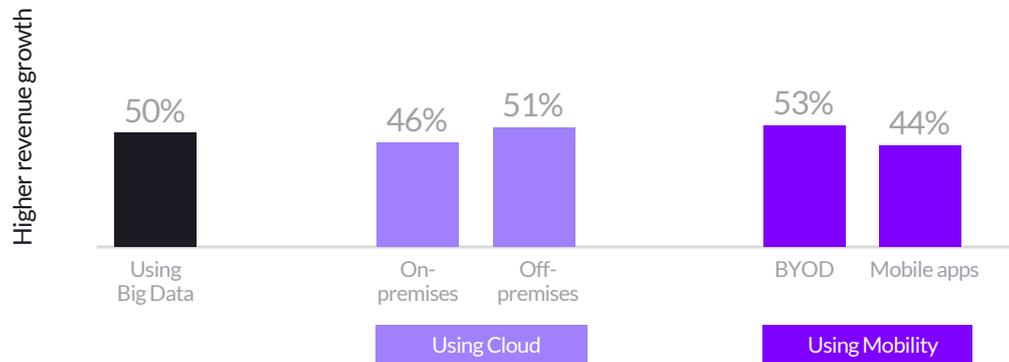
Transitioning to Cloud-Native

In terms of unifying the many disparate parts of innovation in healthcare, the most value-driven place to start is in transitioning to a cloud-native strategy. Beyond simply migrating current products and platforms to the cloud, changing the way information is shared, products are built and improvements are made pushes businesses one step closer to a truly connected healthcare ecosystem.

According to Gartner's 2018 Public Cloud Revenue Forecast, cloud users will double by 2021; at the same time, the market built around this technology will grow from \$153 billion in 2017 to an estimated \$302 billion by 2021. Also, Dell reports that companies that invest in big data, cloud, mobility, and security enjoy up to 53% faster revenue growth than do their competitors.²³

Dell GTAI 2015 Findings

Organizations actively using Big data, Cloud and Mobility are growing up to 53% faster than laggards



Source: Dell, Companies Growing Faster, 2019

The full value of the cloud comes from approaching it as part of a holistic strategy to rethink business processes for the digital age rather than digitising what you have. Just lifting and shifting legacy applications to the cloud won't automatically deliver the benefits. Cloud-native strategy is about the approach to how apps are created and deployed, not whether they are created on a mainframe or are serverless. And the benefits can be significant.

Speed to Market

Cloud technologies give healthcare firms the ability to innovate quickly as enterprises. First and foremost, companies can take advantage of the ability to acquire infrastructure instantly. Gone are the days when a team might need to wait weeks or even months to get a new server requisitioned in a data centre; cloud platforms, networking, computation and storage can all be requisitioned in minutes. Furthermore, because cloud infrastructure can be easily scaled, teams no longer must go through lengthy architectural reviews or sizing exercises before getting their infrastructure approved.

²³ Dell, What companies growing more than 50% faster are investing in, 2019

Cloud platforms support infrastructure as code, whereby developers can utilise scripting technologies, such as CloudFormation or Terraform, to generate the infrastructure quickly. Using infrastructure as code allows enterprises to define repeatable templates for infrastructure for application classes, such as internal web applications or analytics use cases.

Speed to market does not end with infrastructure creation. Modern cloud applications utilise continuous integration and deployment (CI/CD), a mechanism by which each unit of code can be delivered to a production environment. This allows for shortened periods between production deploys, with representative deployments often decreasing from months to days.

Finally, healthcare enterprises can take advantage of turnkey healthcare solutions available on cloud platforms. Amazon Web Services, Google Cloud Platform and Microsoft Azure all offer platforms supporting EHR as well as FHIR/HR7-compatible solutions to exchange electronic medical records (EMR). In addition, each major platform also provides guidebooks for HIPAA and HITRUST compliance.

Cost Rationalisation

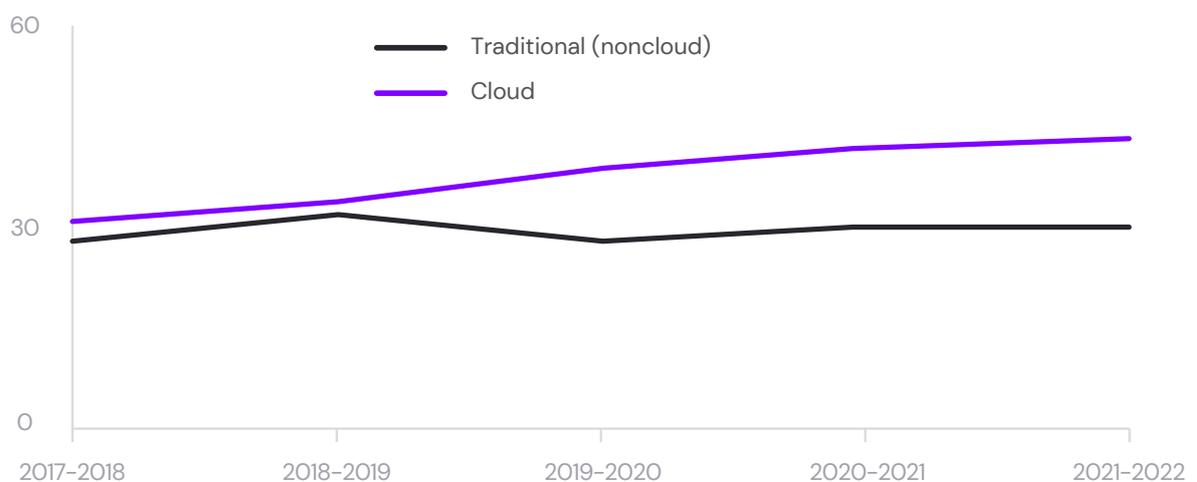
Cloud technologies offer an immediate opportunity to better rationalise IT expenditures. One of the most enticing aspects of cloud technology is the opportunity to convert significant capital expenses to operational expenses. Because cloud technologies can be requisitioned easily and scaling can happen automatically, firms no longer need to pre-purchase large amounts of equipment up front. Those expenses can instead be directed towards other imperatives, such as R&D, service provision, patient support, medical equipment and manufacturing.

²⁴ SCA, Investing AWS Pricing, 2018

One remarkable aspect of cloud technologies is the rapidity with which cloud vendors continue to reduce their costs. For instance, AWS has reduced storage prices by 83 per cent since 2009.²⁴ Any firm can take advantage of these prices immediately. These costs can be reduced even further by utilising spot instances, which compute resources that are bid by the minute. These instances can offer substantial savings over reserved instances and are ideal for batch processes or analytical jobs. Overall savings will contribute to increase revenue: according to Gartner, growth in enterprise IT spending for cloud-based offerings will be faster than growth in traditional (non-cloud) IT offerings through 2022.²⁵

As mentioned above, storage can be one of the greatest opportunities for cost savings. Particularly in healthcare, with the explosion in the use of connected devices, the cost-saving potential of cloud technology makes storing the data feasible in ways that storing it on premises never would be. Solutions such as AWS offer object storage using S3, which provides an inexpensive option to store the plethora of documents generated in modern healthcare systems. These cloud solutions offer

Growth in Revenue Worldwide, 2017-2022



Source: Gartner, Market Insight: Cloud Shift 2018

²⁵ Gartner, Market Insight: Cloud Shift, 2018

²⁶ Vansom Bourne, Cloud Computing Benefits, 2018

²⁷ Gartner, CASB Report, 2019

further cost savings by utilising infrequent or cold storage versions of S3, which can be utilised as a cost-effective solution for document archiving.

According to a study by Vanson Bourne, cloud infrastructure is having a measurable impact on business, with a 15 per cent decrease in average IT spending and a 17 per cent average reduction in IT maintenance cost²⁶ as a result. Also, half of all CIOs and IT leaders surveyed by Bitglass reported cost savings in 2015 as a result of using cloud-based applications.²⁷

Business Resiliency

Moving to cloud-based infrastructure gives IT a much-improved posture around business resiliency. Every major cloud vendor provides multi data-centre and multi region support; any firm taking advantage of these capabilities can be safe from the failure of any given data centre as well as large regional failures or natural disasters, such as hurricanes. According to Salesforce, whereas 20 per cent of cloud users claim disaster recovery in four hours or less, only 9 per cent of non-cloud users can claim the same.²⁸

For a healthcare industry that is quickly becoming more global and interconnected, cloud technologies offer vital solutions. The major cloud vendors offer global content delivery networks (CDNs) to facilitate serving content, such as web pages, images and video, around the world. For healthcare firms working with interconnected data across several continents, Google's Spanner database is a unique offering that offers quick performance and strong consistency guarantees all across the globe. For firms with a wide variety of data needs, Microsoft's Cosmos database offers a variety of storage options, reliable performance and global scalability and replication.

Cloud technologies don't just protect against large-scale failures.

²⁸ Salesforce, Benefits of Cloud Computing, 2019

They also offer automated scalability to help with unexpected spikes in demand. Where traditional IT struggles with large changes in application usage, cloud technologies handle these changes with ease. Cloud platforms are either scalable services by default (for example, Amazon S3 or Google Cloud Run) or are built upon platforms-as-a-service (PaaS), which can trigger auto-scaling rules (i.e. Amazon Elastic Beanstalk).

Security and Compliance

With all the advantages laid out above, why aren't healthcare businesses moving more aggressively to the cloud? Security remains the single largest concern. However, we maintain that moving to cloud-based solutions can decrease exposure to security risks, instead of increasing them. Through 2024, workloads that leverage the programmability of cloud infrastructure to improve security protection will suffer at least 60 per cent²⁹ fewer security incidents than those in traditional data centres. In fact, 61%³⁰ of security professionals now believe that the risk associated with a security breach in a cloud environment is the same as or less than that of software installed on-premise.

Scalable cloud technologies are far more resilient to external bad actors. Cloud vendors provide sophisticated and intelligent intrusion detection systems. Google, Microsoft and Amazon base these systems on their own internal tools, which they have used for decades to protect their own sizable internet presences. The platforms also offer advanced monitoring and logging capabilities at the application level to help developers understand when the systems are being tested. Additionally, major cloud vendors respond quickly to large-scale security issues. For example, when an Intel chipset bug was discovered

²⁹ Gartner, Innovation Insight for Cloud Security, 2019

³⁰ Nominet, Cyber Security and the Cloud, 2019

³¹ Amazon, Intel Quarterly Security Release, 2019

³² Rapidscale Cloud Computing, Status & Recovery, 2019

in the first half of 2019, Amazon was able to quickly release a patch³¹ to address the vulnerability across all of its EC2 instances.

Healthcare businesses are rightly concerned about compliance. HIPAA, HITRUST and GDPR compliance guidebooks are available for all the major vendors; these guidebooks provide a straightforward, secure path to compliance for firms moving to the cloud. RapidScale claims that 94 per cent of businesses saw an improvement in security after switching to the cloud, and 91 per cent said that the cloud makes it easier to meet government compliance requirements.³²

At the infrastructure creation level, the ability to write code to generate infrastructure (commonly referred to as infrastructure-as-code) is an important security feature. Because this infrastructure is created as code, security teams can establish baseline secure setups and ensure that these baselines are used for any applications being developed. In addition, this infrastructure code is automatically documented and version controlled in a system, such as Git, so any changes can be tracked and audited. In this way, infrastructure teams can avoid 'snowflake' configurations, where administrators make one-off, undocumented changes.

Finally, enterprises can—and should—set up code review processes so that infrastructure architects, security reviewers and application teams can collaborate to review any changes occurring in the infrastructure. The ability to ensure that all infrastructure aligns with base templates and all changes to those templates are reviewed by relevant parties helps provide greater security than that found in traditional data centre environments.

Making it Happen

At Kin + Carta, there's a reason we refer to our family of organisations as The Connective.

When healthcare-focused consultants work alongside product designers, the strategy, vision and technology necessary to design patient-centred experiences are clear from the start. When engineering teams sit alongside data scientists and marketing specialists, data can be shared faster, experimentation never stops and new opportunities are uncovered in real time.

We believe that the key to creating lasting change is to put the right people in the room. If you'd like to continue the conversation about creating patient-centred, technology-driven solutions for your business, our team of specialists is eager to hear from you.

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The Health Care Disconnect
Making Personalised Healthcare
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