

# WHAT IS DIGITAL HEALTH? AND WHY DOES IT MATTER?

White paper

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 **DIGITAL HEALTH**  
WORKFORCE ACADEMY

HISA  AUSTRALIA'S DIGITAL  
HEALTH COMMUNITY

What is digital health? And why does it matter.

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## PREFACE

This Whitepaper is provided to outline a viewpoint and its implications. The viewpoint is that digital health is not just new jargon for 'e-health' or 'health IT', but represents a paradigm shift. The implications are profound. If health's decision-makers do not see the difference, they may miss the opportunities associated with digital health, and run aground on its challenges.

The tagline for the Digital Health Workforce Academy (DHWAcademy.com) is: Your future in health is digital. Understanding what digital health is all about is the first step towards this future.

The views expressed in this paper are those of the author and the Digital Health Workforce Academy alone, and are not attributable to any other organisation with which the author is associated. Thanks are given to Uschi Schreiber, Michael Walsh and Drs John Zelcer and Louise Schaper and others, who provided both encouragement and input.

The purpose of this paper is to promote and provoke discussion about the nature of digital health – before we are overtaken by it. Please discuss!



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## From HISA

HISA has had a long association with David Rowlands. He has served as a HISA volunteer for well over a decade, has been Board Chair and in 2018 was awarded Life Membership. David was instrumental in the development and ongoing evolution of the Certified Health Informatician Australasia program and currently volunteers as HISA's Chief Health Informatician and Board Director.

HISA is pleased to support and give our full endorsement to this important paper.

In recognition of the importance of 'digital health' to the future of our health system and for health, HISA

changed its tagline in 2014 to 'Australia's Digital Health Community'. We see digital health as being a distinct and important evolutionary step in how healthcare functions and even as to how healthcare itself is defined. It is the digital health era which will bring about a time where digital is so embedded in health that we can go back to calling it simply 'healthcare'. Health informaticians and a health workforce skilled in health informatics and digital health will be critical to enabling this future.

This paper is to support all those individuals who make up Australia's digital health community and who are, together, delivering the future of health.

# EXECUTIVE SUMMARY

Health organisations all over the world are developing and implementing digital health strategies, and companies from start-ups to long-established players are spruiking digital health. But are we all talking about the same thing?

This paper presents the view that digital health is in fact something quite new – an evolutionary step in the 70-year journey of the use of information and communications technology (ICT) in the health sector, but a step that transcends technology.

It presents digital health as health and healthcare in the context of digital societies. Digital health harvests data, information and knowledge in real time from all societal activities, not just interactions with the health system and/or data traditionally regarded as 'health' data; uses sophisticated analytics to distil knowledge from these data; intervenes in the widest possible range of societal and economic activities and technologies to encourage and generate better health and better value for health investments; and is citizen centric, decentralised and requires health service providers to participate, not control.

The digital health era will be characterised by major shifts in citizen-and consumer centricity, industry convergence and the range of services offered. It will be funded, regulated, delivered and consumed by a significantly different population – digital natives.

The expectations of healthcare's consumers and providers are diverging at pace, and the tipping point for digital health in Australia is likely to eventuate during the 2020s – driven by consumers.

Digital health, and its associated disruption is upon us. There are useful lessons from other industries that have already experienced

disruption at scale. These are lessons the health sector, seen as a relative laggard in terms of digital intensity, must learn from. Barriers that health can expect to face include employee and professional pushback, lack of appropriate organisation and/or system wide strategy, lack of expertise to lead digital transformation, rigid organisational structures and policy settings, and traditional funding models that are not equipped to manage health in a digital society.

This paper calls for further conversation as a precursor to development of Australia's next digital health strategy, but is equally applicable to atsub-national and organisational levels. It calls for health's leaders to get on the same page concerning the nature of digital health and to reach consensus on what we need to do to realise its potential. It calls for citizens and consumers to take the lead, as they have done in other industries. It calls for national conversations about:

- The nature of digital health, and the distinction between digital health and digital health technologies
- The nature of system changes required
- The nature of changes required from health and professional workforces, and
- The nature of leadership required

Digital disruption tends to start slowly but accelerate quickly. It is fast approaching in the form of digital health. Now is the time to explore the nature of the issue and ensure readiness.

Digital health is not about technologies. It is about health.

To comment on this paper, please visit [www.linkedin.com/company/dhwacademy](http://www.linkedin.com/company/dhwacademy)

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# 01

## WHAT IS DIGITAL HEALTH, AND WHY DOES IT MATTER?

### **“The beginning of wisdom is to call things by their right names”**

(Proverbials.com, n.d.).

The era of digital health seems to be upon us. Health organisations all over the world are developing and implementing digital health strategies, and companies from start-ups to long-established players are spruiking digital health. But are we all talking about the same thing?

Many people and organisations seem to have simply interchanged the words ‘digital health’ for terms they previously used such as ‘health IT’ and ‘e-health’.

This paper presents the view that digital health is in fact something quite new – an evolutionary step in the 70-year journey of the use of information and communication technology (ICT) in the health sector, but a step that transcends technology. This difference in perspective is important. It underpins why transformational changes are needed in order to take advantage of the potential of digital health.

The Chinese proverb quoted above pinpoints the purpose of this paper. We can’t manage what we don’t recognise and/or understand. If we don’t discern a fundamental difference between ‘health IT’ and ‘digital health’, we run the risk of missing out on the latter’s potential.

This paper represents a call for further conversation as a precursor to development of Australia’s next digital health strategy, but is equally applicable to other countries and at sub-national and organisational levels. It represents a call for health’s leaders to get on the same page concerning the nature of digital health and to reach consensus on what we need to do to realise its potential.

First, some definitions of digital health are discussed before presenting it as an evolutionary concept. Then, some critical issues are highlighted and finally a series of stakeholder imperatives and next steps are called out.

This paper takes a systemic view. Its focus is changes to the entire health system. However, change does not happen evenly across industries, sectors or societies. Rather, changes occur incrementally, sporadically and are unevenly distributed until a critical mass is reached – a tipping point beyond which the change becomes the new norm. This paper posits that we have not yet reached the tipping point for digital health, but readers should not infer that the change is not happening. Rather, there are leaders and laggards, and a critical mass has not yet been reached.

## Some definitions

The explanatory statement to the governing legislation for the Australian Digital Health Agency (ADHA) defines digital health as:

“any application of information and communication technologies in order to improve healthcare and health outcomes” (Cormann, 2016).

On its website, ADHA describes digital health as being “about electronically connecting up the points of care so that health information can be shared securely” (ADHA, n.d.).

The former does not imply that digital health is anything new or different. Information and communication technologies (ICT) have been used in healthcare for the last 70+ years. The technologies have matured, and their sophistication and ubiquity are accelerating exponentially, but ICT is still ICT.

This description of digital health is also too limited. “Electronically connecting” is not the same as digitally connecting. Faxes are electronic, but do not share information in digital form. The “points of care” may be interpreted widely by some, but digital societies will capture all sorts of information not traditionally associated with healthcare. Is a citizen tracking their sleep quality through a smart watch a point of care? Most people would probably think not, yet devices such as this will be important sources of information in the world of digital health.

From the perspective of this paper, both of these descriptions miss the mark.

Other descriptions of digital health include:

- “The implementation of HIT [is] referred to as

digital health interventions” (Shaw, Hines, & Kielly-Carroll, 2018).

- “The use of information technology/electronic communication tools, services and processes to deliver healthcare services or to facilitate better health” (Canada Health Infoway, n.d.).
- The combination of e-health (“the cost-effective and secure use of ICTs for health and health-related fields”) and m-health (“the provision of health services and information via mobile technologies”) as well as emerging areas, such as the use of advanced computing sciences in big data, genomics and artificial intelligence” (WHO, 2019, p. ix).
- “The range of services and technologies that allow patients to seek help without physically going to a hospital or clinic” (Ericksen, 2018).

Definitions such as these are similarly limited. Infoway’s has the same limitation as ADHA’s – it suggests nothing new. WHO’s and Ericksen’s focus on specific technologies – pieces of the puzzle rather than the picture as a whole.

These limitations are described by McDonald in relation to digital society more broadly:

“We are entering the next age of digital, leaving behind the prior one with its application of digital technology to make resources more information intensive and connected. Those terms [digital technologies] continue to describe what it means to be digital, but not how those characteristics are being applied to the world” (McDonald, 2019).

# DIGITAL HEALTH IS MORE THAN TECHNOLOGY

Sonnier describes digital health as:

“The convergence of the digital and genomic revolutions with health, healthcare, living and society” (Sonnier, 2017).

The Scottish Digital Health and Care Institute also refers to the union of digital health and genomics (DHI, n.d.) in its definition.

Descriptions such as these are influenced by futurist Alvin Toffler’s thinking on epochal changes in the nature of society. Indeed, Sonnier describes digital health as a fundamental element of the ‘fourth wave’ which, in Toffler’s words, “combines information technology with the genetic advances that we’ve made into a completely new wave of political, religious, ethical and legal changes” (as quoted by Alderman, 1997). The first three of Toffler’s waves were the agricultural, industrial and digital revolutions.

This concept of a fourth era is also used by the World Economic Forum (WEF) in its description of the fourth industrial revolution, a fusion of the physical, digital, and biological worlds that is driving societal transformations globally and is characterised by its speed, scope and systems impact (Schwab, 2016). Schwab’s first three industrial revolutions were enabled by steam power, electricity and electronics and IT respectively.

Toffler’s fourth wave and Schwab’s fourth industrial revolution point to dramatic changes in societies overall. The scope of this paper is limited to health, but like the fourth wave paradigms it sees digital health as a substantive shift, and seeks to expose important consequential issues for health and healthcare. This perspective sees digital health not just as technology-driven and enabled, but as health and healthcare in the context of a society which has evolved to rely on and use digital information and technologies in virtually every facet of life. Digital health is not how we do health, it’s what we do in and with regard to health.

The Australian and New Zealand Productivity Commissions recently provided a useful parallel in relation to the economy:

“Given the ubiquitous nature of ‘digital’ in everyday life, there is little to differentiate the digital economy from the broader economy; in other words, the digital economy is the economy” (Australian Productivity Commission and New Zealand Productivity Commission, 2019, p. 1).

**Digital health is health – or at least it will be.**

## Revolution 5.0?

Very recently, some business and societal leaders have begun to reference a fifth revolution coming close on the heels of the fourth – for example Keidanren (the Japan Business Federation) on “Society 5.0” (2016) and Vollmer on “Industry 5.0” (2018). Whether or not this nomenclature gains traction, the underlying themes feature personalisation taken to new levels, far greater

industry convergence and the digital transformation of society itself, not just its components, and are powered by artificial intelligence (AI), robotics and the Internet of Things (IoT).

These themes are all associated with digital health, as described below.



# 02

## AN EVOLUTIONARY PERSPECTIVE

The central premise of this paper is that digital health is something quite new – a progression along the evolutionary path of ICT in healthcare but constituting a great leap forward and transcending technologies rather than just the next technological step.

In sociological terms, the progression from one era to the next constitutes a tipping point – a critical

point beyond which a significant (often unstoppable) effect or change takes place (Merriam-Webster, n.d.). However, it is not always easy to discern such change when immersed in it.

The starting point for the evolutionary pathway to digital health was the 1950s, when IT and telecommunications began to be used within the health sector.

### The First Wave: ICT in Health (early 1950s)

The Electronic Age is generally regarded as beginning around 1940, when the first computers as we know them today were created. The first general-purpose computers for commercial use appeared in the early 1950s.

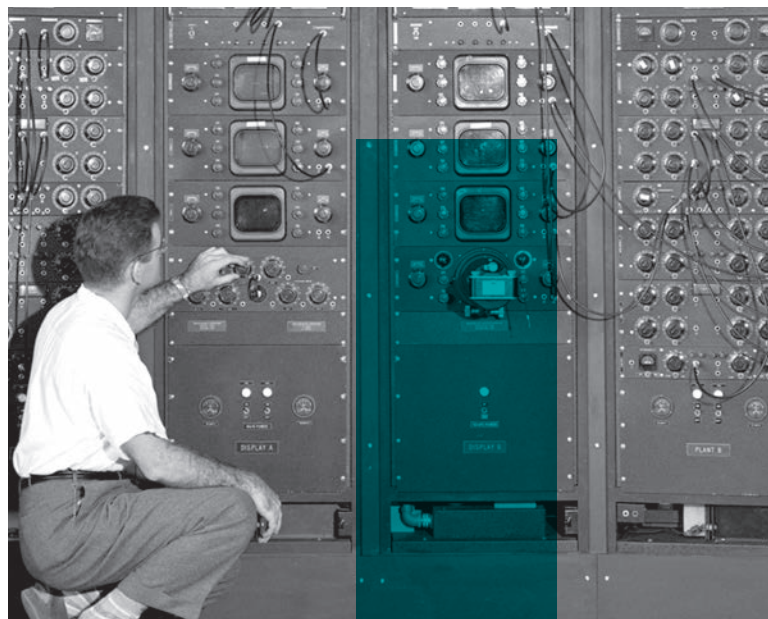
These were the days of huge mainframe computers, and code written in machine and assembly languages. Both the hardware and software were prohibitively expensive for tailored applications, so they tended to be used across industries to automate highly standardised, process-intensive functions such as accounting and payroll.

These applications were functionally driven, and industry-agnostic.

The use of applications such as these in healthcare can be termed the era of IT in Health. It was preceded by the existence of problem-oriented medical records, which developed from the 1920s to the 1940s, and enabled by breakthroughs in information technologies. It had relatively little impact on the core functions of healthcare, focusing

instead on corporate support functions that had greater commonality with other industries.

The “C” in ICT was also very limited during this period. The deployed telecommunications infrastructure was extremely limited by today’s standards.



An early version of the modern computer in Cleveland, Ohio, US (1949), Source: Wikimedia Commons

## The Second Wave: Health ICT (mid 1960s)

The next set of breakthroughs in information technologies enabled an evolutionary leap. These breakthroughs were initially in the form of hardware and software, then in telecommunications. The early 1960s saw vacuum tubes being replaced by transistors and punch cards by magnetic tape and disks, and the introduction of higher-level programming languages such as FORTRAN and COBOL. Individual transistors were replaced by integrated circuits from the mid-60s, and microprocessors holding memory, logic, and control circuits on single chips proliferated from the late 1970s, enabling personal computers.

In the health sector (assimilated from Collen, 1986, Cesnik, 2010, Haux, 2010, Thede and Sewell, 2012; and UIC, 2014):

- Shared data-processing centres were providing some larger hospitals with business system processing by the mid 1960s, and some hospitals were beginning to implement patient care applications.
- The US Congress amended the Social Security Act to include Medicare and Medicaid in 1965. To qualify for reimbursement, nurses were required to provide data to document the care delivered. This US development provided impetus to the development of nursing informatics and modern performance reporting.
- The American College of Pathology began to systematise the language of pathology, also in 1965, initiating the long journey towards SNOMED as we know it today.

- In 1968, Dr Lawrence Weed at the University Medical Center in Burlington, Vermont, commenced development of PROMIS – the Problem Oriented Medical Information System. This was the first recognised attempt to provide a total, integrated system that included all aspects of healthcare, using as its framework the problem-oriented medical record.

The advent of mini and personal computers, the proliferation of telecommunication networks with ever increasing bandwidth, the greater abstraction and re-use associated with modern software languages, and ICT commoditisation all continued to accelerate the expansion of Health ICT – the second era of the sector's use of computers. IT was deployed throughout hospitals, and later health services based in communities. Big, integrated systems co-existed with best-of-breed in hospitals to satisfy departmental as well as whole-organisation needs, and practice management systems were developed and deployed in smaller health services.

The focus of health ICT was the healthcare organisation. It was provider-centric, and for most of this period, focussed on corporate applications for healthcare – it was more about healthcare logistics and performance management than about clinical and patient/citizen needs.

## The Third Wave: E-Health (2000s)

The impetus and enablers for the third era of health's use of ICT resulted from both demand and supply factors. On the demand side:

- Health needed to more systematically address chronic conditions, which had taken over as the leading cause of mortality and morbidity in western societies. This required greater information sharing across the health system and more structured communication.
- The magnitude of safety and quality issues facing the health system became evident following landmark reports by the US Institute of Medicine (IOM)<sup>1</sup>, and led to recognition that systematic responses were required in clinical practice, cross-organisational coordination, the diffusion of evidence and good practice, clinical access to knowledge, etc.
- 24/7/365 consumerism also began to play a part. Healthcare patients/clients began to expect their health needs to be satisfiable anytime, anywhere, as was increasingly the case in other parts of their lives.
- Clinicians were beginning to make real demands that ICT service their needs, not just their organisations' performance management needs.

Demand-side factors such as these catalysed a shift away from the focus on single organisations supported by the health ICT era, to a whole-of health system approach (theoretically at least).

On the supply side:

- The Internet matured and proliferated, followed by mobile technologies then social media.
- Advances in genomics and the digitisation of images began to create large increases in the quantity of health data. Advances in materials science and 3-D printing began to fuse the physical and ICT sciences, as noted by Schwab (2016), and the boundaries between medical devices, robotics and ICT began to blur.
- Advances in telecommunications, with nationwide rollouts of 3G, 4G and 4GLTE networks began to release higher bandwidth to anyone who wanted it.
- Breakthroughs in AI and machine learning began to enable their more ubiquitous use in everyday life (eg in search engines) and began to penetrate healthcare, driving big data capture and analysis.

While momentum for e-health in Australia was building from the mid to late 1990s, and the language changed to reflect that, the tipping point making it a reality was reached around the mid 2000s. From that point on, e-health became the predominant target for the health system overall and e-health capabilities became essential requirements.

The need for system-wide information flows drove the quest for healthcare interoperability and governments around the world became key players in and funders of *e-health*, the third era. E-health was widely recognised as a paradigm shift, warranting this new term, though as for digital health, the term was variously defined. Descriptors included (Oh et al, 2005):

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<sup>1</sup> Institute of Medicine (IOM)'s 1999 report *To Err Is Human: Building a Safer Health System*; followed by their 2001 report *Crossing the Quality Chasm: A New Health System for the 21st Century*

- “The use of information technology in the delivery of healthcare”
- “The application of e-commerce to healthcare and pharmaceuticals”
- “All forms of electronic healthcare delivered over the Internet, ranging from informational, educational and commercial products to direct services offered by professionals, non-professionals, businesses or consumers themselves”
- “Connectivity”
- “A consumer-centred model of healthcare where stakeholders collaborate utilizing ICTs including Internet technologies to manage health, arrange, deliver, and account for care, and manage the healthcare system”

One of the commonalities associated with definitions of e-health was that “health ... usually referred explicitly to healthcare as a process, rather than to health as an outcome” (Oh et al, 2005).

Perhaps the most obvious manifestation of the e-health era has been enterprise-wide (multi-organisation) shared health records and regional/national health records, for example My Health Record in Australia, shared-care records in other nations and Health Information Exchanges in the USA.

The focus for this era is the healthcare delivery system, not just individual organisations. Although often described as patient-centric, it is better depicted as patient-following, but still provider-centric – patients began to be given access to (parts of) providers’ records but the vast bulk of healthcare data was still provider-associated and controlled.

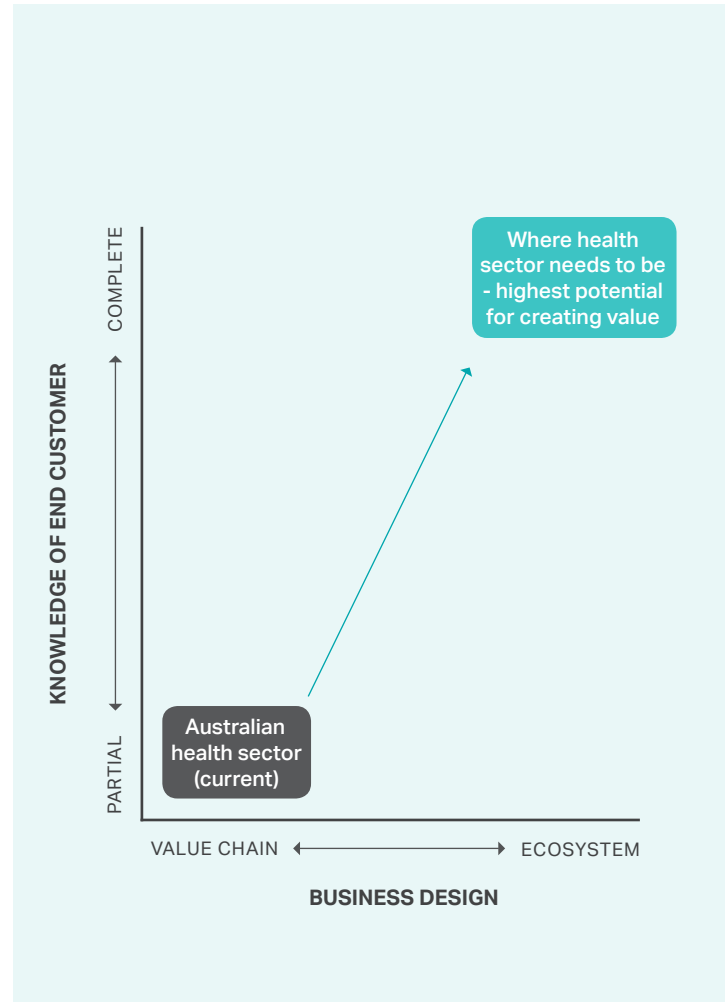


Figure 1 – Health sector ‘s value creation parameters<sup>2</sup>

<sup>2</sup> Inspired by Weill & Woerner, 2015 model on value creation parameters

# The Fourth Wave: Digital Health (2020+)

The maturing of various technologies such as data analytics, AI and machine learning, robotics and Cloud-based services, and further advances from nano-tech to neuroscience have all begun to open new thresholds of possibility. Exponential expansion of the Internet of Things (IoT), health apps, 'always on' devices and immersive interfaces including augmented and virtual reality, hypersurfaces and health linguistics are beginning to make medical-grade data capture easy and ubiquitous, and further heighten consumer and clinician expectations.

The digital health era is about health, not just the healthcare delivery system. It is citizen centric. It is enabled by exponential increases in the pervasion of ICT throughout digital societies/economies, and driven by citizens' demands that their health and wellbeing are controlled by them, and citizens' expectations that health services respond to their needs as other services do – digitally, with workflows (lifeflows) embedded within *their* life patterns rather than within the patterns of convenience of health service providers.

This is a consistent template for truly digital organisations/industries/economies/societies. They ensure that their workflows can be accommodated within their users' lifestyles and patterns, and reap the rewards of doing so in terms of the value of digital assets generated and leveraged. Weill and Woerner (2015) map digital business models in terms of extent of knowledge of end customers and business design, illustrated in Figure 1.

Referencing Weill & Woerner (2015) model, most Australian health services would currently be categorised as:

- Having deep knowledge of *some* aspects of some of the "customers"<sup>3</sup> they interact with, but quite partial knowledge overall; and
- Being only one of a range of suppliers of healthcare to their "customers" – ie being part of a value chain rather than an ecosystem.

Accordingly, Australia's health sector lies towards the bottom left in Figure 1. Despite being surrounded by a digital society, the health sector is lagging. Digital health organisations can be expected to seek to be more value-based by shifting towards the top right.

## Patients vs consumers

All words carry historical, cultural, sociological and political connotations. Attachment 1 provides brief discussion of the rationale for using 'consumers' and 'customers' in this paper in preference to 'patients'. In short, the connotations of these terms, implying choice, expectation and empowerment, are better aligned with digital health.

The pervasion of increasingly sophisticated ICT throughout people's lives will enable healthcare to be delivered much more ubiquitously, when, where and how patients want it, particularly in primary care. It will enable advances in prevention, early detection and early intervention, and precision health. It will enable citizens to decide how and where their data are assimilated and used.

The digital health era will be characterised by major shifts in:

<sup>3</sup> For example, a hospital may know a great deal about a specific aspect of a patient's illness, but know relatively little about their overall health and wellness, their service preferences, the patterns of behaviour that might influence their access and experience, the social determinants of their health and wellbeing etc, and may know very little of their formal and informal carers - at the very least stakeholders if not also 'customers'.

**1. Citizen-and consumer centricity.** The e-health era saw the beginning of a shift away from health service provider centricity towards health system centricity. Digital technologies were re-oriented to connecting providers, and sharing (often summarised) patient data between authorised providers. Patients and some carers have been increasingly able to access some of the data held by providers about them through patient portals and shared electronic records. Consumers have been able to add some of their own insights to some of these data holdings, and increasing numbers of patients are being advised to use health apps and access peer-patient communities online.

The digital health era will greatly expand such practices, and some may even see it as breaking them. Consumers will increasingly choose where and how they store their data and make it accessible to providers (eg via Apple Health). They will choose between service models to find the ones that best fit their lifeflows rather than those of their clinicians. They will express their requirements and expect providers to meet them, rather than traditional “take it or leave it” (remain patient) modes. A great deal of improvement in health and wellbeing will focus on citizens, not just health service consumers, and not involve traditional health services at all.

**2. New entrants.** Digital disruption is being driven by players that have not traditionally been part of healthcare – big tech, telcos and digital entrepreneurs. Large multinational companies such as Amazon, Facebook, Google, Apple, Uber and Salesforce are investing heavily in health and are not simply investing in ‘health as usual’ but are developing models of health provision that are likely to disrupt healthcare business models and healthcare service delivery at a global scale. Locally, telecommunications company Telstra has invested heavily in health since forming Telstra Health in 2013. Likewise, venture capital investment in health

is in the multi-billions globally. In the USA alone, USD\$5.5B of investment has poured into digital health start-ups throughout Q1-Q3 2019 (Day, 2019).

**3. Industry convergence.** Just as in other parts of the economy, the boundaries of health service delivery are no longer just blurring but are beginning to overlap with other sectors/industries. Health service delivery and pharma are moving from consumer-supplier relationships to competitors/collaborators, and not only are health, aged and social care continuing to overlap, but increasingly health-related services can be provided or enabled by housing and automobile (IoT’s on wheels) providers, lifestyle businesses, tourism operators, etc.

In the USA, retail giant Walmart now offers a range of health-related services including screenings, immunisations and insurance plans and there is little doubt that Amazon is also inclined in this direction, having acquired pharmacy licenses in several US states and acquired PillPack, which mails prescriptions to people taking multiple medicines.

The bottom line is this. The things that influence one’s health often aren’t clinical<sup>4</sup>. Health and ill-health are pervasive - wherever people go and whatever they do there are opportunities to embed health and related services.

**4. Role convergence.** As is occurring in other industries, the carefully guarded and protected boundaries of professional practice for clinicians will diverge and meld. While core competencies of specific roles may not move, what will blur are those competencies and activities at the edges of what has traditionally defined clinical roles. This is likely to be strongly resisted but will be driven by a multitude of factors on both the demand and supply side of health service delivery.

<sup>4</sup> For a wonderful diagram showing visually those determinants of health see [www.goinvo.com/vision/determinants-of-health](http://www.goinvo.com/vision/determinants-of-health)

Recently graduated doctors are not content with traditional career pathways they see as restrictive to their digital health interests. Midwives and nurse practitioners can already prescribe medication, while the push for pharmacist prescribing is being actively opposed by GPs. As demand for health services continues to outstrip supply, this convergence will accelerate. Much of the role convergence will be enabled through technology such as the use of artificial intelligence surgical robotics and telementoring to enable nurses and midwives to be trained to perform some surgery (Mohr, 2019).

- 5. Origin of data.** The origin of data used by health professionals, patients and citizens. Until now, virtually all data used for clinical purposes has been captured via patients transacting with the health system. Other data, including patient-supplied data, has been seen as largely contextual and peripheral.

However, vast amounts of new health and health-relevant data will be captured via sensors in home, working and civic environments, worn, implanted and ingested.

“Currently, there are over 12 billion devices that can connect to the Internet. By 2025, there are expected to be more than 75 billion IoT devices worldwide. 30.3% of IoT devices are used in the healthcare industry [and] health-related technology is expected to make up 40% of IoT by 2020” (iPropertyManagement, n.d.).

“In 2025, each connected person will have at least one data interaction every 18 seconds. Many of these interactions are because of the billions of IoT devices connected across the globe, which are expected to create over 90ZB of data in 2025” (Reinsel, Gantz & Rydning, 2018, p.5).

These data capture mechanisms are increasingly medical-grade. For example, the Apple Watch 3 was found to be 84% accurate in detecting atrial fibrillation when the user was being simultaneously monitored with the watch and an ECG in a 2017 study of 400,000 users by Apple and Stanford University (Windsor, 2019). While 84% is not good enough, the US Food and Drug Administration (FDA) has cleared a medical device accessory for the Apple Watch that records an ECG (Huston, 2017). The KardiaBand can record a clinical-grade ECG in 30 seconds and display the results on the Apple Watch (Chang, 2017)<sup>5</sup>.

In a digital society and economy, data originating outside the historical health system will not be able to be disregarded or downplayed by health services. Many traditional, episodic/opportunistic measurements will be replaced or supplemented by continuous monitoring via always-on devices. Yes, there will be large quantities of low-quality data to be navigated through in the shorter term, but the direction of travel is clear.

<sup>5</sup>

Note – The Kardiaband has recently been withdrawn from sale, most likely because similar functionality has now been added to the Apple watch and other smart watches (Pearson, 2019).

**6. Analytics and algorithms.** The extent and sophistication of analytics and algorithms. While the healthcare sector is currently a moderate user of analytics, it is forecast to be the fastest-growing industry vertical for analytics between 2019 and 2025 (Grandview Research, 2019). This is depicted in Figures 2 and 3.

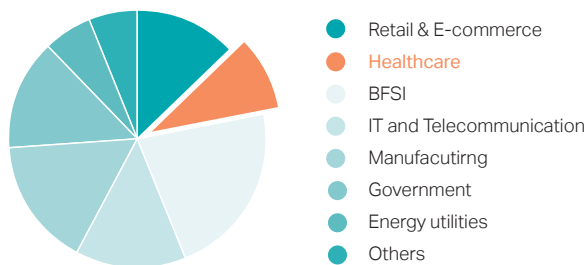


Figure 2 - Global augmented analytics market share by industry vertical, 2018 (Grandview Research, 2019)

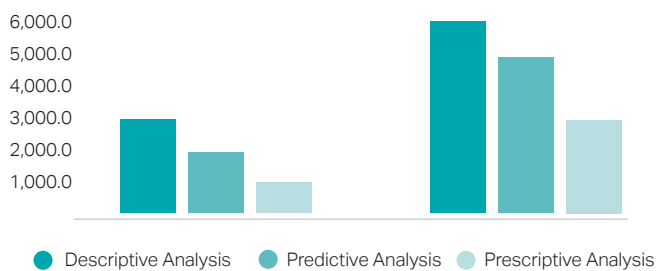


Figure 3 - US healthcare analytics market size, 2018 & 2025, USD billion (Global Market Insights, 2017)

New analytical capabilities will drive new models of care as well as generating new information and knowledge (Ginsburg et al, 2018). Many routine visits to a clinician may be replaced by continuous monitoring and virtual consultations. Health service delivery will be improved by more sophisticated quality metrics drawn from an ecosystem of digital health tools. Care options may be determined through enhancing expert judgment with algorithms fed by information from selective patients around the world. Support may be customised for an individual's personal genetic information, and clinicians will need to be skilled interpreters of advanced

ways to diagnose, track, and treat illnesses. Importantly, the mode of health service interactions will also be enhanced by augmented analytics<sup>6</sup>, to improve patient, carer, etc. engagement and experiences.

**7. Broader than health.** Our health system is built around treating illness and while the nature of what ails and kills us has changed substantially in the last 100 years, the system and its structures hail from over a century ago. We now define health as more than the absence of illness, and yet our health system structure is still based around an illness model. This is changing.

Clinical care provides only a relatively minor, albeit important, contribution to citizens' length and quality of life (CSIRO, 2018). Social determinants of health (the conditions in which people are born, grow, work, live, and age, together with the wider set of forces and systems shaping the conditions of daily life) are generally much more consequential. In addition to the social determinants of health, we will also see a broadening of the health sector to incorporate the somewhat arbitrary boundaries placed between the health, aged care, mental health, social services and disability sectors.

The level of connection that is already available to most citizens<sup>7</sup> will enable interventions to improve health and wellbeing across the lifecycle to be embedded into people's daily lives, thus broadening the range of interventions that can encourage and generate better health and better value for health investments.

Digital health has the potential to enable substantive changes to health behaviours and systemic factors. However, this will involve digital disruption – changes to longstanding business and funding models, policy settings and possibly professional structures. Resistance can be expected.

<sup>6</sup> Augmented analytics: the use of machine learning (ML) and natural language processing (NLP) to enhance data analytics, data sharing and business intelligence (Rouse, 2018)

<sup>7</sup> Care must be taken to ensure that specific population cohorts are not disenfranchised via systematic lack of access.



# THE ERA OF DIGITAL HEALTH





The era of digital health is upon us. It is fundamentally different from what has come before, with profound influences on health and healthcare.



## What has come before

### ICT in Health 1950s – 1960s

#### 1<sup>st</sup> WAVE







-  Mainframe computers
-  Focus on corporate support functions such as accounting and payroll
-  Applications were function driven
-  Industry agnostic (not health specific)

### Health ICT 1960s – 2000s

#### 2<sup>nd</sup> WAVE

-  Practice management systems
-  Big integrated systems
-  Best of breed systems
-  Focus was the healthcare organisation
-  Corporate applications for logistics and performance management
-  Health service provider centric

### E-Health 2000s – 2020

-  Enterprise and system wide information flows begin
-  Shared health records and health information exchanges
-  Focus on whole of health system Health system centricity
-  Patient following but still provider centric
-  Governments as key players in and funders of e-health
-  Healthcare as a process rather than health as an outcome
-  Bulk of healthcare data provider-originated and controlled

#### 3<sup>rd</sup> WAVE

## THE FOURTH WAVE: DIGITAL HEALTH (2020+)

**DIGITAL HEALTH = HEALTH AND HEALTHCARE IN THE DIGITAL SOCIETY**

### Digital Health is about HEALTH

-  **The 4<sup>th</sup> wave**  
A great leap forward along the evolutionary path of ICT in healthcare
-  **Tech**  
Enabled by exponential increases in the pervasion of ICT throughout society
-  **Decentralised**  
With service providers as participants, not controllers
-  **Citizen centric**  
Driven by citizens' demands that their health and wellbeing are controlled by them and expectations for digital service delivery embedded within their life patterns
-  **Data, data everywhere**  
Harvests data in real time from sources within and outside of traditional health settings
-  **Knowledge**  
Generated via sophisticated analytics

# THE DIGITAL HEALTH ERA IS CHARACTERISED BY 7 MAJOR SHIFTS



## 1. CITIZEN AND CONSUMER CENTRICITY

Citizens choose where and how they store their data, who they share it with and expect service models to fit their life flows



## 2. NEW ENTRANTS

Big tech disruption with non-healthcare companies becoming health data companies



## 3. INDUSTRY CONVERGENCE

The boundaries of health service delivery overlapping with other sectors /industries



## 4. ROLE CONVERGENCE

Boundaries of clinical professional practice diverge and meld



## 5. ORIGIN OF DATA

Vast amounts of new health and health-relevant data captured outside of traditional clinical care settings



## 6. ANALYTICS AND ALGORITHMS

New analytical capabilities drive new models of care



## 7. BROADER THAN HEALTH

Dissolving the arbitrary boundaries placed between health, aged care, mental health, social services and disability sectors

## The shifts result in changes to



Longstanding business and funding models



Policy settings



Professional structures



The role of the citizen

## DIGITAL HEALTH AND THE RESULTANT DISRUPTION PROVIDES OPPORTUNITIES AND CHALLENGES FOR



Citizens



Clinicians



Policy makers and regulators



Health executives



Technology suppliers



Media and influencers



Universities / educators

JOIN THE NATIONAL CONVERSATION AND HELP US CREATE HEALTH FOR THE DIGITAL SOCIETY

## Digital natives

Digital health will be delivered by and to a significantly different population. Health ICT was delivered to relatively passive populations with mainly episodic health needs, and used by clinicians with relatively low digital literacy and mostly local (limited) information management needs. The e-health era was driven in part by changing population needs – an ageing population with more chronic illness as well as rising consumer expectations. Clinicians needed to interact more with ICT, and to adopt greater information management discipline so that information could be shared and re-used.

Digital health will increasingly be delivered by and to digital natives. Already, 50% of the Australian population and 46% of people of working age are either millennial or generation Z – collectively, digital natives (ABS, 2018). By 2029, 65% of the population is projected to be digital native, including 56% of people of working age (ABS, 2017). Digital natives will soon be dominant as citizens, customers, clinicians, carers, taxpayers, voters, and regulators, and they have different perspectives on health service delivery. For example, they (Econsultancy, 2019; Liquid State, 2018; Transamerica Center for Health Studies, 2019):

- Prefer to proactively engage in their own health, and consider preventive healthcare and self-care their most important health-related priorities

- Are more likely to rely on a broader array of internet resources for information about healthcare than older generations
- Expect better digital engagement. Even now, around 70% of all consumers state that they prefer digital solutions to phone or in-person for many healthcare interactions. In fact, 79% of all consumers say they are more likely to select a provider who allows them to conduct healthcare interactions online or on a mobile device. These proportions can be expected to be higher for digital natives
- Believe they should have the same level of service in healthcare that they receive from other sectors – responsive, convenient and digitally-enabled
- Are likely to be less loyal to healthcare providers. Nearly 80% of US healthcare consumers who are digital natives report being less loyal to healthcare providers than older generations, and more concerned with service than relationship. 94% of digital natives report being open to switching providers if it offers a better experience.

The biggest difference in this new era will not be the technologies per se and their capabilities, but rather their absorption into people's everyday lives, thinking and expectations.

## Digital health is upon us – but does the health sector know it?

The tipping point for the fourth era in health's use of ICT is likely to eventuate during the 2020s. Capabilities are currently being developed and deployed, expectations are changing and the language has already substantially changed. Some processes are being digitised (eg medication management), and digital experiences are being built into some health service interactions (eg telehealth, online scheduling). But whole new service delivery models that take advantage of digital ubiquity are not yet proliferating. The tipping point has not yet been reached – health systems are not yet delivering digital health at scale.

Organisations in many other industries are, en-masse, facing widespread digital *disruption* – defined by Gartner (n.d.) as “an effect that changes the fundamental expectations and behaviours in a culture, market, industry or process that is caused by, or expressed through, digital capabilities, channels or assets”. This disruption is changing whole business paradigms.

Such disruption is not yet evident in Australian healthcare as a whole, but then health is seen as a laggard globally in terms of digital intensity<sup>8</sup>, as exemplified in Table 1. Some initial signs are being observed in the UK National Health Service (NHS) – see Case Study 1 insert.

(a) Sectors are ranked by their value as an average across countries and years. Data was sourced from sectors in Australia, Austria, Denmark, Finland, France, Italy, Japan, the Netherlands, Norway, Sweden, the United Kingdom and the United States.

Sector	Intensity
Agriculture	Low
Construction	Low
Electricity, gas and steam	Low
Food products	Low
Hotels and food services	Low
Mining	Low
Real estate	Low
Transport services	Low
Water, sewerage and waste	Low
Basic metals	Medium-low
Care and social work	Medium-low
Chemicals	Medium-low
Coke and petroleum	Medium-low
Education	Medium-low
<b>Health services</b>	<b>Medium-low</b>
Pharmaceuticals	Medium-low
Rubber, plastics and minerals	Medium-low
Textiles and apparel	Medium-low
Arts and entertainment	Medium-high
Computers and electronics	Medium-high
Electrical equipment	Medium-high
Machinery	Medium-high
Other manufactures	Medium-high
Public admin and defence	Medium-high
Publishing and broadcasting	Medium-high
Wholesale and retail	Medium-high
Wood and paper	Medium-high
Admin and support services	High
Finance and insurance	High
IT services	High
Law and accountancy services	High
Other business services	High
Other services	High
Scientific R&D	High
Telecommunications	High
Transport equipment	High

Table 1 - Sectors by quartile of digital intensity 2013-15<sup>a</sup> (Grundke et al., 2018)

<sup>8</sup>

<sup>a</sup>An assessment or measure of the degree to which a firm or industry uses digital technologies” (Australian Productivity Commission and New Zealand Productivity Commission, 2019, p. x).

# 03

## SYNTHESIS

Much of the ICT-related activity that is currently taking place in Australia and most other parts of the world still fits the patterns of health ICT and e-health. These eras have not ended; in many parts of the world, health is still in 'catch up' mode. The implementation of My Health Record<sup>9</sup> is an example of e-health. Such applications allow authorised health service providers and consumers to connect and access specific (pre-determined) clinical data sourced from health services, with the ability for consumers to manually enter certain data. Capturing data passively from citizen-centric sources such as smart health devices or a wide range of sensors is outside their current scope.

Two important points must be made here. Firstly, each era builds on the previous. Patient data could not be shared between providers and selectively with consumers in the e-health era without the provider-based capture and storage system

deployed during the health ICT era. Similarly, the abilities for software systems to interoperate more widely are being created in the e-health era. Digital health evolves from, but is more than, e-health.

Secondly, as a result, the boundaries between the eras are blurred. The tipping points (shown in red in Figure 4) are the points where the societal/systematic change arrives – where a critical mass is reached – not where the capabilities are first created.

Figure 4 depicts these four eras, mapping the passage of time against the extent of pervasiveness of ICT throughout society. Digital health is enabled not by the requisite technologies alone, but also by the extent to which they are fundamental to virtually everything that citizens do, and are taken for granted as such. Digital health exists in a world in which ubiquitous use of technology is an assumption, not a privilege.

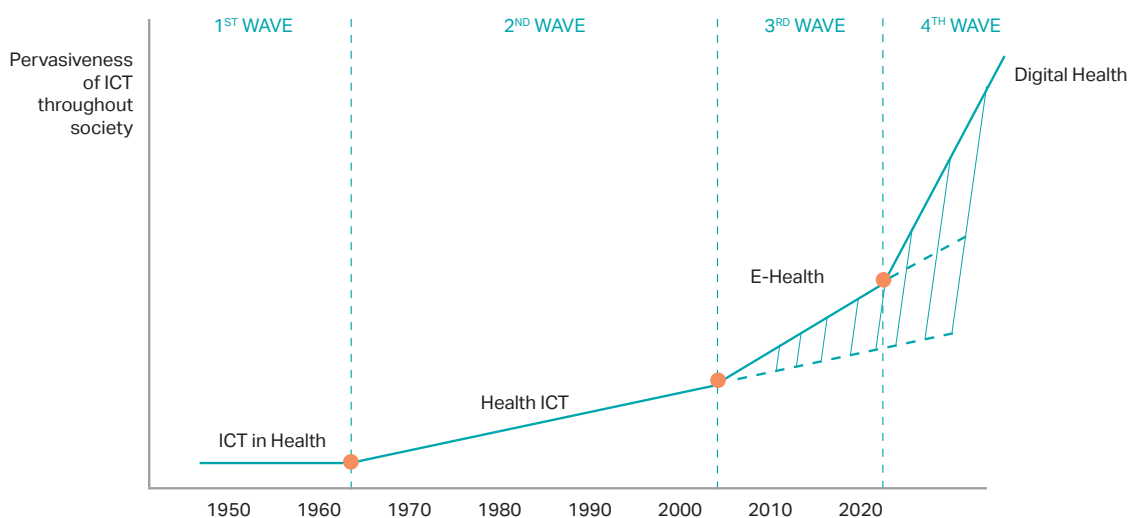


Figure 4 – The four eras of the use of ICT in health

<sup>9</sup> Australia's, online summary of individuals' key health information – see <https://www.myhealthrecord.gov.au/for-you-your-family/what-is-my-health-record>.

# What is digital health?

Digital health can be defined as health and healthcare in the context of digital societies<sup>10</sup>.

Digital health:

- Harvests data, information and knowledge in real time from all societal activities, not just interactions with the health system and/or data traditionally regarded as “health” data

- Uses sophisticated analytics to distil knowledge from these data
- Intervenes in the widest possible range of societal and economic activities and technologies to encourage and generate better health and better value for health investments
- Is citizen (not provider/customer/patient) centric, decentralised and requires health service providers to participate, not control.

## Two key challenges

Any paradigm shift brings with it an array of both opportunities and challenges. Comprehensive coverage of these is beyond the scope of this paper, but two key challenges for health organisations and the health and wellbeing sector are directly associated with the fundamental nature of differences between digital health and its predecessors.

### 1. Divergent perspectives

Recent research indicates that Australia’s physicians expect more digital health technology impact than consumers do, but there is a strong disparity in scope (EY, 2018). Physicians think substantial tech-enabled care will happen, but within the context of traditional services. Consumers, on the other hand, are interested in tech-enabled care – anywhere!

Interestingly, Australian physicians also viewed health system performance far more favourably than consumers, with 62% and 42% respectively rating the system as “excellent” or “very good”.

<sup>10</sup>

The people, organisations and things engaged in persistent digital interactions.



## 2. Digital disruption

A substantial body of knowledge is emerging about digital disruption. The term 'disruption' is significant – new digital products/services/business models disrupt the market fundamentals and cause the need for wholesale re-evaluation. Digital disruption typically originates in changes in consumer needs and/or expectations (Oxford College of Marketing, n.d.). Digital disruption is not just another term for change management.

The introduction of GP at Hand by the UK NHS provides an early indicator of such disruption in healthcare.

The deployment of Babylon GP at Hand has

undoubtedly raised a series of concerns, and there is some industry resistance. However, this is typical of digital disruption. Uber, AirBnB and a host of other new market entrants to other industries have all faced similar criticisms. And like these others, consumers rate GP at Hand more highly than traditional services, with a 96% satisfaction score compared to 63% (and lower for younger patients) for traditional GP services (Babylon GP at Hand, n.d.; Nuffield Trust, 2018).

The NHS Long Term Plan states that every patient will be able to access a digital-first primary care offer by 2023/24 (NHS, n.d.), so substantially more disruption can be expected yet.

### Case study 1

Babylon GP at Hand is a practice in North West London operated for the NHS by Babylon Health.

It offers traditional general medical services to registered patients using a "digital-first" model via a mobile app. It also provides in-person services as required. It is an NHS General Medical Practice – its NHS services are provided free-of-charge for citizens just like any other NHS GP practice (NHS, n.d.) and it also offers subscription services. It's

product set includes video consultations with a health professional and health monitoring tools. It operates 24x7x365. It commenced operation in November 2017 in the Hammersmith & Fulham area and is not expanding into Birmingham following an NHS review.

GP at Hand has attracted a range of criticisms including the following (Castle-Clarke & Scobie, 2018; Merriman, 2018; The Lancet, 2019).

#### CRITICISM

#### BABYLON HEALTH / NHS RESPONSE

GP at Hand cherry-picks younger, healthier patients, leaving more complex cases with traditional practices.

The list of conditions where it may not have been clinically appropriate for patients with them to register has been removed following review by the NHS. There is nothing inherently wrong with patient choice.

GP at Hand's patient profile and fast-throughput challenge the NHS's funding model.

One of the NHS's objectives is to determine appropriate funding models from digital-first services. The existing funding model incorporates casemix and should theoretically be able to handle differing service profiles

Babylon's AI tools miss warning signs of serious conditions.

"Babylon technology products used in the GP at hand service ... meet the standards required by the NHS and [their safety cases have] been completed using a robust assessment methodology to a high standard" (NHS England, as quoted in Merriman, 2018). Safety and quality are ongoing issues in any health service. Safety and quality issues exist in traditional services too.



## Digital adaptation

Figure 6 demonstrates the digital disruption pathway that has been followed in multiple industries, together with pertinent market signals, typical responses from incumbents and common barriers that incumbents experience.

In terms of this model, digital disruption has now been detectable in the UK NHS for over 12 months, progress to a validated model is well underway, and the Government expects “inevitability” by 2023/24.

In contrast, digital disruption is barely detectable in the Australian health system. There are undoubtedly forces of disruption underway in some health organisations, but this has not reached systematic proportions.

When digital disruption does arrive and transformation (the integration of digital technology into all areas of a firm, government agency or economy in ways that fundamentally change how

they operate) is required, barriers can be expected to include employee and professional pushback, lack of organisation and/or system wide strategy, lack of expertise to lead digital transformation, rigid organisational structures and policy settings, and funding.

It has been said that digital disruption starts slowly but ends rapidly. This reflects the acceleration evident in the red line in Figure 6. Typically, “outbreaks” of disruption happen amongst individual organisations that become more digitally capable, then suddenly these capabilities are widespread enough to join up, providing the tipping point for change. Platforms reach critical mass, new business models reach critical approval levels, and customer expectations change from the exception to the norm. Suddenly the disruption to individual organisations turns into disruption of the sector, leaving those who are unprepared behind in its wake.

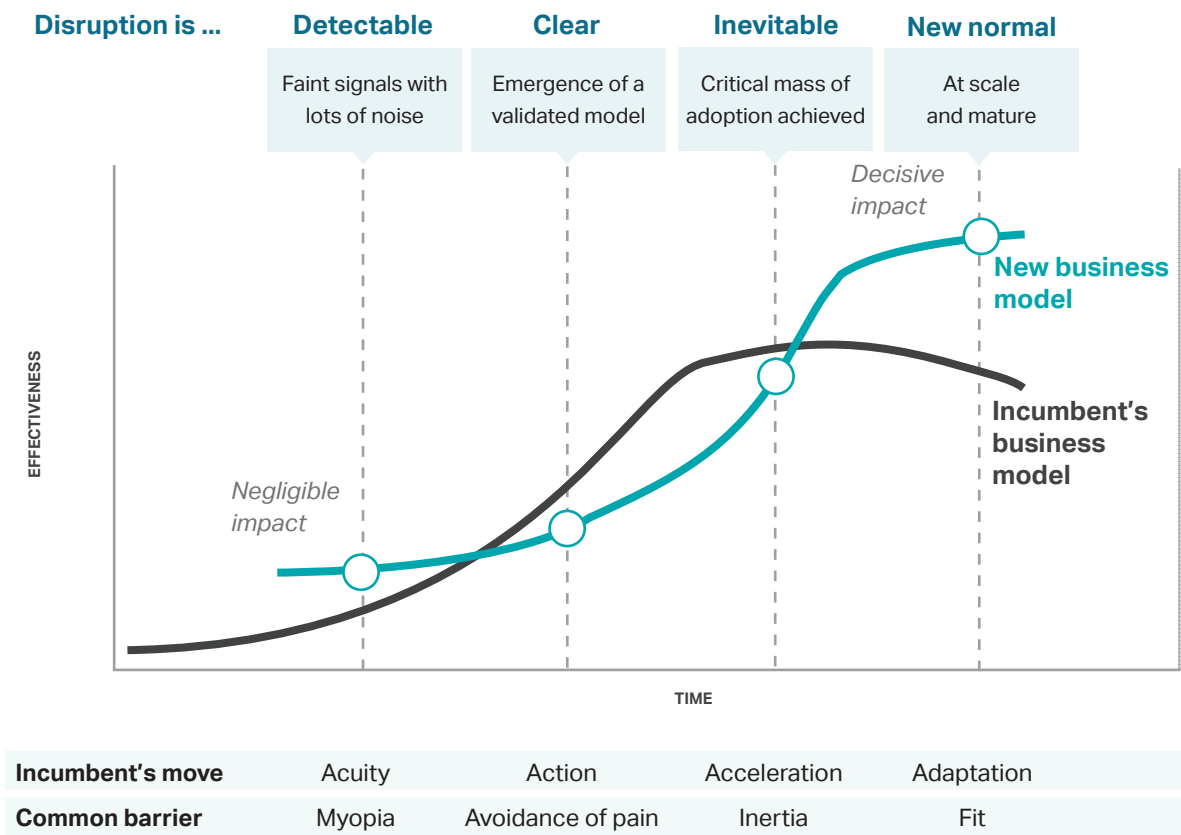


Figure 6 - Digital disruption journey (Bradley & O'Toole, 2016)

# 04

## IMPERATIVES

As digital health really is something substantially different to e-health and health IT, and is likely to be accompanied by substantial disruption, generated externally as a force upon health service providers, then there are some imperatives for health sector stakeholders. As the digital society is all embracing, so to are our stakeholders diverse.

### CITIZENS AND CONSUMERS

#### **“Nothing about me, without me”**

(Valarie Billingham, 1998 as quoted by Quinlan, 2018)

Imperatives for citizens and for the consumers of healthcare services include:

#### **The rise of the citizen as leader**

- Taking a leadership role in conversations about what constitutes digital health, including ensuring that such conversations focus on health and wellbeing and the roles of health services in optimising these across a society and communities that are digitally-enabled, and are not constrained to discussion of digital health technologies.

#### **Extent, breadth and diversity**

- Ensuring that such conversations are far reaching, led by consumer expectations rather than the status quo, and that they reflect the diversity of citizen and consumer views (including these of digital natives).

#### **Nothing about me, without me**

- Voting with their feet – keeping abreast of developments in digital health including those arising from outside the traditional healthcare system; advocating for the best and most

accessible care not just the retention of longstanding power and economic structures; demanding access to and control of their health data; and sharing feedback about their experiences.

#### **Advocates for self and others**

- Identifying groups of citizens and consumers who are relatively disempowered (e.g. by lack of health or digital literacy, or by poor access to digital infrastructure), and advocating for their interests / assisting them to overcome digital health divides.

#### **Active participants**

- Thinking outside the existing patterns of delivery of health, well-being, disability, ageing, social and other related services and becoming active participants of innovation ecosystems rather than “patient” recipients.

#### **Citizen data scientists**

- Asserting the validity of high-quality, citizen-generated data and its use to improve health and wellbeing. In the USA the rise of the ‘e-patient’<sup>11</sup> social movement provides a glimpse into and inspiration for what can be in the digital era of health.

## MEDIA AND INFLUENCERS

Imperatives for the media and other commentators and influencers include:

- Stimulating, catalysing, facilitating and enabling debate that starts with exploring the nature and potential of digital health and look to manage the challenges, rather than constrained thinking that promotes the status quo.
- Ensuring balance and manage expectations while promoting widespread engagement in conversations about digital health.

## POLICY MAKERS AND REGULATORS

Some imperatives for policy makers and regulators include:

- Keeping up – being aware of digital developments, ensuring policy is ahead of the curve rather than just being facilitators of extant industry interests, and exploring more agile regulatory approaches.
- Providing a clear long-term vision for digital health that is coherent across Australia and led by the needs and expectations of citizens and consumers.
- Ensuring that regulation and funding models developed for earlier eras do not impede better health and healthcare in the digital age.

- Being aware that digital disruption tends to start slowly but accelerate quickly, and be ready.
- Ensure that regulation prevents, and policies discourage data blocking and the ability for data silos to perpetuate, with data 'locked' into software with proprietary data standards.

## HEALTH EXECUTIVES

Some imperatives for health service executives include:

- Raising awareness within their organisations. This means seeking a variety of inputs about the nature of digital health, looking as broadly as possible; identifying specifically what it means for different but inter-related organisations; scenario planning; and potentially even reconstructing the organisation's mission, vision and values in the context of digital health.

The imperative is to get all the organisations' executives on the same page, and this requires conversation.

- Aligning the executive and organisational cultures to potential new realities. This includes promoting innovation at all levels within the organisation; seeking partnerships; and developing a service culture at all levels.

Ultimately this requires Copernican shifts - making the change from being at the centre of the organisations' universe to being just one of the stars.

---

11

See <https://participatorymedicine.org/>; <https://www.epatientdave.com/blog/>; <https://www.opennotes.org/>

- Re-conceptualising and redesigning patient/client/citizen experiences. This means using scenarios; asking, not assuming; including a variety of consumers – including digital natives – on project teams from the outset; looking at other industries/technologies; and systematic unlearning and re-learning.
- Reviewing existing key capabilities. This means determining whether:
  - Clinical governance is digitally literate/aware/astute; able to determine whether a digital health innovation is appropriate/efficacious/safe/ethical/justifiable; willing and able to envisage/lead changes to their own professions (e.g. displacement by AI/robotics, role substitution); and aware at all times which “hat they are wearing” – executive/health professional/patient advocate/citizen advocate/...
  - The existing IM/IT organisation is a trusted operator (focusing on operational efficiency, resiliency and cost-savings), a change instigator (leading business improvements for the enterprise), or a business co-creator (driving business strategy and enabling transformational change that executes new strategies). It will need to be all three.
- Building new capabilities - to capture, analyse and use external, real-time data and integrate it with the organisation's; assure data quality and provenance; present much higher volumes of data to decision-makers, especially clinicians; deliver services virtually, including to new markets and through new partnerships and technologies; receive services virtually, including through new partnerships and technologies; and deploy quickly, but safely.

## CLINICIANS AND CLINICAL LEADERSHIP ORGANISATIONS

Some imperatives for clinicians include:

- Designing for different perspectives between clinicians and consumers. This means looking beyond traditional health service delivery settings and the organisation of health services around health professions, and reconceptualising these around the consumer. This takes into account service settings and information flows throughout the continuum of care, not just episodic care. For example, does a diabetic patient need to visit a need to visit a GP, a dietician, a podiatrist, et al., or do health services need to offer (virtual) services for diabetics that incorporate all aspects (professions) of care? Where is the data generated, by whom (and what), and how does it get in front of the clinicians and the patient who needs it?
- Advocating for change throughout and within the system and within their professional disciplines.
- Understanding and organising for the citizen drive for wellbeing rather than just addressing ill-health.
- Using clinically valuable information that is sourced from societal data, not just information sourced from within health services.
- Leading and being prepared for changes to professions and professional hierarchies if they benefit health and well-being.
- Leadership in clinical informatics is imperative to digital health. Clinicians need to upskill in clinical informatics and some are already calling for clinical informatics to be a recognised clinical speciality (HISA, 2018).

## **DIGITAL HEALTH TECHNOLOGY SUPPLIERS**

- Innovating to disrupt as well as supporting existing customers. Digital technologies provide enormous opportunities to change the nature and form of healthcare and support wellbeing.
- Moving to business models that reward the most effective services, rather than reward via client capture.
- Infusing customer service cultures evident in other industries into healthcare.

## **UNIVERSITIES, EDUCATORS AND TRAINERS**

Some imperatives for educators and trainers include:

- Infusing digital literacy and core health informatics competencies into the courses they provide to train clinicians, health service executives and other relevant stakeholders.
- Modelling the competencies required through their teaching programs, for example through virtual services, cutting edge teaching technologies and the use of soft skills.
- Encouraging students to innovate and critically appraise rather than reinforcing traditional cultures and attitudes, professional hierarchies and boundaries, fragmentation, etc.

# 05

## WHERE TO FROM HERE?

This paper calls for further conversation as a precursor to development of Australia's next digital health strategy. The current strategy was published in 2017, with a 5-year horizon, meaning that work should commence on its refreshment in the near future.

However, the current strategy does not define digital health and primarily describes e-health as defined in this paper and exemplified in Figure 5. Its replacement should aim to be much more citizen-centric, and to canvas the digital disruptions required to really move to digital health.

National conversations are required about:

- The nature of digital health, and the distinction between digital health and digital health technologies – the 'what' versus the 'how'. This conversation should aim at broad agreement on a common lexicon that enables a clear digital health vision for Australia to emerge.
- The nature of system changes required to facilitate digital health. This should aim at broad agreement on a work program that better aligns technology and infrastructure development with policy, regulation, funding and culture change programs.
- The nature of changes required from health and professional workforces. This should aim at enhancing education, training and career pathways supporting digital health capability building across the health workforce.
- The nature of leadership required in the health sector to build and sustain momentum for change. This should aim to enhance health leadership development.

No single organisation is responsible for or best equipped to lead these conversations – this leadership must be broad-based. However, organisations well-placed to lead include:

- The Consumers' Health Forum and the Health Informatics Society of Australia, both of which have very wide constituencies
- The Australian Digital Health Agency, which can coordinate Commonwealth, State and Territory dialogue
- The Medical Software Industry Association and Australian Information Industry Association, which can mobilise industry players from inside and outside health
- The Australasian College of Health Informatics, which provides a forum for senior informaticians
- The Australasian College of Health Service Management, which provides a forum for health decision-makers; and
- Health professional colleges, which should provide clinical thought leadership.

These conversations also need to happen at state and local levels and we encourage readers to stimulate and lead discussions with your colleagues and peers.

## List of acronyms

ABS	Australian Bureau of Statistics
ADHA	Australian Digital Health Agency
AI	Artificial Intelligence
DVA	Department of Veterans' Affairs
EHR	Electronic Health Record
EMR	Electronic Medical Record
FDA	[US] Food and Drug Administration
ICT	Information and Communication Technology(ies)
IOM	Institute of Medicine
IoT	Internet of Things
IT	Information Technology
NHS	National Health Service
PACS	Picture Archiving and Communication System
PAS	Patient Administration System
RIS	Radiology Information System
WEF	World Economic Forum

## Definitions used in this paper

<b>Digital asset</b>	Data, information or knowledge that is readily computer-processable and includes the right to use it.
<b>Digital disruption</b>	An effect that changes the fundamental expectations and behaviours in a culture, market, industry or process that is caused by, or expressed through, digital capabilities, channels or assets.
<b>Digital health</b>	Health and healthcare in the context of digital societies. Digital health: <ol style="list-style-type: none"><li>1. Harvests data, information and knowledge in real time from all societal activities, not just interactions with the health system and/or data traditionally regarded as "health" data;</li><li>2. Uses sophisticated analytics to distil knowledge from these data;</li><li>3. Intervenes in the widest possible range of societal and economic activities and technologies to encourage and generate better health and better value for health investments;</li><li>4. Is citizen (not provider/customer/patient) centric, decentralised and requires health service providers to participate, not control</li></ol>
<b>Digital intensity</b>	An assessment or measure of the degree to which a firm or industry uses digital technologies.
<b>Digital society</b>	The people, organisations and things engaged in persistent digital interactions.
<b>Digital transformation</b>	The integration of digital technology into all areas of a firm, government agency or economy in ways that fundamentally change how they operate.



## References

- Alderman, J. (1997, 27 February). *Keeping up with the clones*. *WIRED*. Retrieved from <https://www.wired.com/1997/02/keeping-up-with-the-clones/>.
- Australian Bureau of Statistics (ABS). (2017). *Population projections, By age and sex, Australia, Series B*. Population Projections, Australia, 2017 (base) – 2066. Time Series Spreadsheets, Table B9. Retrieved from [https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3222.02017%20\(base\)%20-%202066?OpenDocument](https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3222.02017%20(base)%20-%202066?OpenDocument).
- Australian Bureau of Statistics (ABS). (2018). *Estimated Resident Population by Single Year of Age, Australia*. Australian Demographic Statistics, Time Series Spreadsheets, Table 59. Retrieved from <https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Dec%202018?OpenDocument>.
- Australian Digital Health Agency (ADHA). (2017). *A Strategic Direction for Digital Health in Australia*. Retrieved from <https://conversation.digitalhealth.gov.au/strategic-direction-digital-health-australia>.
- Australian Digital Health Agency (ADHA). (n.d.). *What is digital health?* Retrieved from <https://www.digitalhealth.gov.au/get-started-with-digital-health/what-is-digital-health> on 04 July 2019.
- Australian Productivity Commission and New Zealand Productivity Commission. (2019, January). *Growing the digital economy in Australia and New Zealand. Maximising opportunities for SMEs*. Joint Research Report. Retrieved from <https://www.pc.gov.au/research/completed/growing-digital-economy/growing-digital-economy.pdf>.
- Babylon GP at Hand. (n.d.). Home page. Retrieved from <https://www.gpathand.nhs.uk/> on 14 November 2019.
- Backman, M. (2017, 1 May). *This Is the No. 1 Reason Americans File for Bankruptcy*. The Motley Fool. Retrieved from [https://www.fool.com/retirement/2017/05/01/this-is-the-no-1-reason-americans-file-for-bankrup.aspx?Cid=wt6orw&utm\\_campaign=PiBKWv&utm\\_source=LwD4ln&utm\\_medium=727tXM&utm\\_content=3xE5Vc&utm\\_term=4i8L1l](https://www.fool.com/retirement/2017/05/01/this-is-the-no-1-reason-americans-file-for-bankrup.aspx?Cid=wt6orw&utm_campaign=PiBKWv&utm_source=LwD4ln&utm_medium=727tXM&utm_content=3xE5Vc&utm_term=4i8L1l).
- Bradley, C. and O'Toole, C. (2016, May). *An incumbent's guide to digital disruption*. McKinsey and Company. Retrieved from <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/an-incumbents-guide-to-digital-disruption>.
- Canada Health Infoway. (n.d.). *What Is Digital Health?* Retrieved from <https://www.infoway-inforoute.ca/en/what-we-do/benefits-of-digital-health/what-is-digital-health> on 12 July 2019.
- Castle-Clarke, S. and Scobie, S. (2018, 5 June). *GP at Hand: destabilising or modernising general practice?* Nuffield Trust. Retrieved from <https://www.nuffieldtrust.org.uk/news-item/gp-at-hand-destabilising-or-modernising-general-practice#final-reflections>.
- Cesnik, B. (2010). History of Health Informatics. In *Health Informatics: An Overview*. IOS Press. Retrieved from [http://www.achi.org.au/docs/HNI\\_Book/Chapter\\_02.pdf](http://www.achi.org.au/docs/HNI_Book/Chapter_02.pdf)
- Chang, L. (2017, 1 December). *KardiaBand helps the Apple Watch inch closer to becoming a medical device*. Digital Trends. Retrieved from <https://www.digitaltrends.com/mobile/kardiaband-first-apple-watch-medical-accessory/>.
- Collen, M. (1986). *Origins of Medical Informatics*. *Western Journal of Medicine*, 145(6), pp. 778–785.
- Collins English Dictionary. (n.d.). Retrieved from <https://www.collinsdictionary.com/> on 16 October 2019.

- Cormann, M. (2016). *Explanatory Statement, Public Governance, Performance and Accountability Act 2013, Public Governance, Performance and Accountability (Establishing the Australian Digital Health Agency) Rule 2016*. Australian Government. Retrieved from <https://www.legislation.gov.au/Details/F2016L00070/Explanatory%20Statement/Text>.
- CSIRO. (2018, September). *Future of Health: Shifting Australia's focus from illness treatment to health and wellbeing management*. Retrieved from [https://www.csiro.au/~media/Showcases/FOH/18-00380\\_SER-FUT\\_FutureofHealthReport.html?la=en&hash=AC843DAB13EF0532D1D3CDDFF7A0654884F874D4](https://www.csiro.au/~media/Showcases/FOH/18-00380_SER-FUT_FutureofHealthReport.html?la=en&hash=AC843DAB13EF0532D1D3CDDFF7A0654884F874D4).
- Day, S. (2019). Q3 2019: *Digital health funding moderates after particularly strong first half*. Retrieved from <https://rockhealth.com/reports/q3-2019-digital-health-funding-moderates-after-particularly-strong-first-half/>.
- Digital Health & Care Institute (DHI). (n.d.). *What is digital health?* Retrieved from <https://dhi-scotland.com/about-dhi/what-is-digital-health/> on 12 July 2019.
- Econsultancy. (2019, February). *The consumerization of healthcare. In association with Adobe*. Retrieved from <https://www.adobe.com/content/dam/acom/en/industries/healthcare/pdfs/adobe-econsultancy-2019-report-the-consumerization-of-healthcare.pdf>
- Ericksen, K. (2018, 30 May). What's the Big Deal About Digital Health? Understanding This Revolution in Healthcare. Rasmussen College General Health Sciences. Retrieved from <https://www.rasmussen.edu/degrees/health-sciences/blog/what-is-digital-health/>.
- EY. (2018). *How will tech-enabled change play out in health care in the next decade? A NextWave Health report*. Retrieved from [https://assets.ey.com/content/dam/ey-sites/ey-com/en\\_gl/topics/health/ey-tech-enable-next-decade.pdf](https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/health/ey-tech-enable-next-decade.pdf).
- Gartner. (n.d.). *Digital Disruption*. Gartner IT Glossary. Retrieved from <https://www.gartner.com/it-glossary/digital-disruption/> on 13 July 2019.
- Ginsburg, P., de Loera-Brust, A., Brandt, C. and Durak, A. (2018, 1 November). *The opportunities and challenges of data analytics in health care*. Brookings Institution. Retrieved from <https://www.brookings.edu/research/the-opportunities-and-challenges-of-data-analytics-in-health-care/>.
- Grandview Research. (2019, July). *Augmented Analytics Market Size, Share & Trends Analysis Report By Enterprise Size, By Component (Software, Services), By Deployment Type, By Industry Vertical, By Region And Segment Forecasts, 2019 – 2025*. Retrieved from <https://www.grandviewresearch.com/industry-analysis/augmented-analytics-market>.
- Grundke et al. (2018), as reported in Australian Productivity Commission and New Zealand Productivity Commission, 2019.
- Haux, R. (2010). *Medical Informatics: Past, Present, Future*. International Journal of Medical Informatics, 79, pp. 599–610.
- HISA. (2018, July). *Leadership in Clinical Informatics. A HISA White Paper*. Health Informatics Society of Australia. Retrieved from <https://www.hisa.org.au/publications/>
- Huston, L. (2017, 30 November). *CardioBrief: FDA Clears ECG Band for Apple Watch*. MedPage Today. Retrieved from <https://www.medpagetoday.com/cardiology/cardiobrief/69571>.
- iPropertyManagement. (n.d.). *IoT Statistics: Number of Enabled Devices & Growth*. Retrieved from <https://ipropertymanagement.com/iot-statistics/> on 16 September 2019.
- Keidanren (Japan Business Federation). (2016, 19 April). *Toward realization of the new economy and society: Reform of the economy and society by the deepening of "Society 5.0"*. [PowerPoint]. Retrieved from [http://www.keidanren.or.jp/en/policy/2016/029\\_outline.pdf](http://www.keidanren.or.jp/en/policy/2016/029_outline.pdf).
- Lichtenwald, I. (2019, 20 August). *HIT Think Why it's crucial to remember that healthcare is not a typical business*. Health Data Management. Retrieved from <https://www.healthdatamanagement.com/opinion/why-providers-need-to-remember-that-healthcare-is-not-a-typical-business>.
- Liquid State. (2018, 12 December). *Engaging the Healthcare Consumer: The Key to Success in 2019*. Retrieved from <https://liquid-state.com/engaging-the-healthcare-consumer-the-key-to-success-in-2019/>.

- McDonald, M. (2019, 4 August). *Welcome to the Digital Society*. Gartner Blog Network. Retrieved from [https://blogs.gartner.com/mark\\_mcdonald/2019/08/04/welcome-digital-society/](https://blogs.gartner.com/mark_mcdonald/2019/08/04/welcome-digital-society/).
- Merriam-Webster. (n.d.). *Tipping point*. Dictionary. Retrieved from <https://www.merriam-webster.com/dictionary/tipping%20point> on 23 July 2019.
- Merriman, C. (2018, 18 December). *Babylon Health hits back at claims its AI isn't up to the job*. The Inquirer. Retrieved from <https://www.theinquirer.net/inquirer/news/3068427/babylon-health-hits-back-at-claims-its-ai-isnt-up-to-the-job>.
- Mohr, C. (2019, 4 November). *Robotics, Humans & Hybridization: The New Surgical Team*. Presentation and interview at Exponential Medicine Conference, San Diego USA. Retrieved from <https://exponential.singularityu.org/medicine/xmed-live/>
- NHS. (n.d.). *Online version of the NHS Long Term Plan*. Chapter 5: Digitally-enabled care will go mainstream across the NHS, section 5 Improving clinical efficiency and safety. Retrieved from <https://www.longtermplan.nhs.uk/online-version/chapter-5-digitally-enabled-care-will-go-mainstream-across-the-nhs/5-improving-clinical-efficiency-and-safety/> on 19 September 2019.
- NHS England and NHS Improvement, London. (n.d.). *GP at Hand – Fact Sheet*. Retrieved from <https://www.england.nhs.uk/london/our-work/gp-at-hand-fact-sheet/> on 19 September 2019.
- Nuffield Trust. (2018, 7 March). Public satisfaction with the NHS and social care in 2018: Results from the British Social Attitudes survey. Retrieved from <https://www.nuffieldtrust.org.uk/research/public-satisfaction-with-the-nhs-and-social-care-in-2018>.
- Oh, H., Rizo, C, Enkin, M. & Jadad, A. (2005, January-March). *What Is eHealth: A Systematic Review of Published Definitions*. Journal of Medical Internet Research 7(1): e1. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550636/>.
- Oxford College of Marketing. (n.d.). *Digital Disruption: What Is It and How Does It Impact Businesses?* Retrieved from <https://blog.oxfordcollegeofmarketing.com/2016/02/22/what-is-digital-disruption/> on 19 September 2019.
- Pearson, A. (2019, 27 August). *AliveCor's KardiaBand Will No Longer Be Sold and Smart Rhythm is No More*. The Skeptical Cardiologist. Retrieved from <https://theskepticalcardiologist.com/tag/kardia-band/>.
- Press, G. (2016, 01 November). *Top 10 Tech Predictions For 2017 From IDC*. Forbes. Retrieved from <https://www.forbes.com/sites/gilpress/2016/11/01/top-10-tech-predictions-for-2017-from-idc/#abe3ff4aad6b>.
- Proverbicals.com. (n.d.). *Names Proverbs*. Retrieved from <https://proverbicals.com/names-proverbs> on 09 July 2019.
- Quinlan, C. (2018, 25 April). *"Nothing About Me Without Me" — 20 Years Later*. Science37.com. Retrieved from <https://www.science37.com/blog/nothing-about-me-without-me-progress-in-participatory-healthcare/> on 20 November 2019.
- Reinsel, D., Gantz, J. and Rydning, J. (2018, November). *Data Age 2025: The Digitization of the World from Edge to Core*. IDC White Paper. Retrieved from <https://www.seagate.com/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf>.
- Reinsel, D., Shegawi, M. and Gantz, J. (2018, November). *Healthcare: DATCON Level 3. An Industry with a Weak Data Management Pulse*. IDC White Paper. Retrieved from <https://www.seagate.com/www-content/our-story/trends/files/idc-seagate-datcon-healthcare.pdf>.
- Rouse, M. (2018, November). *Augmented analytics*. Retrieved from <https://whatis.techtarget.com/definition/augmented-analytics>.
- Schwab, K. (2016, 16 January). *The Fourth Industrial Revolution: What it means, how to respond*. Retrieved from <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>.
- Shaw, T., Hines, M. & Kielly-Carroll, C. (2018, January). *Impact of Digital Health on the Safety and Quality of Health Care*. Research in Implementation Science and eHealth, University of Sydney. Prepared on behalf of the Australian Commission on Safety and Quality in Health Care. Retrieved from <https://www.safetyandquality.gov.au/wp-content/uploads/2018/02/Report-The-Impact-of-Digital-Health-on-Safety-and-Quality-of-Healthcar....pdf>.

Sonnier, P. (n.d.). *Definition of Digital Health*. Retrieved from Sonnier, P. (2017). *The Fourth Wave: Digital Health*. Available at <https://www.amazon.com/Fourth-Wave-Digital-Health/dp/1976791553>.

Thede, L. & Sewell, L. (2012). *Computer Development and Health Care Information Systems: 1950 to Present*. Retrieved from [http://dlthede.net/informatics/chap01introni/healthcare\\_computers.html](http://dlthede.net/informatics/chap01introni/healthcare_computers.html)

The Lancet. (2019, 10 August). *GP at hand: a digital revolution for health care provision?* World Report. Retrieved from [https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(19\)31802-1.pdf](https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(19)31802-1.pdf).

Transamerica Center for Health Studies. (2019, May). *Millennials: Digital Natives Disrupting Healthcare*. Retrieved from [https://www.transamericacenterforhealthstudies.org/docs/default-source/research/tchsmillennialreport2019\\_final.pdf](https://www.transamericacenterforhealthstudies.org/docs/default-source/research/tchsmillennialreport2019_final.pdf).

University of Illinois (UIC) (n.d.). *50+ Years of Complexity: The History of Health Informatics*. Retrieved from <http://healthinformatics.uic.edu/a-brief-history-of-health-informatics/>.

Vollmer, M. (2018, 24 August). *What is Industry 5.0?* LinkedIn. Retrieved from <https://www.linkedin.com/pulse/what-industry-50-dr-marcell-vollmer/>.

Weill, P. and Woerner, S. (2015), as presented in Sviokla, J. (2016, 8 December). *Four Business Models for the Digital Age*. Strategy+Business. Retrieved from <https://www.strategy-business.com/blog/Four-Business-Models-for-the-Digital-Age>.

Windsor, R. (2019, 18 March). *Apple is a bit closer to a killer use case for wearables*. Forbes. Retrieved from <https://www.forbes.com/sites/richardwindsoreurope/2019/03/18/apple-is-a-bit-closer-to-a-killer-use-case-for-wearables/#3139b6995873>.

World Health Organization (WHO). (2019). *WHO guideline. Recommendations on digital interventions for health system strengthening*. Geneva. Retrieved from <https://apps.who.int/iris/bitstream/handle/10665/311941/9789241550505-eng.pdf>.

## Patients, consumers and citizens

The use of the term “consumers” or “customers” is fiercely contested in healthcare, and their usage in this paper will doubtless cause “weeping and gnashing of teeth” for some readers. The rationale for their usage in this paper are therefore described, as follows.

All words carry historical, cultural, sociological and political connotations. The word “patient” dates back to the 14th century and is derived from the Latin “pati” - to suffer (Lichtenwald, 2019). The Collins English Dictionary (n.d.) defines “patient” as:

- A person who is receiving medical treatment from a doctor or hospital, or someone who is registered with a particular doctor, when used as a noun. Synonyms include sick person, sufferer and invalid; and
- Someone “who stays calm and does not get annoyed, for example when something takes a long time, or when someone else is not doing what you want them to do”. Synonyms include forbearing, understanding, forgiving and mild.

While some might argue that the term “patient” as used today should simply be regarded neutrally, the connotations are difficult to overlook from such definitions. They include stigma (illness/disability), ownership or control of the patient by the doctor, tolerance of lack of control, a medical model and an inherently unequal relationship.

Collins defines:

- A consumer as “a person who buys things or uses services”; and

- A customer as “a person who buys, or a person with whom one has dealings”

Objections to the usage of these terms instead of “patient” tend to highlight that they:

- Describe economic relationships, not therapeutic ones. However, healthcare is undoubtedly economic as well as therapeutic (as not therapeutic) – indeed, medical debt is the largest source of bankruptcy in the USA (Backman, 2017).
- Imply equality of relationship that is unlikely due to an imbalance of knowledge. However, many consumer/customer relationships embody such imbalances. Most consumers have no idea how service their cars today, how to fly aeroplanes or how to navigate the complexity of disability and social services, but they do not become “patients” (sufferers?) of those services suppliers when they engage with them. And increasingly, healthcare consumers can access and understand as much as or more than clinicians on some topics.

A full discussion of this topic is beyond the scope of this paper, but digital health as described herein does strive for equal partnerships between consumer/customer and health service provider, even though they bring different knowledge, skills, experiences and perspectives. It also features far greater choice of services and service modalities, and is citizen, not healthcare provider, centric. Accordingly, terms that have these connotations (citizen, consumer, customer) are preferred to those associated with earlier eras (patients) herein.

