



Health reimagined:

a new participatory
health paradigm

Foreword



It is an exciting, yet profoundly disruptive time in the health industry as powerful forces intersect to drive industry transformation. Twenty-first century health systems are facing intense pressures for change. With this change, comes opportunity, especially as the digital revolution is quickly changing what is possible in healthcare and placing the tools of participation in the hands of consumers. In this white paper, we raise a fundamental idea: that solutions to sustainability, growth and delivering healthcare to the rapidly growing population will be driven by three key shifts around digital technologies, social media 2.0 and a maturing healthcare consumerism. As these forces become part of the core business of healthcare, new ways of thinking and transformative business models will become paramount.

This paper explores a vision of the future of an expanding and participatory health ecosystem based around the individual as an engaged and active consumer. Intended to stimulate thought and discussion, this paper sets the scene and examines what we consider is a profoundly disruptive change that will re-shape the health landscape and open up new avenues for industry players. Our second paper in this series will dive more deeply into some of the changes that these shifts will bring in the design, delivery and financing of healthcare and to the healthcare experience.

And so, it is timely to re-imagine healthcare with fresh eyes and begin the conversation about a radically different future. Opportunities emerge at the intersection of consumerism, technology and markets for those willing to explore beyond their traditional boundaries. To do this, strategy agenda's – whether they be global, regional or local will require assessing how far and in what direction to reach. For some, this will mean weighing up where to play – either in adjacent markets or in undertaking radical changes and pursuing innovation. For others, this may mean deciding on the right fit – whether to lead, partner or follow in the footsteps of others. However, no matter where the strategic decisions lie, doing nothing is not an option.

Dave Roberts
Asia-Pacific Health Leader





The impatient patient

Introduction

Introduction

In six simple words “*The Patient Will See You Now*” U.S. physician and futurist Eric Topol upends healthcare as we know it, foreshadowing a future of ‘bottom-up’ medicine in which digitally empowered patients participate in and take charge of their own health and care.¹

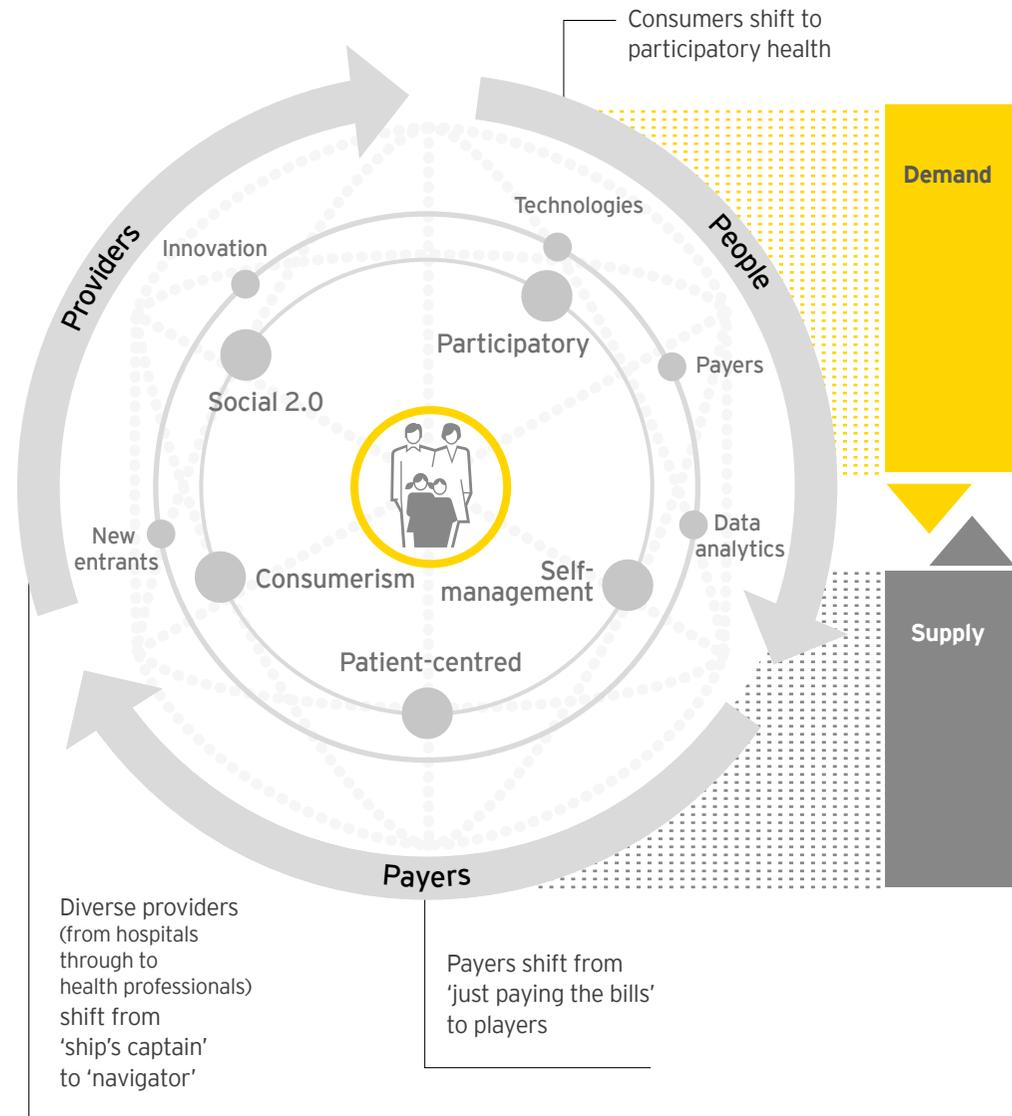
Twenty-first century health systems are facing profound pressures for change. Rising costs, growing consumer expectations, new technologies and increasing globalisation all place intense and disruptive pressure on the health sector. For advanced economies it is clear that the challenges of sustainability and growth can no longer be dealt with by traditional industry responses and practices.^{2,3} Many emerging economies are by-passing the traditional altogether, delivering health services in very different ways in an effort to better align health spending with economic constraints.⁴

In parallel, is the digital revolution which is quickly changing what is possible in healthcare. Technologies open the doors to radically different approaches to care and ease the entrance into the health space of new and non-traditional players through increasingly permeable boundaries. The broad reach of low-cost and fast mobile broadband, smart devices and rapid uptake of new technologies deliver tools that redefine how consumers manage their health and engage with care systems.

With this pressure, comes opportunity. Novel solutions and digital infrastructure can fundamentally transform how we deal with ill health and disease; how we capture, manage and share health data; and, how we tackle the root causes of persistent problems in healthcare to improve access, outcomes and value.

A long-awaited transformation of the health system is underway. Powerful elements such as social networks, innovation, technologies, data analytics, new industry players and the most powerful of all, a maturing consumerism come together to drive this transformation (Figure 1). Three shifts are presently unfolding that pave the way for major disruption to conventional healthcare systems.

Figure 1: Powerful elements intersect to drive health industry transformation



It is time to begin the conversation

Payers are shifting from 'just paying the bills' to being a player in the health dialogue. A diverse range of providers are shifting from being the 'ship's captain' to 'navigator' or expert adviser. However, the real game-changer is a technologically empowered shift by consumers towards participatory health. Central to this is the emergence of the patient or healthcare consumer as an equal and responsible partner.

Although many avenues of reform are needed to put the health sector on a sustainable footing, improve competitiveness and productivity, in this white paper we focus upon the potential impact that an engaged consumer may have on re-shaping the provider-side of healthcare. We suggest that participatory health may, for the first time, deliver tools that will influence the 'demand-side' of the health equation recognising the 'supply-side' dominance of healthcare today. Consumers empowered with the tools of participation to make smarter choices and pursue responsible behaviours creates bottom-up levers for change, changes themselves that align to global industrial shifts capable of re-shaping the healthcare industry. The payment-side is covered in another EY paper, *"The future of health insurance: A roadmap through change"*.⁵

An emerging paradigm, there is an energy and excitement about participatory health as a potentially disruptive innovation [refer sidebar] that may provide practical solutions to some of the intractable problems of healthcare. Increasing patient engagement has long been part of health industry rhetoric.^{6,7} Digital technologies are perhaps the long awaited tool needed to build something new – a viable collaborative partnership achieved via personal health technologies. A narrative is forming around moving from "patient" to "person," empowering individuals to make positive care and lifestyle choices and be engaged in and accountable for lifelong health.

The promise of participatory health to change the healthcare system is encouraging but this change needs to be driven harder and faster. A groundswell is beginning to develop and it is timely to begin the conversation about what will be necessary as the consumer becomes a full participant and then moves into control through being an equal partner in healthcare. This conversation will need to include how to redefine the importance of the patient in the healthcare system as a vital lever in the effort to reconfigure supply and demand and drive towards sustainability. In particular, how to scale-up the promise of participatory health to effect system-wide change with a multi-industry and global perspective. The health industry will need to step up to drive the disruption and take the lead in developing innovations and delivering transformation. New relationships and new ways of partnering that blend healthcare expertise with high-tech skills, connected technologies and deep consumer insights will be necessary to foster innovation and shift from legacy ways of delivering and paying for care.

This white paper draws upon conversations with health industry experts and extensive research including a survey of health consumers' interest in and ability to engage in health and wellness. This paper explores a vision for the future of an expanding and participatory health ecosystem based around the individual. Firstly, we outline the perfect storm of factors that are challenging existing health systems. We then discuss participatory health as health systems re-shape into a digital health ecosystem – one that is globally connected and locally relevant. We think of this as a 'health digisphere' – a complex, borderless, interconnected community (virtual as well as real) formed around an individual and advancing lifelong health. Finally, we suggest three moonshots – big ideas that have the potential to re-shape the healthcare system globally and then conclude with some thoughts about 'where to next'.

Disruptive innovation

In *"The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail"* (1997, Harvard Business School Press) leading academic and author Clayton Christensen tells of the disruptive innovation model developed to explain how new technologies create revolutionary change for companies and industries. The model describes how a product or service enters a market, and by simplifying technology and making it more affordable, ultimately re-shapes the market and displaces established competitors. Some competitors will not have anticipated the disruptor. Others will have, but lacked agility to adapt or to adopt the incoming technological disruption. Successive refinements of the innovations with more efficient and lower-cost methods end up re-shaping entire industries.

Examples abound of disruptive innovation including: classified ads (Craigslist), long distance calls (Skype), record stores (iTunes), research libraries (Google), retail (Alibaba), taxis (Uber), accommodation (Airbnb), higher education (MOOC's), financial services (cryptocurrencies such as Bitcoin and altcoins such as Litecoin) and fast fashion (Zara).



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A perfect storm for change

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Globally, health systems are under pressure

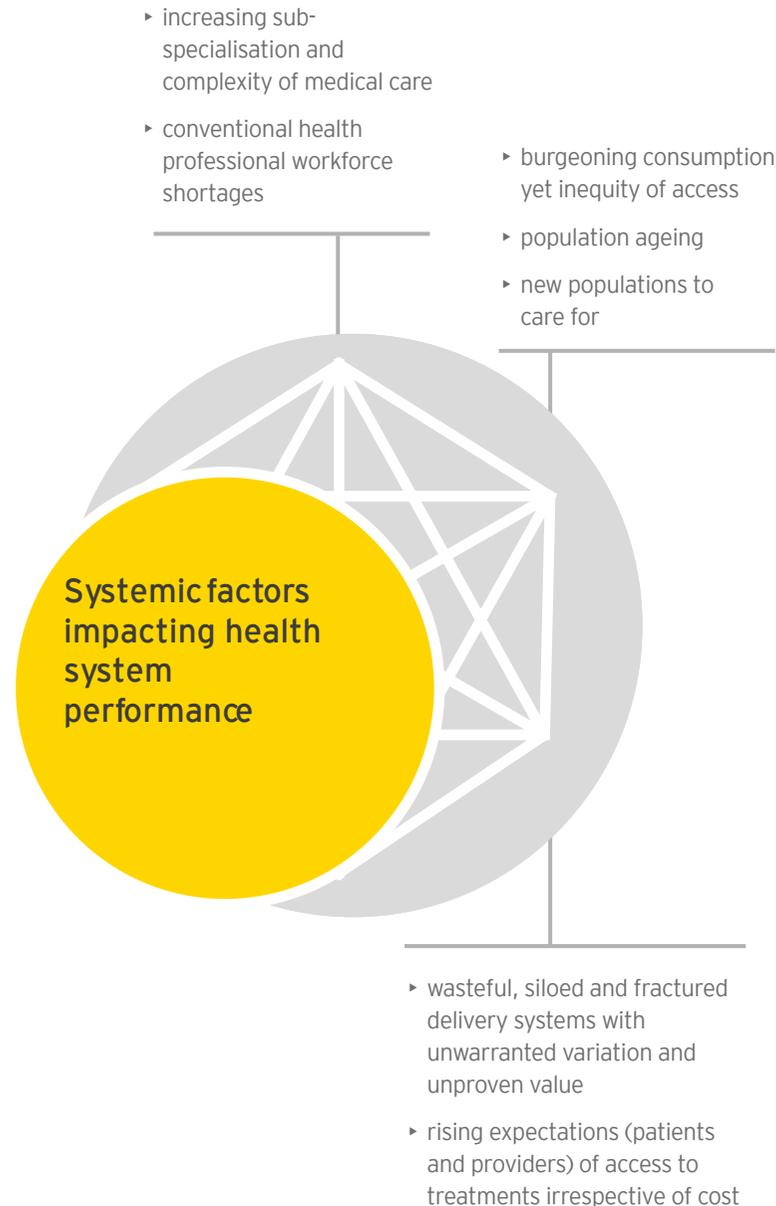
Globally, health systems are under pressure – to reduce the rate of increase of expenditures and pursue value; to meet rising demand and slow the growth in costs. Healthcare is big business and getting bigger. Nominal global health spending rose by 2.6% in 2013⁸ consuming an estimated 10% of global gross domestic product (GDP).⁹ Economic conditions, demographic and lifestyle factors, and rising costs of services, treatments and new technologies will propel an average nominal 5.3% annual growth in global health spending between 2014 and 2018.⁸

Much has been written and more said¹⁰⁻¹³ about the perfect storm of factors that combine to make the current systems of providing healthcare both unaffordable and unsustainable. These factors are well known and equally well understood. What is less clear, is where to go next – what combination of policy levers, innovations that extend the 'realm of the possible'¹⁴ and behavioural incentives will likely improve access, enhance outcomes, and lower costs. In pursuit of these goals, contemporary policy calls out three essential shifts:

- ▶ from volume to value and outcomes
- ▶ towards greater engagement and personal responsibility of individuals
- ▶ a shift in organisational forms of delivery of health.

In many countries, health reforms are testing new service delivery and payment models. Mostly focused upon the supply-side of health such as provider performance and payment, few, if any, consider what can and could disrupt the system to deliver an alternative paradigm, or most importantly, consider demand-side disruption that needs to occur.

The context of health is changing profoundly, demanding a very different way of thinking about health and how care is delivered. The pyramidal structures of increasing specialisation between primary, secondary and tertiary care¹⁵ of traditional health systems have been found wanting in



At the end of 2014, 40% of total global connections were mobile broadband (3G and 4G). Increasing smartphone affordability and deeper network coverage will drive an increase to around 70% by 2020.

[GSMA: the Mobile Economy, 2015. http://www.gsmamobileeconomy.com/](http://www.gsmamobileeconomy.com/)

Smartphone adoption is projected to plateau at around 80% in the developed world, and, rise to 63% in developing markets, by 2020; with most running on broadband networks.

[GSMA: the Mobile Economy, 2015. http://www.gsmamobileeconomy.com/](http://www.gsmamobileeconomy.com/)

Data, in particular unstructured data (photos, social media, videos) generated by consumers, is growing exponentially – data production will be 44 times greater in 2020 than it was in 2009.

http://www.csc.com/insights/flxwd/78931-big_data_universe_beginning_to_explode

Health consumption and lifestyle changes will be driven by a rising middle class

Over the next two decades, it is estimated that the global middle class will expand by another three billion people, coming almost exclusively from the emerging world.¹

Non-fatal dimensions of disease and injury will increasingly demand attention from health systems

Ageing populations are driving increase in disability-adjusted life years due to YLDs (years lived with disability) rising globally from 21.1% in 1990 to 31.2% in 2013. Leading causes include: low back pain, major depressive disorder, musculoskeletal, substance use, neurological and chronic respiratory diseases.³

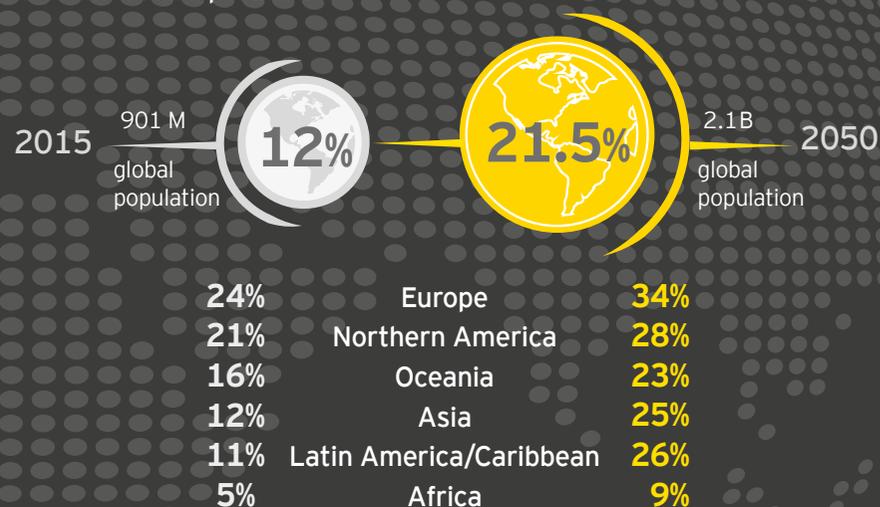
In all countries, both health and long-term care will drive up public spending

In a cost-containment scenario expenditures are projected to rise:⁴

	OECD countries	BRIICS countries
Public health expenditure	5.5% of GDP (2010) to 8% (2060)	2.4% of GDP (2010) to 4% (2060)
Long-term care expenditure	0.8% of GDP (2010) to 1.6% (2060)	0.1% of GDP (2010) to 0.9% (2060)

Rapidly ageing population

By 2050, one-fourth of the population will be aged 60+ in all major areas of the world except Africa²



Sources:

1 The Skolkovo Institute for Emerging Market Studies and EY, *Hitting the sweet spot. The growth of the middle class in emerging markets.* 2013.

2 United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables.* Working Paper No. ESA/P/WP.241.

3 Murray, C.J.L., R.M. Barber, K.J. Foreman, et al., *Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition.* The Lancet, 2015: p. 1-47. Epub 25 August 2015.

4 de la Maisonneuve, C. and J.O. Martins. Public spending on health and long-term care: a new set of projections. Economics Department Working Paper No.06 Paris: OECD, 2013

a rapidly changing world. Insufficiently agile, health systems in advanced economies struggle to respond in an environment being re-shaped by the exponential growth of innovative technologies and telecommunications; social networks; and, rights-based¹⁵ expectations of participation. Facing the 'double burden of disease' (the overlap between communicable diseases and a growing prevalence of chronic health conditions), emerging economies are bypassing creating traditional institutional structures and delivering services via low-cost mobile and telehealth solutions.¹⁶⁻¹⁹ Changing epidemiologic trends with the burden of disease shifting from episodic to chronic conditions,^{20, 21} rising lifestyle related, largely preventable conditions (such as heart disease and diabetes),²²⁻²⁶ and advances in medical knowledge and technologies are all major forces challenging the status-quo. Residual models or 'more of the same' are no longer sustainable or desirable.

In addition, the broader environment is highly fluid. Globally, the digital life has been adopted by consumers with enthusiasm driven by a deep reach of fast and inexpensive broadband, rapidly growing mobility and ever-increasing functionality of cheap devices. Three-fifths of the global population will have at least one mobile subscription by 2020 and the majority of households some degree of access to the internet by that time.^{27, 28}

Mobile networks will ultimately address the internet gap between economies and become the conduit for communications and services for underserved populations.²⁸ As internet access opens up new platforms that bring people together, the sharing economy, crowdsourcing and the generation of vast amounts of personal data through the 'quantified self' and the 'Internet of Things' (IoT) offer potential new pathways by which to organise and deliver healthcare. Increasingly, consumers will bring to healthcare expectations of mobile-enabled solutions that they enjoy in the travel, transportation, financial services and retail industries.

The above shifts and disruptors bring pressure to bear on how the business of health is delivered and ultimately, the performance of the industry. Digitisation is powering a personal health technology revolution and placing control in the hands of the consumer. The case is argued that empowering consumers to make smarter choices and responsible behaviours are bottom-up levers for change that will re-shape the healthcare industry.²⁹



The tools of participation
open consumers to a
world of alternatives

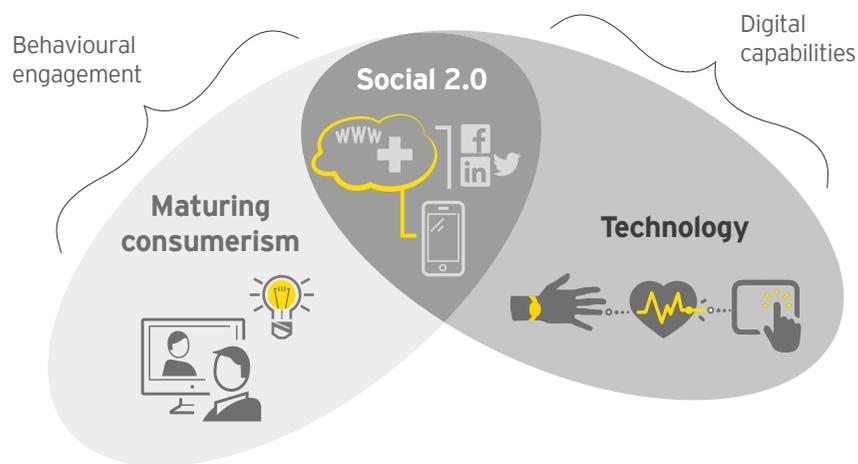
Social 2.0, technology and a maturing healthcare consumerism

Participatory health: enabled by Social 2.0, technology and a maturing healthcare consumerism

The perfect storm puts health systems on notice – to examine what they are now and what they might be in the future. We suggest that one way forward may lie with participatory health in the developing digisphere. Three enablers, Social 2.0, technology and a maturing healthcare consumerism, are foundations necessary to deliver the promise of participatory health to re-shape the demand-side of healthcare. (Figure 2) Each brings tools and channels necessary to empower consumers to make smarter choices and behaviours as they curate the services and experiences they want and gain skills and confidence in managing their own health and wellbeing. Underpinning an individual's capabilities to manage health status and lifestyle choices, foster prevention and wellness, support chronic conditions in vastly different ways and moderate health consumption and expectations can re-shape the demand for healthcare.

Two further dimensions are necessary – appropriate infrastructure (networks, speed, capacity) and psycho-social elements of behavioural engagement [refer side-bar].

Figure 2: Participatory health: key enablers



Behavioural engagement

There is a pressing need to drive behavioural change to counter the growing epidemic of chronic diseases. Noncommunicable diseases account for 70 percent of global mortality and years lived with disability^{20, 30, 31} and behaviours give rise to around 30 percent^{32, 33} of chronic conditions.

Participation and engagement can require complex action and motivation on behalf of the individual and carers. But typically, individuals have difficulty predicting or understanding their future health needs. Decision-making, particularly under conditions of stress or anxiety, is shaped by many things including a preference for maintaining the status-quo, choice-overload, loss-aversion, and procrastination, the influence of social contexts and misperception of risk.³⁴⁻³⁷ Health literacy, or the ability to understand health and medical information sufficiently well enough to make informed decisions to maintain or improve their health is foundational to engaging individuals.

Lessons learned from behavioural economics and social psychology have been instrumental in the design of strategies intended to shape an individual's behaviour, achieve compliance and adherence, and sustained overall engagement. The premise of participatory health – active engagement, knowledge and motivational levers, draws upon understanding the behavioural components of health and the propensity to take action. Popular interventions that "help people help themselves"³⁴ include "nudges"³⁸ and choice architecture³⁵ that draw upon economic, behavioural and cognitive insights to shape behaviour and decisions. Strengthening the individual's capability to self-manage is essential in an environment of increasing consumer engagement where complex drug and treatment regimens mean that adherence and compliance and behavioural change can impact the success or otherwise of care.³⁹

Participatory health – what’s in a name?

A significant catalyst for change is an engaged and participatory patient or healthcare consumer; one that assumes a role as an equal partner in their healthcare experience.

“e-patients”:
empowered, engaged,
equipped, enabled

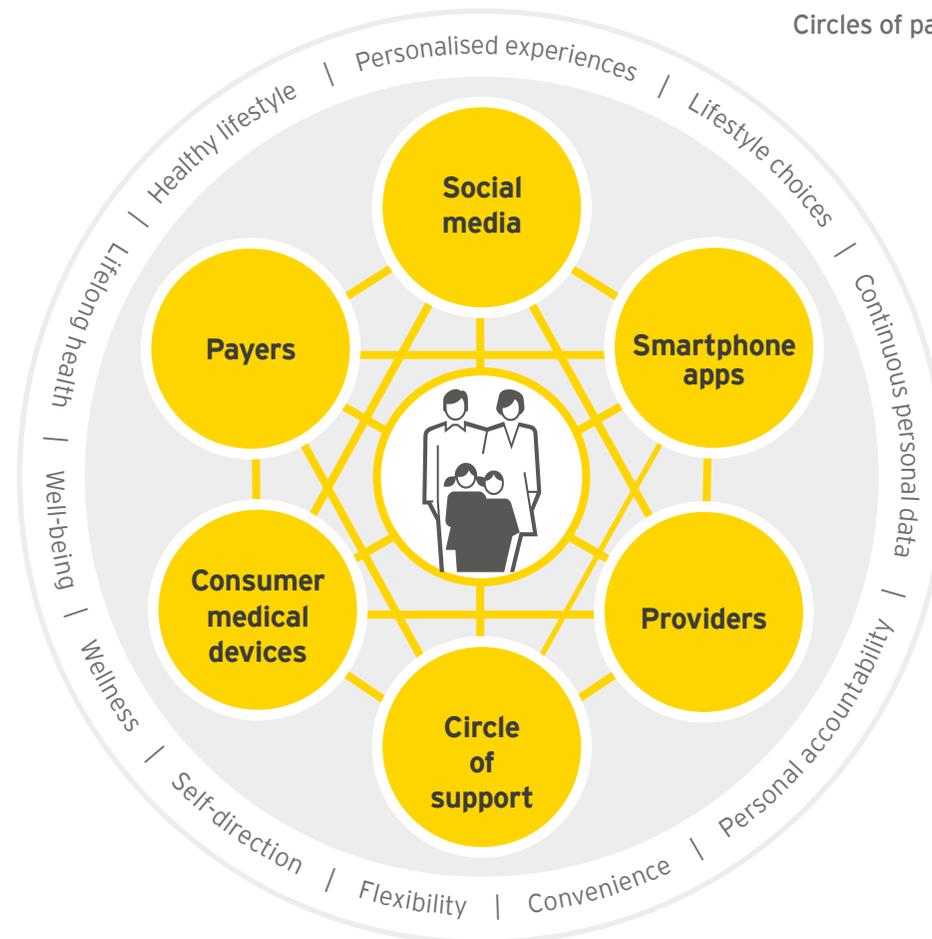
Tom Ferguson

“e-patients. how they can help us heal health care” 2007.

Participatory health is a relatively new stream of thought in the literature of patient engagement (see also for example, patient-activation;⁴⁰ patient-centred/consumer-directed care^{41, 42 43}). Participatory health is usually described in terms of a transformation in the patient-provider relationship and is premised upon individuals taking active responsibility for their health. To do this, they draw upon digital technologies; look to peer and social networks for support; and, act as an equal partner in shared clinical decision making. A move away from medical paternalism,^{41, 44-46} the individual becomes the centre of the action, curating and navigating their health and their care as an equal partner. Technological empowerment is key to individuals (and their circle of support) becoming more health literate and actively engaging in and managing health.

The Society for Participatory Medicine has been instrumental in articulating and popularising patient empowerment and engagement through participation. In particular, in recognising that the future of healthcare rests with “e-patients” as active and autonomous contributors. The Society describes participatory medicine as a cooperative and active relationship between ‘patients, professionals, caregivers and others along the continuum of care on all issues related to an individual’s health’.⁴⁷ “E-patient Dave”, international speaker, empowered-patient advocate and cancer survivor Dave deBronkart, puts it in a nutshell when he says ‘this movement is not anti-physician, it’s about partnership’. A professional’s essential clinical knowledge and experience combines with a patient’s life experience and intimate knowledge of their own needs as best practice care.⁴⁸

Figure 3:
Circles of participatory health



The vital role of digital technologies, social networks and communities as the driving forces behind consumer participation is recognised by Leroy Hood and others⁴⁹⁻⁵¹ in their vision of the future of medicine as being “P4” – predictive, personalised, preventive and participatory. Others extend this vision to “P6” to incorporate psycho-cognitive and public – capturing psychological health and individuals making the most of web tools such as blogs, tagging, wikis, online communities and Twitter for crowd-sourcing, communication, collaboration.^{52, 53}

However, participatory health is not one size fits all. Atul Gawande, the surgeon and author, makes the point that the capacity to step away or to opt out is part of the deal and while patients ‘are glad to have their autonomy respected... the exercise of that autonomy means being able to relinquish it.’⁵⁴

The way that we view and interact with the world is altering and participatory health is an echo of complex changes underway in the broader community. Mobility and near universal smart device ownership underpin a new social contract as culture, identity and relationships shift towards sharing and participation. Participatory health is more than just better patient inclusion and a transformed patient and provider relationship, which many argue should clearly underpin the nature of any therapeutic relationship.^{42, 55} Participatory health is reflective of a deep and profound shift in perspective around health towards well-being and wellness, greater convenience, flexibility, self-direction and personalised experiences. This goes beyond “sick care” to “healthfulness” inspiring, encouraging and teaching individuals to make positive care and lifestyle choices and be engaged in and accountable for lifelong health. (Figure 3) But most importantly, the tools of participation open consumers to a world of alternatives. Alternatives that the emerging digisphere, social media and affinity networks will enable. New entrants, new funding routes, ultimate choice and highly deregulated social constructs open new pathways towards health and wellness.

Three key enablers of participation

Social 2.0

Social 2.0, a rich, interactive and dynamically changing virtual environment is a core platform underpinning participatory health. Social networking tools and dynamic web capabilities combine to create channels or platforms through which consumers can obtain information, find or establish affinity with others, share experiences and encouragement. Increasingly universal, Social 2.0 is growing into its capabilities, building the routes between the consumer and the personalised knowledge and expertise that is necessary to their wellbeing. It is however, in the early stages of development. A body of inquiry is slowly building, seeking evidence of impact on health behaviours and health outcomes.

Participatory health becomes possible through

- ▶ The underlying features of web-based platforms such as ‘participation, communication, user-centeredness, collaboration and openness’⁵⁶ supporting the creation of health social networks that connect patients, providers and research
- ▶ The technical capabilities of the web (for example, always-on, interactivity, continuous updating) deliver to consumers a rich vein of support that was previously not possible including communities of interest, social networking sites, collaborative projects, virtual gaming, blogs and wikis^{57, 58}
- ▶ Commonly-shared platforms give rise to different forms of engagement between consumers and health industry players. For example, pharmaceutical companies are developing social listening skills to get closer to patients, to understand their experiences and unmet needs, and to monitor content for pharmacovigilance. Insurers are using retail-like social business strategies to form long-term relationships with members and such things as interactive challenges and gamification to change behaviours and increase engagement. Institutions use social networks to recruit for clinical trials and to source suggestions for future trials and trial methodologies

Technology

Slow to adopt the capabilities of new technologies, the health industry is now awash with wearables, devices, sensors and apps with functionalities that range from supporting health and fitness through to the management of clinical conditions. Personal technologies are foundational to participatory health as care shifts to the home/community and as self-quantification becomes part of daily life. Application is broad, ranging from personal data collection and self-monitoring through to chronic condition management and participatory epidemiology.

Participatory health is supported by

- ▶ Technology that orients around the person and mobility features that support health anytime, anywhere
- ▶ Core features common to a vast range of devices (sensors, cameras, connectivity to social platforms) and emerging intelligence capabilities in recognising and understanding an individual's habitual behaviour patterns
- ▶ Cheap wireless technology and extensive connectivity of everyday things with sensors to the internet

Maturing consumerism

The notion of consumerism, the consumer as an informed, active and engaged decision-maker, is slowly maturing in healthcare. Healthcare consumerism is on the rise, driven by individuals bringing a very different perspective to health. In part, due to consumers seeking value and better outcomes as they increasingly participate in self-management of health and wellness, and, as many bear more of the financial burden of their care. This shift is emerging as people expect healthcare to deliver what they have in other areas of their lives – connectivity, mobility, agility, immediacy and the tools for self-direction.

Participatory health will be shaped by

- ▶ As consumerism has been an unstoppable force for change in other industries it can be expected to do so in healthcare. Looking to the consumer may well provide valuable clues. For instance, expectations and actions of many digital natives (those who grew up immersed in digital technologies) and digitally savvy 50+ baby boomers have already transitioned way beyond the confines of traditional health systems
- ▶ Many, (but not all) seek to select and organise their own healthcare experiences and to have the opportunity to participate in a meaningful way and as an equal partner in decisions. Younger generations more so than older, and this will increase as upcoming generations begin to interact with the health system either for themselves or on behalf of others in their care such as children or ageing parents
- ▶ Others embrace technologically driven self-care, bypassing the formal system and going straight to mobile – using tools and affinity networks for information, advice, support and self-generated state of health data

Australian healthcare consumers – poised to adopt digital health

As part of building a global picture, we undertook primary research to understand the extent to which Australian consumers have an interest in and ability to engage in a healthcare marketplace. (Refer side-bar) This study will be repeated in several countries.

Overall, healthcare consumers in Australia are poised to adopt technologies and assume a higher degree of participatory involvement in their health, wellness and interactions with the health sector – a move already taking place in emerging markets and where the U.S.^{59, 60} and parts of Europe⁶¹ are also well down the road. In the first instance, these will be tools that simplify organising care such as online appointments and scheduling, electronic communications with professionals and patient-portals.

An indicator of engagement is the extent to which consumers turn to online resources. Highly digitally active,⁶² Australian consumers are doing their homework online researching health issues and wellness. In the past year, well over half of respondents (63 percent) searched online for information about an illness, injury or health problem. Around half (47 percent) looked for fitness and healthy living information and 38 percent sought information to self-diagnose an illness or condition. Although most respondents are active in using social media in their daily lives, few do so for health purposes at present.

There are clear signs of an inclination towards participatory health – in particular, (but not restricted to) the younger generational groups. Around half of all respondents consider they have been included and consulted in decisions about their care to the extent that they wish. Seniors feel more included than do younger age

groups. Information is an important condition of active participation and nearly all respondents believe that doctors should share tests, notes, and the computer screen during a consultation with the patient. Consumers' interests extend beyond the current capabilities of the health system with high receptivity to personalised care and non-traditional service delivery models. (Figure 4)

A leading edge of a growing healthcare consumerism is evident, with 'early adopters' taking-up and actively using tools and technologies in an active and participatory sense. Many more express an interest in doing so in the future. (Figure 5) In part due to the early-stage of development of the Australian digital health environment, as the system matures and tools and technologies develop, technologies will become embedded and a core tool of regular health activity. Similar to the adoption of technology in other industries such as retail and banking, once experienced, technology will be absorbed, adopted and expected. From other industries we know that... "If you provide it, they will embrace it."

Australian healthcare consumer survey

In July 2015, EY conducted a nationally representative online survey of 1,761 randomly selected adult Australians age 18+ years.

The survey examined consumers' use of digital, social and mobile technologies in the context of managing their health, fitness and wellness.

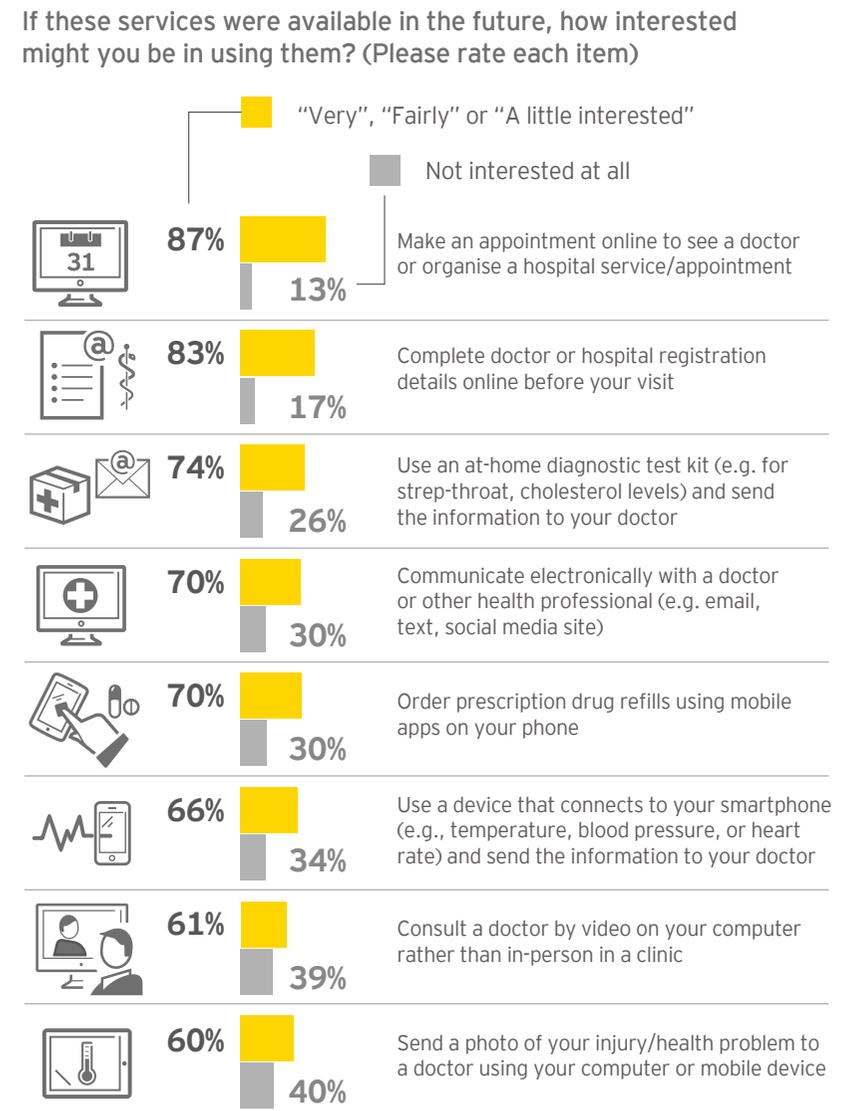
A range of questions explored attitudinal and behavioural preferences in such key areas as decision-making, preferred physician characteristics, active versus passive preferences and perceptions around individual responsibility and the notion of health.

Figure 4: Consumer receptivity to non-traditional service delivery models

Totally agree (rating 4 or 5 on a 5 point scale)	To what extent do the following statements accurately reflect your views? I am willing to...	Totally disagree (rating 1 or 2 on a 5 point scale)
59%	Be treated by a health professional (e.g., registered nurse, physician assistant, pharmacist) instead of a doctor for minor /non-urgent health problems, vaccinations and basic health screenings (e.g., blood pressure, blood sugar, weight)	11%
47%	Take medications or treatments that have been customized to my genetic profile in order to treat certain diseases or disorders	15%
45%	Have non-urgent treatment, vaccinations and health screenings (blood pressure, blood sugar, weight) by a health professional (e.g., registered nurse, pharmacist) at a retail pharmacy or in a facility located in a department store	21%
43%	Undergo genetic/DNA testing to confirm a diagnosis or whether I might develop certain diseases or disorders	21%
37%	Have a health condition treated with a "high-tech" product such as a ingestible sensor that delivers medication targeted to specific areas of the body or a personalised jointreplacement manufactured by a 3-D printer	22%
32%	Be treated by a health professional (e.g., registered nurse, physician assistant, ambulance officer) instead of a doctor at an Emergency Department in a hospital	30%
27%	Be treated by a health professional (e.g., registered nurse, physician assistant, pharmacist) instead of a doctor for urgent or complex health problems or screening procedures	38%
19%	Travel overseas for health care if it is cheaper but of equivalent quality to care in Australia	55%
19%	Receive a diagnosis/prescription/advice or undergo treatment /surgery by a robotic device	46%

EY Healthcare consumer survey 2015: Australia
 Weighted data; total respondents N=1761
 Data are rounded
 The 'Between' response (rating of 3 on a 5-point scale) not shown

Figure 5: Future interest in using digital technologies



EY Healthcare consumer survey 2015: Australia
 Weighted data; total respondents N=1761
 Data are rounded



Today's healthcare
now on notice

A new ecosystem that
complements but also
challenges existing systems

A new ecosystem that complements but also challenges existing systems

Today's healthcare now on notice

Social, mobile, analytics, cloud and sensor (SMACS) technologies are the tools of change that support participation and collaboration. Active, participatory and consumer-centered, participatory health is made possible by advances in web capabilities that support interactivity and the dynamism (continuous modifications as a result of user participation) inherent in such things as social networking and user-generated content.⁶³

Case study

HealthEY microsimulation tool: The impact of wearable activity trackers on the prevalence of type 2 diabetes

Behavioural microsimulation models human behaviour arising from decision-making preferences and customary cognitive processes. Ranging from modelling individuals behaviours through to that of populations, microsimulation can predict likely responses to new policies, treatment interventions or disruptive events and has significant health policy and chronic condition management application.

One such condition, type 2 diabetes currently affects over 1M Australians, is rapidly increasing in the population with an annual direct cost to the Australian economy of around \$6B.¹ Type 2 diabetes is a chronic condition associated with well-known modifiable risk factors including lifestyle factors such as poor diet, obesity, being overweight and lack of physical activity. Preventive measures including healthy lifestyle and moderate exercise are advocated to stop the development or progression of the disease.^{2,3} EY applied the behavioural microsimulation model, HealthEY, to estimate the potential impact on the prevalence of type 2 diabetes in Australia over a 15year period (2015-30) of wearable activity trackers, such as Fitbit or Apple Watch, that monitor, track and motivate fitness-related metrics.

Drawing upon population demographics along with population-based dietary, activity and tobacco consumption data the prevalence of type 2 diabetes over the study time period was predicted. Using highly conservative assumptions about adoption and retention rates of fitness trackers and personal characteristics of likely adopters, three uptake scenarios - low, medium, and high were modelled. Results suggest that without any intervention, the prevalence of type 2 diabetes in the adult population over the years 2015-30 would almost double from 7.9% to 14.5%. In the simulation, increased physical activity due to adoption of activity trackers led to a reduction in prevalence of between 0.7-1.9% by 2030 depending on the specific uptake scenario. When combined with annual cost data, the microsimulation using HealthEY predicts that a device aimed at preventative intervention can, with just a modest improvement to risk at the individual level, translate to a significant aggregate benefit, measured in terms of billions of dollars of savings to the Australian economy.

The predicted prevalence of type 2 diabetes in the adult population of Australia over the period 2015-30 for zero uptake of wearable activity trackers (Baseline) and the predicted reduction under three product uptake scenarios (Low, Medium and High).	Year	Baseline	Low	Medium	High
	2015	7.89%	-0.00%	-0.00%	-0.00%
	2020	10.42%	-0.05%	-0.16%	-0.34%
	2025	12.57%	-0.31%	-0.69%	-1.12%
	2030	14.45%	-0.68%	-1.27%	-1.85%

1 Diabetes Australia. <https://static.diabetesaustralia.com.au/s/fileassets/diabetes-australia/e7282521-472b-4313-b18e-be84c3d5d907.pdf>

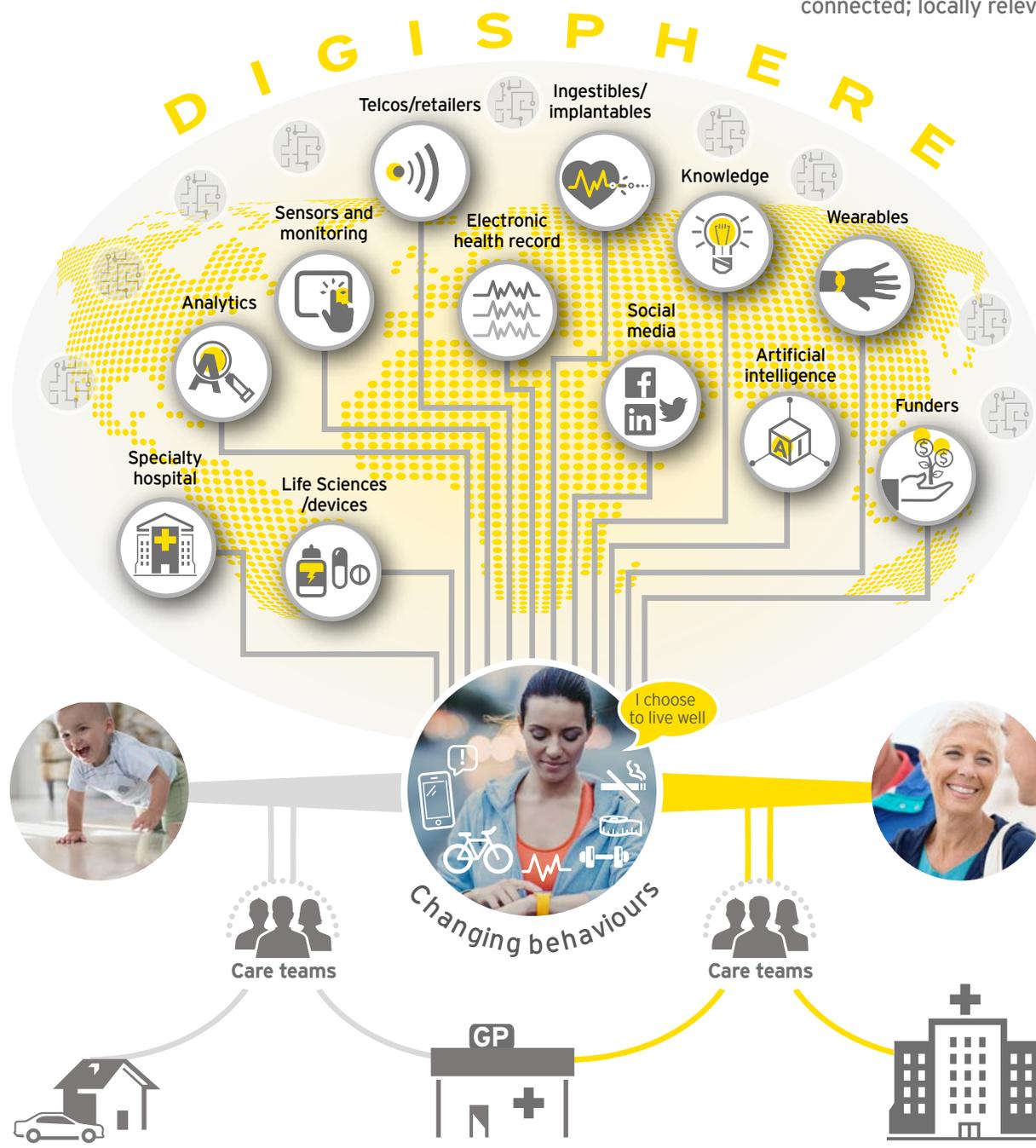
2 Wearable Devices as Facilitators, Not Drivers, of Health Behavior Change. JAMA 313: 459-460, 2 2015. <http://jama.jamanetwork.com/article.aspx?articleid=2089651>

3 Diabetes Queensland. <http://www.diabetesqld.org.au/healthy-living/healthy-u/get-motivated-personal-activity-tracker-style.aspx>

Figure 6. Health digisphere: globally connected; locally relevant

So, what might an expanding and participatory health ecosystem in a health digisphere look like? (Figure 6)

- ▶ **Individuals** are actively involved in managing their lifelong health and wellness and curate their health experiences through their personal health cloud – a network of connected personal devices that capture and share personal health data in addition to their integrated electronic health record
- ▶ **Shared experiences**, peer-to-peer information and motivational encouragement are gained via social networking channels
- ▶ For many, the **relationship** between the individual and physician shifts to that of partners or co-producers, with physician's as expert advisors. Others will seek a more traditional relationship
- ▶ At a **service delivery** level, clinical and decision-making algorithms, artificial intelligence (AI) diagnostics, case management and care delivery pathways systematise care delivery systems and processes efficiently and effectively
- ▶ **Convergence** and the blurring of boundaries between industries enables greater permeability in healthcare and new entrants (telecommunications and technology companies, retailers, start-up entrepreneurs and venture capital investors) see opportunity in the vast healthcare market. They seek to actively disrupt the health industry using exponentially developing technologies to remake clinical delivery systems, population health management, back-end operational capabilities, business models and consumer engagement
- ▶ **Existing players** such as traditional life-sciences businesses and insurers also see potential to better align with the end-consumer by developing new social partnerships and by mining customer insights to better target products and services
- ▶ **Advancing capabilities** in analysing and understanding vast quantities of health data open pathways towards new insights that improve understanding of the 'disease journey' and the vast possibilities of rapidly developing disciplines including integrative systems biology and medicine, biomedical informatics, personalised medicine and population health



This new ecosystem complements but also challenges existing systems, particularly in the primary care domain and may well offer alternatives that relieve some of the current system failures such as wait times, miscommunications, and burdensome paperwork to name but a few. The emphasis shifts from a supply-side push of services to one where consumer demand is the main determinant of value and activity. Indeed, rather than further fragmenting the system, some of the pressure points of healthcare such as peak demand, care variations and inappropriate demand may well be smoothed. As healthcare becomes untethered by mobile technologies the epicentre of healthcare shifts to the home and community. In-person encounters and hospitals will always play a vital role in any health system, however, digital and mobile technologies make considerable headway towards re-envisioning healthcare way beyond episodic acute and facility-based care.

Opportunities arising in the digisphere attract investors and entrepreneurs. Venture capital investors, for example, show strong interest in digital health with attention directed towards six key categories providing new alternatives for consumers. (Figure 7)

Figure 7: Venture capital investment (United States): Digital health, 2015
Total investment in digital health Q1-Q4 2015 = \$4.3B

Top 6 categories		Q1-Q4 2015	Key deal
	Healthcare consumer engagement Consumer tools for purchasing healthcare services or health insurance (B2B and B2C)	\$613M	ZocDoc (\$130M)
	Wearables and bio-sensing Consumer wearables or accessory devices that detect specific biometrics	\$489M	Jawbone (\$300M)
	Personal health tools and tracking Products to assist in the tracking of personal health (e.g., physical activity, nutrition, genetics) and health records	\$407M	23andMe (\$115M)
	Payer administration Data aggregation/analysis to support a wide range of healthcare use cases	\$252M	Collective Health (\$81M)
	Telemedicine Delivery of healthcare services through non-physical means (for example, telephone, digital imaging, videoconferencing)	\$234M	Doctor on Demand (\$63M)
	Care coordination Coordination and management of care for a patient, across providers or other carers	\$208M	Tigertext (\$50M)

Source: RockHealth. Digital health funding: 2015 in Review. 8 December, 2015
<http://rockhealth.com/reports/digital-health-funding-2015-year-in-review/>

Case study

“Consumers demand change... not to make aged care better but to create something quite different”

RSL Care's new 'Bravo – Go Get Tomorrow' business model has been driven by a passion for consumer engagement, an unwavering focus on the customer and consumer participation in co-designing new experiences and services.

A leading non-profit provider of retirement living, community care and aged care services for 75 years, RSL Care operates more than 28 communities throughout Queensland and New South Wales, employs 3,500 staff and manages approximately \$1B in assets. Beverly Smith, Chief Customer Officer, spoke with EY about their award winning 'Bravo – Go Get Tomorrow' program.

Customer and competitor activity will disrupt the aged care industry

RSL Care was aware that existing industry models of residential care were being rejected by consumers as unappealing and outdated. Taking steps to address the growing gap between mission, financial health and service delivery was critical for the organisation and as Smith notes, they faced a very real challenge that “we have a \$1B worth of assets that no one will want to live in within 10 years”. In 2012, the RSL Care board endorsed a shift in organisational strategy and Smith's team embarked upon a two-year journey designing evidence-based, innovative services founded on customer insight. Central to this were two beliefs. Firstly, that the services should be co-created with consumers and built around customer value, and secondly, that the core task was that of reinventing and redefining the experience of ageing to meet rapidly changing consumer demand.

Independent customer behavioural research revealed how and why people make decisions, their preferences and motivations. Over 2,000 older Australians were surveyed and this was

supplemented with over 200 hours of in-depth interviews. Customer behavioural profiling resulted in identifying five unique consumer segments and the profiles became the cornerstone of RSL Care's diversification strategy. The messages in the customer research were “unequivocal...the aged care system is broken and people dread it” and that the experience of ageing needed to be re-oriented towards a healthy and extended life expectancy and a productive and purposeful 'second half of life.'

The 'Bravo – Go Get Tomorrow' business model

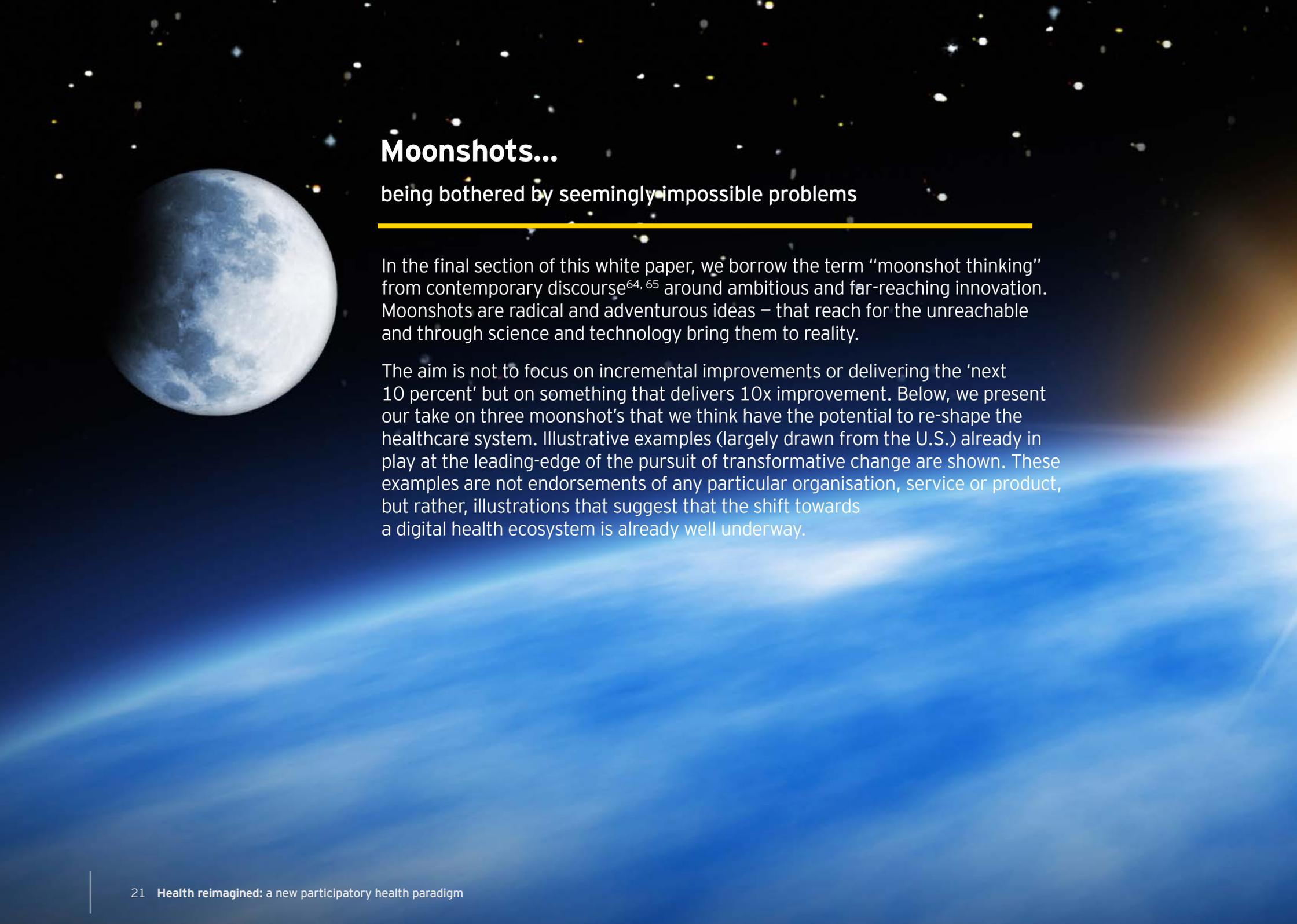
A Wellbeing Design Hub was created for ideation and prototyping of new services with customers deeply involved in the design and development. A new platform was grounded in a shift of value proposition from reactive delivery of care packages to proactively guiding customers to wellbeing and independence outcomes. Services are highly personalised, designed to meet each individual's goals and ambitions, achieve wellness and maintain independence. Wellness Guides partner with individuals to develop individualised programs in five key areas of wellbeing covering 'eat, mind, move, home, heal'. At the heart of the new service is a value proposition that guides people to positive health outcomes through a customer experience tailored around their specific behavioural profile. Each new customer is mapped to a behavioural segment using an algorithm of 20 questions. Collaborations with industry leaders such as QUT's Business School have been forged to leverage their expertise in such things as behaviour change in Public Health and Health Services utilising nudging techniques. Purpose built technologies play a key role in the program – such as integrating the tools and resources individuals need to maintain a healthy lifestyle and achieve their goals.

Undertaking the comprehensive evidence-based research was the game-changer for RSL Care. “What has really set this work apart and given it a lot of rigour and credibility is the evidence base that sits behind it. There are a lot of organisations that talk at high levels about [being] customer-led, customer-driven but they don't have the evidence. What has given our leaders and the board the confidence in decision-making is the evidence – it's indisputable”. Smith is clear that success in embedding the new service in the organisation depended upon creating deep and systemic change at the highest order of innovation – at the business model level and “not at process level which is just continuous improvement or at the product level”.

Embraced very positively by customers and staff, achieving such a major organisational change has been by no means easy. Smith says that “every step has been incredibly hard fought, and we have needed to demonstrate customer value all the way through.” The critical catalyst was a passionately held belief in the need to revitalise ageing and aged-care. This belief was shared and driven by the chairman and CEO. This was essential to the success of the program. The board gave the Wellbeing Design Hub the mandate to change and the freedom to test provocative ideas. The industry was ripe for disruption with customer rejection of existing models, the need for diversification as a long-term business strategy and marketplace vulnerability to a disruptive competitor entering the space. RSL Care moved to fill a gap with a market-led approach based upon consumer co-creation and participation.

In July 2015, RSL Care won the Australian National Good Design Award for innovation and entrepreneurship.

[Note: Beverly Smith has since departed RSL Care]



Moonshots...

being bothered by seemingly impossible problems

In the final section of this white paper, we borrow the term “moonshot thinking” from contemporary discourse^{64, 65} around ambitious and far-reaching innovation. Moonshots are radical and adventurous ideas – that reach for the unreachable and through science and technology bring them to reality.

The aim is not to focus on incremental improvements or delivering the ‘next 10 percent’ but on something that delivers 10x improvement. Below, we present our take on three moonshot’s that we think have the potential to re-shape the healthcare system. Illustrative examples (largely drawn from the U.S.) already in play at the leading-edge of the pursuit of transformative change are shown. These examples are not endorsements of any particular organisation, service or product, but rather, illustrations that suggest that the shift towards a digital health ecosystem is already well underway.



Moonshot #1: Social Media 2.0 – Knowledge and behaviour drives wellbeing

Maturing healthcare consumerism – “It’s all about me” as consumers actively curate lifelong well-being through engagement, participation and healthy behaviours to live the life that they want... on their terms.

In brief

Technologies, along with a growing willingness to share personal information, facilitate clear consumer preferences to use social media, peer and affinity networks for information and personal support outside of the formal healthcare system

Personalisation and engagement is driven by predictive analytics as deep data resources (personal data, online, social media, geolocation) combine with insights around consumer needs, preferences and behavioural propensities. Deep understandings of behaviours, attitudes, market segments and archetypes that cut across demographics drive highly targeted, personalised omni-channel experiences and relationships

Market dynamics turn towards the consumer as financial risk shifts through consumers increasingly bearing more of the costs of their care. This gives rise to different expectations of the health industry as consumers seek greater transparency of costs and quality, accountability for results and a better customer experience through a more retail-like approach to delivering services

Social 2.0

Growing social and mobile penetration levels **change relationships** in healthcare. Patients and caregivers draw upon the **power of the crowd** through online platforms to form communities of interest, some of which mature into influential online communities of action.

Social 2.0 – new platforms in virtual networks and communities providing 'social proof of similar voices'⁶⁶ is founded in a trustworthy belief in peers and in recognised experts or authorities. Social 2.0 offers feelings of reciprocity (being able to share as well as benefit from experiences), advice and information. This increasingly challenges and replaces existing trusted and authoritative systems. Health industry players dig deep into these channels to build relationships and explore and exploit brand perception with consumers

- ▶ Access to the experiences and opinions of others is gained via crowdsourced collective consumer experience data in forums such as PatientOpinionAustralia (www.patientopinion.org.au), Healthtalk Australia (www.healthtalkaustralia.org) and CureTogether (www.curetogether.com) and comparator websites such as iselect (www.iselect.com.au) and helpmechoose (www.helpmechoose.com.au) that focus upon insurance. UK based NHS Choices (www.nhs.uk/pages/home.aspx) website and European participatory health organisation PatientView (www.patient-view.com) actively evaluate and recommend apps to patients

- ▶ Online patient network, PatientsLikeMe (www.patientslikeme.com) draws people together in affinity groups, enabling people to learn from others and get a broader view concerning their condition but also acts as a clinical data aggregator for research purposes. Similarly, SmartPatients (www.smartpatients.com) forms communities of interest and is a platform to share experiences, seek and offer information and learn about clinical trials and new treatments
- ▶ Outbreaks of disease are tracked and mapped by self-reporting sites such as HealthMap (www.healthmap.org) and Sickweather (www.sickweather.com) that draw information from social platforms, curated discussions, official reports and eye-witnesses



Power of the crowd

Crowdsharing of experiences shape **both consumer and provider behaviours** through ratings, reviews and experiences feedback. Regulators stimulate transparency through the release of comparative performance information and organisations step up to increasing accountability for outcomes with increasingly transparent processes. Consumers seek retail-like experiences and increasing value.

- ▶ Sites such as whynotthebest (www.whynotthebest.com); Consumer Reports (www.consumerreports.com) and Healthgrades (www.healthgrades.com) enable consumers to compare patient experiences of physicians, hospitals, specific procedures and geographic localities based upon a combination of user feedback, performance data and evaluation
- ▶ Healthcare bluebook (www.healthcarebluebook.com) draws upon U.S. national payment data to enable consumers and employers to shop around for the 'fair price' of healthcare based upon cost and quality data
- ▶ The Health Care Cost Institute (U.S.) healthcare price comparison website Guroo.com (www.guroo.com) allows consumers to compare prices for around 70 common services drawing upon data from major insurers including United Healthcare, Humana, Aetna and Assurant Health
- ▶ In 2014, the Centers for Medicare and Medicaid Services (CMS) site Physician Compare released physician quality performance information on a set of quality measures assigning star quality ratings as indicators of performance (www.medicare.gov/physiciancompare)



Behavioural and social engagement

The intersection of **Social, Mobile, Analytics, Cloud and Sensor** technologies (SMACS) gives the health-care industry new ways in which to understand and interact with patients, families and carers. Persuasive technologies, behavioural economics, behavioural sciences, increasing miniaturisation of devices and proliferation of tracking methods deliver insights about consumer behaviour and how individuals make decisions. Better insights derived from better data underpin the shift to value and support care in the community.

Growing use of apps for chronic disease management is evidenced in one-fourth of apps currently available focusing on disease management and treatment of chronic conditions. Consumer engagement is being driven by the most frequently prescribed/downloaded apps, of which 65% connect to social media.⁶⁰

- ▶ Ginger.io (<https://ginger.io>) uses behavioural analytics based upon big data from mobile phones to identify changes in behavior that may be warning signs, especially when monitoring people with chronic issues such as diabetes or depression
- ▶ Health engagement company Red Brick Health (<https://home.redbrickhealth.com>) draws upon behavioural economics, choice architecture, social network analysis and adaptive technologies to engage consumers in managing better health. Focus is employer sponsored health and wellness programs and targets high-cost condition management and member engagement
- ▶ EY Simulait Online analytics (<http://eyc3.com>) build microsimulation solutions to deliver prescriptive predictions on consumer behaviour

from whole populations to the individual level. Drawing upon human cognitive frameworks of how and why people make decisions, models test the health pathways and decision points for individuals. These can include lifestyle and prevention, diagnosis, and treatment and test how interventions or disruption can influence consumer choice and behaviour at the various stages of an individual's health pathway. The impact of future trends, changes in health policy and interventions and disruptive new technologies on consumer behaviour and health can be modelled to determine the overall impact on the health system, in addition to impact at the individual level

- ▶ Concerns regarding the scientific validity and health outcomes of health apps are beginning to be addressed with third-party evaluations by groups such as Evidation Health (www.evidation.com) and the Validation Institute (www.validationinstitute.com)



Moonshot #2: Technology – Your personal health cloud curates your life journey

“New knowledge” (clinical, technological, social, cultural, environmental and ethical) revolutionises medicine taking it into a new future – one that is predictive and personalised, proactive and integrated but hugely diversified.

In brief

New entrants side-step away from the traditional health industry, re-envisioning healthcare and building novel solutions that target clinical delivery, health and wellness, population health and patient segmentation management, data, and analytics. Behavioural sciences emerge as a core platform

The practice of medicine shifts from episodic and reactive to one that is integrated and prevention-focused – based on consumer engagement to drive an individual's health rather than manage a disease. Prevention takes place along the continuum of care. The concept of health broadens to embrace beyond the traditional in a more diverse, integrated and seamless system of care and wellbeing including behavioural, environmental and social factors that contribute to population health

The provision of care becomes agnostic to location as the system shifts beyond the four walls of the clinic or hospital to care anywhere and at any time in the home and community. Community is not necessarily geographic, but may be based upon shared interests



New players and cross-sector partnering

Increasingly permeable and blurred boundaries of the healthcare system give rise to completely **new paradigms**. Non-traditional players – entrepreneurs, retail organisations, communications and technology companies as well as life sciences companies and insurers look to enter healthcare, seeing opportunities in consumer-driven healthcare, potential market size and prospects for growth.

Fast-moving consumer product companies, telecommunications companies and big-box retailers bring different ways of thinking to the health industry. Drawing upon core capabilities around logistics and vertical integration to drive down costs, new entrants develop consumer-oriented services that compete with or coexist with existing systems. New opportunities arise for cross-sector partnering.

- ▶ In partnership with the Mayo Clinic, Apple has developed HealthKit (www.applehealthkit.com) as a central platform for health information. Users can upload, store and share health and fitness data. The company's open source medical research platform, ResearchKit tracks symptoms of chronic conditions such as Parkinson's Disease, diabetes, breast cancer, and cardiovascular disease for large scale population clinical research
- ▶ Telstra Health, (www.telstra.com.au/telstra-health) a division of Telstra Corporation, the Australian telecommunications company, launched ReadyCare telemedicine service in July 2015. Phone and video access to a doctor in Australia is available 24/7 for

advice, diagnosis, prescriptions, care and treatment. The service is positioned as complementary to care provided by a user's regular GP. Other services developed by Telstra Health include back-end functions such as online appointment scheduling systems, scheduling platforms across enterprises and home and mobile monitoring targeting chronic condition management

- ▶ Google is making broad-ranging forays into the health space including researching ageing and age-related diseases, acquiring robotics, artificial intelligence and IoT companies and pursuing health relevant projects ranging from smart contact lenses for diabetes through to nanoparticle pills that detect the presence of biomarker molecules inside the body that indicate diseases such as cancer or heart disease. Google's new human body Baseline project aims to collect extensive data from volunteers to build a model of the characteristics of a healthy human <https://verily.com/>

- ▶ Insurers move to enhance their retail capabilities with consumer-oriented platforms including benefits management apps, price and payment estimators, and gamification tools. For example, CIGNA's Health Matters (www.cigna.com/cigna-health-matters) health coaching program; Oscar Health Insurance (www.hioscar.com) partnership with Misfit Wearables; and, Kaiser Permanente's flagship member portal MyHealthManager site and app (<http://centerfortotalhealth.org>)

Rapid-cycle technological change, idea exchange on converging platforms and access to venture capital **disrupt the status-quo** to tackle intractable problems in healthcare bringing clinical and economic benefit for adopters, entrepreneurs and investors.

Increasing integration occurs of biomedicine, information technology, wireless, and mobile and applications such as wearable and environmental monitors, implanted devices, and ingestible chips. Computing technology makes medical devices faster, smaller, cheaper, and mobile. Bioethics raises important questions around informed consent, privacy, autonomy and responsible accountability.

- ▶ Organovo (www.organovo.com) designs and creates functional human tissues using 3D bio-printing technology for research and drug development purposes and ultimate long term vision of producing tissue for surgical transplantation
- ▶ Illumina (www.illumina.com) has developed a range of genomic solutions including next-generation sequencing technology targeted at the research and clinical markets. Applications include life sciences, oncology, reproductive health and agriculture
- ▶ Counsyl (www.counsyl.com) has developed robotically managed lab-on-a-chip low-cost sequencing examination of prospective parent's genes to screen for over 100 types of genetic disorders and cancers

Research shifts to being collaborative and cooperative in projects and data sharing – often on an international scale. Collaboration is occurring across multiple sectors of technology, science, medicine, computing and others. Patient-participation and crowdsourcing draw upon the power of the crowd to collectively solve real-world problems.

- ▶ Human Brain Project (www.humanbrainproject.eu) European initiative with 135 partner institutions in 26 countries; and the US Brain Initiative (www.braininitiative.nih.gov) Brain Activity Map adopt a cross-disciplinary approach
- ▶ Hackathons, for example MIT Hacking Medicine (www.hackingmedicine.mit.edu) and Hacking Health (www.hackinghealth.ca)
- ▶ Competitive events and innovation challenges, including Kaggle (www.kaggle.com) and XPRIZE (www.xprize.org)
- ▶ Citizen scientists, examples include EyeWire (<https://eyewire.org>) and GoViral (www.goviralstudy.com)

- ▶ Wisdom of crowds for example, CrowdMed (www.crowdmed.com) invites crowdsourced opinions on difficult medical cases submitted by physicians; sites such as Almanis (www.almanis.com) seek crowd sourced commentaries, forecasts and suggested problems for resolution drawing upon collective wisdom of contributors
- ▶ Funding and innovation support, such as Watsi (<https://watsi.org>) and AVIA Innovator Network (www.aviahealthinnovation.com)
- ▶ The sharing economy where enabling technologies support direct transactions between networks of people and organisations such as PatientsLikeMe (www.patientslikeme.com), Curetogether (www.curetogether.com), e-NABLE (www.enablingthefuture.org) and Matchmaker Exchange (www.matchmakerexchange.org)



Healthcare: Anytime, anywhere

'Anywhere-anytime' prevails as insights about self and about populations arise from intentional and unintentional data via the Internet of Things and Quantified Self environments.

As consumers become more health conscious, the notion of health transitions from sick care systems to wellness, chronic care and population health management. Behavioural health, environmental and social networks become part of a system of care that is diverse, integrated and seamless. In this new world, community is not just geographic but can be people who have the same condition or shared interests.

Talent shortages of critical skills drive changing workforce models and care delivery is pushed beyond the physician's office and hospital walls into the home and community. Untethered by mobile technologies, patient preferences and a different way of thinking about the delivery of care, the epicentre for much of healthcare becomes the home.

- ▶ Australian telehealth service, GP2U (<https://gp2u.com.au>) provides patients with direct access to Australian doctors (GPs and Specialists) online via video conferencing. Service covers advice, and where indicated,

prescription medications, referrals and medical certificates. Similar U.S. based services include TelaDoc (www.teladoc.com), ZocDoc (www.zocdoc.com) and Healthtap (www.healthtap.com)

- ▶ CarePredict (www.carepredict.com) is a wearable movement sensor and activity tracker that measures daily activities and uploads data into a journal. Targeted at senior's living at home, the program analyses patterns and sends alerts following unusual activity
- ▶ VSee Telemedicine (<http://vsee.com>) is a mobile telemedicine clinic, cloud-based waiting room and e-visit platform. Based upon one-click web video calling, HD video, remote camera and medical device integration that is security encrypted and HIPAA compliant in low band-width service to deliver remote telemedicine services in Africa, South America and was used by NASA in the international space station

- ▶ Patient participation is supported by self-diagnosis products/sites such as Simptify, (www.symptify.com) an online assessment tool that identifies likely problems and suggests care options. System also provides geo-locational support, pre-arrival transfer of information/check-in to the facility and maintains electronic health records of consultations



Moonshot #3: Consumerism – A Health Digisphere connects and empowers

Technology, in all its various forms, embeds as a common platform or 'digisphere' in all aspects of healthcare as an interconnected environment (technologies, existing players, new entrants) around an individual connecting across the continuum of care and across a lifespan.

In brief

Blockbuster innovations and scientific evolution along with rapid and continuous technological advances accelerate new ideas, diverse innovations and fundamentally different approaches to clinical care, customer experience, and clinical and performance insights

Patients, professionals and systems are empowered by tools, devices and technologies that open the doors to connected health. The point of care untethers and delivered through direct-to-consumer platforms; consumers will "own" their medical records and manage their choices directly, especially as Gen Y and Millennials age into care

Data analytics improve understanding of the disease journey and spur the vast possibilities of developing disciplines including integrative systems biology and medicine, biomedical informatics, translational research and population health. Analytics become the norm and a general everyday technology



Innovation brings novel solutions

Technologies, new science, new players and new sources of funding parlay ever increasing speed, powerful processing and low-cost memory into practical solutions.

Mobility and seamless integration into daily life are key for adoption and user-centred design reduces burden and lowers complexity.

- ▶ Enlitic (www.enlitic.com) uses deep machine learning algorithms to analyse vast quantities of medical images, physician's notes and lab tests to identify subtle and hidden patterns and apply to diagnostic healthcare
- ▶ AdhereTech's (www.adheretech.com) smart pill bottle monitors adherence and sends reminders (e.g. texts, emails, phone calls) if a dose is forgotten
- ▶ Qloudlab (www.qloudlab.com) is developing smartphone touchscreen technology to perform connected point-of-care medical diagnostics such as blood pressure, blood lipid panels and blood glucose measurement

For organisations, new analytics-based approaches help address operational challenges such as cost structures, clinical quality, workflows, supply chains, and risk controls.

- ▶ Lumiata's (www.lumiata.com) analytics platform produces a "medical graph" from vast amounts of data with applications in triage, diagnostics and treatment planning as well as predictive population health and financial applications

- ▶ Explorys (www.explorys.com) enables healthcare systems to collect, link, and combine data from disparate sources across the enterprise and clinically integrated networks. Targets the convergence and standardisation of big data internal and external to an organisation to analyse and manage quality, cost, risk, and outcomes across partners delivering healthcare
- ▶ Predixion (www.predixionsoftware.com) cloud-based analytics platform provides real-time, advanced analytics at clinical decision points in order to improve outcomes. Analyses patterns in hospital databases to predict preventable admissions, prevent hospital acquired conditions and chronic condition management

Entrepreneurs, retail organisations, communications and technology companies and life sciences businesses with diversification ambitions see opportunity in the large and growing healthcare market. Investors and accelerators help entrepreneurs build and grow innovative businesses and solutions at the intersection of health and technology

- ▶ Rock Health, (www.rockhealth.com) a full-service early-stage investor fund supports digital health startups. Over half of funds invested in mid-2015 were directed towards wearables and bio-sensing, analytics and big data, healthcare consumer engagement, telemedicine, enterprise wellness, electronic health records and clinical workflow
- ▶ Startup Health (www.startuphealth.com) coaching and peer network group in July 2015 had a portfolio of over 100 companies in 10 countries and had raised a cumulative \$200M to date
- ▶ Qualcomm Life (www.qualcommllife.com) provides infrastructure for mobile health solutions via a multi-level hub that integrates biometric data sent from wirelessly enabled medical monitoring devices in the home. Uploaded data is stored in a cloud-based platform and allows medical device users, their physicians and carers to access biometric data. Other platforms focus on complex care coordination and management of at-risk populations or proactively segmented population groups

Connected health lies at the intersection of telemedicine technologies (the use of technologies to remotely deliver health services) and telehealth technologies⁶⁷ (consumer-oriented personal health technologies including remote monitoring, mobile health, wearables and personal devices).

Connected health has the potential to achieve overall order or systematisation, closing the loop between elements of the healthcare system. Access to data and information supports care delivery outside of traditional health settings such as in the home. In an early stage of development with “early evidence and future promise”,⁶⁸ ultimately connected health will improve complex case coordination, support behavior change, generate efficiencies and improve the quality of care.

- ▶ Validic (www.validic.com) is a cloud-based, health platform that provides a ‘one-to-many’ connection between patient-recorded data from health applications, clinical and remote-monitoring devices, fitness equipment, sensors and wearables to key healthcare companies. The consolidated data supports better patient engagement, population health management and efficient care coordination
- ▶ Extensia (www.extensia.com.au) links existing purpose-built electronic health records systems into a shared electronic health record system to enable sharing between healthcare providers, consumers and their communities

- ▶ A growing number of connected solutions facilitate the participatory interface between patient and provider. e.g., WellDoc’s BlueStar (www.welldoc.com/product/bluestar) prescription-only mobile diabetes management platform, AliveCor’s (www.alivecor.com) ECG device for mobile phones and Propeller Health’s (www.propellerhealth.com) wireless sensor monitoring asthma and COPD. Features in common include the capture and analysis of personal health data, symptoms, lifestyle and environmental triggers that enable individuals to better understand their health status, personalised feedback, coaching and motivational encouragement. Systems interface with the treating physician delivering real-time information and remote monitoring and several provide clinical decision support

- ▶ Melbourne-based tertiary teaching hospital group Alfred Health is trialling Patients Know Best (www.patientsknowbest.com) an integrated patient-portal and information exchange that originated in the United Kingdom. Patients and families communicate with remote care teams, see test results and actively manage care plans. The portal integrates with over 100 devices and apps capturing data such as blood pressure, fitness and activities, weight, sleep and medication adherence



Usable insights and new solutions

Big data can shed light on individual behaviour patterns and predict future behaviours, barriers to change and solutions to overcome behavioural traits. Insights gained regarding the well-being of communities suggest new ways to improve public health and medicine including disease surveillance and risk factor identification, epidemic monitoring and targeting of public health campaigns. Building and analysing a wealth of health and health-related data such as health outcomes, prescribing, insurance, consumer-generated, population health, patient-reported outcomes and genetics forms the foundation of predictive, preventive and personalised healthcare.

Value arises through capturing data as analytics makes sense of disparate data sets and turn what is enormously complex into usable insights and new solutions. But big data brings big challenges of privacy and security, complexity, infrastructure, data management, commercialisation and ownership.

- ▶ “Social physics” and reality mining⁶⁹ draw upon “digital crumbs” or data collected from mobile phones and other technologies about users to map social networks. Analysis of data collected via any digitally based activity (e.g. personal sensors and internet use) measures human physical and social activity in order to understand behaviour, including motivational rewards or incentives
- ▶ A partnership between CVS Health and IBM Watson targets greater engagement of individuals with chronic health conditions. Advanced technologies, key health information and behavioural management predicts high-risk individuals who may benefit

from customised engagement programs. IBM Watson’s artificial intelligence capabilities use predictive analytics to “predict, prevent and personalize” new insights from personal health data including data from medical records, pharmacy, insurance claims, environmental factors and fitness devices⁷⁰

- ▶ The Health eHeart study (www.health-eheartstudy.org/study) aims to end heart disease through comprehensive study of volunteers (healthy and those with cardiovascular disease) to better predict, treat and prevent heart disease through using big data techniques, technology, social media and crowdsourced participants

Our view

The healthcare system of tomorrow will be quite different

The participatory, patient-driven vision of medicine foreshadowed by Eric Topol is not too far away. Increasingly viable digital solutions and rapid uptake, particularly at the leading edge occurring in the United States, mean that the space is rapidly becoming inhabited. Sophisticated products and technologies are moving past the early stage of “bold promises”⁷¹ and becoming part of the core business of healthcare.

In the long-run, doing nothing is not an option and some parts of the world are shifting quickly towards the vision of participatory, connected, technologically-enabled healthcare. A generational shift is underway and the world is moving away from legacy models that struggle to keep pace with the rapidly changing environment. As the leading-edge examples in our moonshots and the shifts to digitally-enabled systems evident in developing economies show, the building blocks of participatory health and the digisphere are already here. And so, it is timely to re-imagine healthcare with fresh eyes and begin the conversation about a radically different future. As Don Berwick, former head of the Center for Medicare and Medicaid Services in the United States observes, the shift to incorporate consumerism into future healthcare strategies will “involve some radical, unfamiliar, and disruptive shifts in control and power, out of the hands of those who give care and into the hands of those who receive it”.⁴¹

This white paper lays the ground for the necessary shift in the health dialogue towards recognising the potential of ‘demand-side’ drivers of participation, consumer-centricity and partnership rather than the ‘supply-side’ dominance of healthcare today.

The conversation may consider:

- ▶ **Healthcare consumer transformation** – how individuals, families and carers will accept, adopt and adapt participatory health and digital technologies; assuming some responsibility for this paradigm shift in power and making progress towards actively managing lifelong health
- ▶ **Health delivery transformation** – how disruption will be executed and the extent of transformation and the key capabilities necessary to deliver individual and population health in a health ecosystem that capitalises upon intelligent analytics of massive health data sets and transformative technologies
- ▶ **Clinical transformation** – the shifts that will shape the fundamentals of the system towards participation, engagement, a holistic and long-term orientation. At a system level, how best to capitalise on the best of what digital technologies can offer while ensuring that technologies deliver value for money
- ▶ **Commercial transformation** – the essential capabilities required to operate and thrive in the new environment of partnerships, alliances, new locations and consumerist-orientation and identifying innovative ways to capture value
- ▶ **Time horizon** – the likely speed of change in varying global economies, in particular, which groups or parts of the current healthcare system are likely to be first-movers and which are likely to be laggards, adopting a wait and see approach

Pressing forward with an innovation and change agenda is imperative. The future for healthcare lies in bold changes in business models, policy and funding that deliver the web of networks consumers need to function as active and engaged participants as the system shifts over to the digital health ecosystem. Signs are evident that the foundational elements of the new digisphere are already underway. The emerging ecosystem will level-set the health industry in a new space that incorporates and may well ultimately be led by, consumers. In a future paper, we will address some of the changes that these shifts will bring in the design, delivery and financing of healthcare and to the healthcare experience.

In the long run,
doing nothing
is not an option.

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APAC no. AUNZ00000613
S1528559
ED 0617

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