more than money

nab

THE FUTURE OF HEALTH

The health system

Chapter 3

The trends reshaping health and the future implications for the Australian marketplace

March 2018

FOREWORD: *Reimagining* AUSTRALIA'S HEALTH SYSTEM

CAMERON FULLER

General Manager, NAB Health

Welcome to our Client Insights Publication the Future of Health – The health system.

This is the third in a series of publications that discuss the interplay of social, economic and technology factors, changing consumer expectations and new business models and channels.

The series explores consumer and practitioner's attitudes to health, the financial dimensions for consumers, practitioners and the health system, together with a range of examples of innovation emerging across the ecosystem.

We have been very fortunate to obtain some wonderful insights and case studies from a range of industry stakeholders to contribute to these publications which highlight the emerging pathways and challenges faced.

NAB remains committed to providing insights to our customers and the community to navigate this changing landscape.

Mr Cameron Fuller
General Manager NAB Health

EXECUTIVE SUMMARY: *The health system* AND OUR FUTURE CHOICES

CATHRYN CARVER
Executive General Manager, Client Coverage, C&IB

ALAN OSTER
Group Chief Economist - NAB

The Future of Health – The Health System continues the discussion on the Australian health ecosystem.

We have been very fortunate in this publication to have editorials provided by two of Australia's thought leaders in the sector on their insights into the current health system, some of the emerging system challenges and the Future of Health.

Mr Mark Fitzgibbon, the Managing Director of ASX listed nib provides his observations on the health system and some of the key decisions we will need to make as a community as the level of expenditure continues to grow over time.

An aging demographic, growing population, a rising prevalence of chronic disease and changing consumer expectations such as those driven by technology are all placing increasing pressures on the level of economic expenditure as a % of GDP for health.

In Mark Fitzgibbon's editorial he outlines that healthcare expenditure in western societies has been increasing at GDP ~+2% p.a. for the last 50 years. He also poses the key question that we as a community face, that being one of how and who funds this increasing cost? Although Australia's Health System expenditure compares favourably against our global peers (e.g. ~10% of GDP in Australia vis a vis ~18% in the US) approximately two thirds of this expenditure of ~$170bn is currently being borne by taxpayers.

Given the aging population and the reduction in working aged taxpayers to support the health tax obligations by the middle of the century there will be insufficient tax payers to support the health system.

Mark presents a case in his editorial which is similar to the case for superannuation reform that occurred in the early 1990's that the obligation will increasingly shift towards individuals to fund lifetime care supported by a level of higher government support for those that are at risk of being left out because of higher medical needs or lower economic means. In this emerging environment data and information that enable consumers to benchmark and make more informed choices, together with personal health insurance play an increasingly important role.

Providing an alternative perspective is Professor David Peins. David is Director, Health System Science at world leading Australian health research organisation, The George Institute. He is also Professor of Medicine at UNSW and a practising GP.

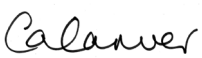
In his editorial, David outlines a landscape where whilst Australians are some of the longest living people in the world we are spending nearly 11 years of our extended life expectancy in ill-health, the highest rate in the OECD.

The rising tide of chronic disease attributed to non-communicable diseases such as cardiovascular disease, chronic respiratory disease, diabetes and their accompanying risk factors is now the leading cause of death, illness, disability and death in Australia.

There are already signs that our health system is beginning to struggle with these threats with Australia having some of the highest out of pocket costs across OECD nations.

In the editorial, David isolates the key question for all of us to consider. It isn't **if** the health system of tomorrow will look different than it does today; the question is **how**?

The editorials together with the three case studies included on the emerging Health Industries South Australia Ecosystem, the Dialysis Project and the Stroke Helmet which highlight the importance of innovation and disruption to the solution and the evolution of the health system.



Cathryn Carver
Executive General Manager, Client Coverage, C&IB – NAB

Mr Alan Oster
Chief Group Economist – NAB

TRENDS SHAPING THE FUTURE HEALTH LANDSCAPE

The state of health is being reshaped by the interplay between social and lifestyle, financial and technology trends, changing consumer expectations and the emergence of new business models and channels.

To assist our customers and community navigate this change the Future of Health publication brings together a range of case studies from key Australian health communities, organisations and businesses that are embracing these trends and reimagining the Future of Health.

The legend below outlines the major trends and can be read in conjunction with the case studies that will be captured across the series of three publications to provide examples and pathways for the Australian community to respond to these shifts.

SOCIAL & LIFESTYLE, FINANCIAL & TECHNOLOGY


Chronic disease


Mental wellbeing

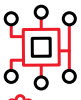

Cancer


Growing population


Aging population


Genetics


Prediction


Digital


Participation


Big Data


Sensors


Rising costs


Fiscal constraint


Advanced Manufacturing

CONSUMER EXPECTATIONS


Wellbeing


Prevention


Social engagement/ community


Value/cost


Personalisation


Happiness


Empathy

HEALTH SYSTEM, NEW CHANNELS & NEW BUSINESS MODELS


At Home


New Channels


Omni-Channel


Globalisation


Outcome Based


Wellbeing


Ecosystem


Community


Predictive

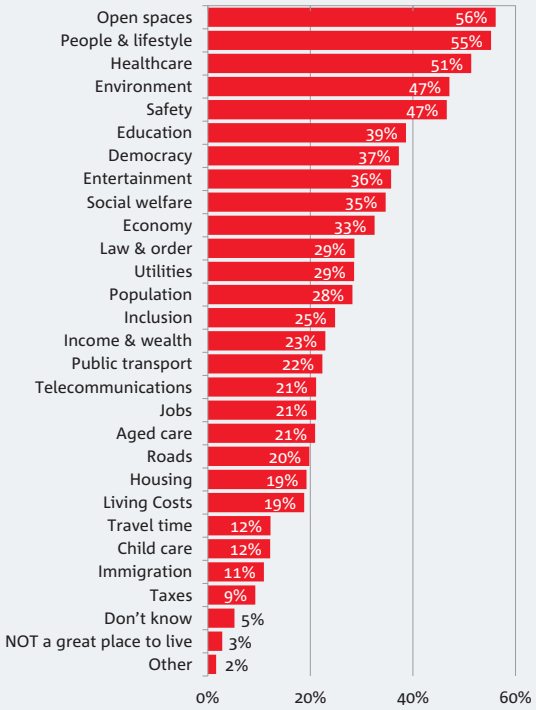

Prevention


Personalisation

AUSTRALIA'S HEALTH SYSTEM NOW AND IN 10 YEARS TIME – PEOPLE & PRACTITIONER'S PERSPECTIVES

What makes Australia a great place to live

(0 = strongly disagree; 10 = strongly agree)



Source: NAB Group Economics

NAB's previous research (Life in the 'Lucky Country' – What makes Australia a great place to live & Our vision and concerns for the Future – 2017) found that 'quality healthcare' was amongst the top 3 factors that made Australia a great place to live.

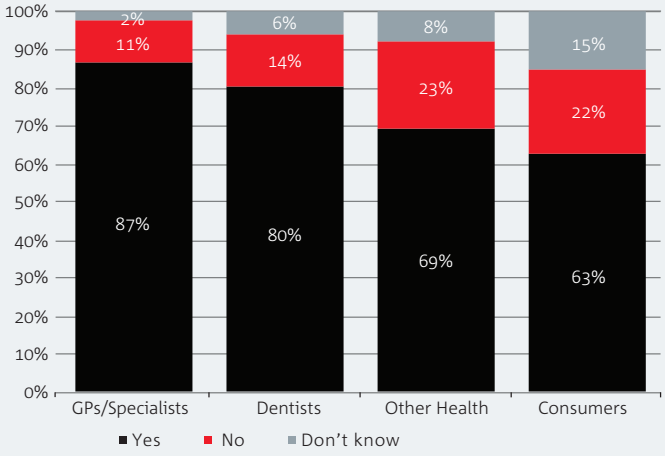
But when asked whether the things that make it a great place now would get better or worse in the next 10 years they expected 'quality healthcare' to deteriorate, but behind issues such as living costs, housing, taxes, jobs, social welfare, safety and immigration.

Aligning with these findings, health practitioners surveyed in the NAB Practitioners Health Survey also had very positive views about Australia's current healthcare system. Almost 9 in 10 GPs/specialists, 8 in 10 dentists and almost 7 in 10 other health practitioners believe Australia currently has a 'world class' health system, a number that was higher than the two thirds of Australian consumers thought was the case.

However, when asked whether the health system will still be world class in 10 years' time, less than 6 in 10 GPs/specialists, less than 1 in 2 dentists and less than 4 in 10 other health practitioners believe this would be the case. This aligned on average closely to the less than 1 in 2 consumers that were surveyed as part of our first publication in the series.

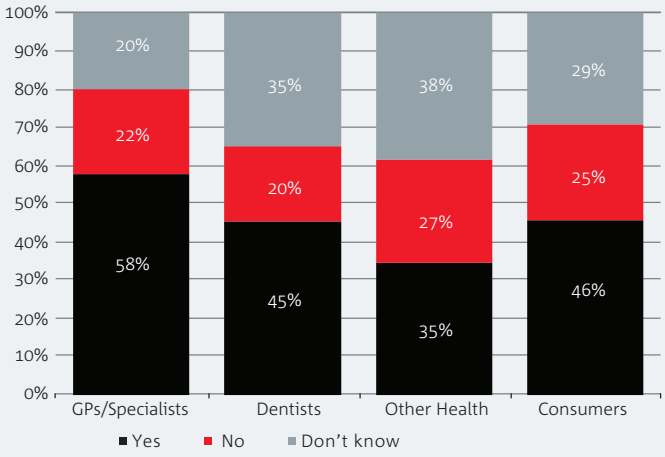
That said, confidence that the status quo will be maintained was much weaker across health practitioners.

Does Australia have a world class Health system now?



Source: NAB Group Economics

Will Australia have a world class Health system in 10 years time?



Source: NAB Group Economics

FUTURE CHOICES

MARK FITZGIBBON

Managing Director, nib holdings limited

One of my favourite healthcare anecdotes is the state of panic the administration of United States President Jimmy Carter found itself in back in 1980. To the boffins, both Government and nation faced potential bankruptcy. The actual event igniting such hysteria? United States spending on healthcare had just tipped 10% of GDP. Fast forward to today and healthcare spending in the US is now pushing 18% with forecasts suggesting nominal annual healthcare growth of about 5.6% per annum through to 2025.

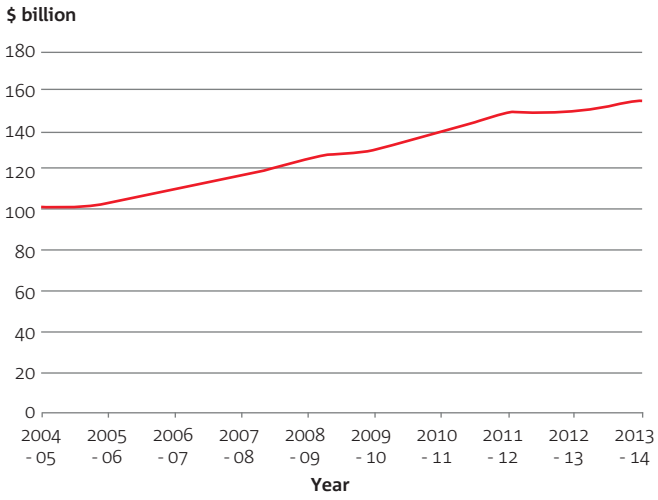
A somewhat inconvenient truth is western societies are each year spending more on their healthcare at a growth rate of around GDP plus 2%.

It's been that way for over 50 years and it isn't likely to change anytime soon. We're spending more and more because of unit cost inflation, an aging population and a profound wealth effect (healthcare spending has a high income elasticity of demand). The rate of growth in rapidly developing nations such as China is considerably higher.

The meaningful questions about healthcare spending are therefore less about sustainability or imposing some kind of natural limit. Hypothetically, there is nothing wrong or impossible about a long run future in which we spend 90% of our economic wealth on wanting to live longer and healthier lives and being able to satisfy all other needs with the remaining 10% via the power of artificial intelligence, Internet of Things, robotics and other technologies. Rather, the real questions centre on how we can fund it with taxation, what level of market inefficiency we are willing to tolerate and how we can keep it equitable.

How we pay for healthcare is arguably the most pressing issue given our very significant reliance on taxes (67% of total spending of circa $170 billion in Australia) and an increasing dependency ratio.

Total health expenditure 2004-05 to 2013-14, adjusted for inflation

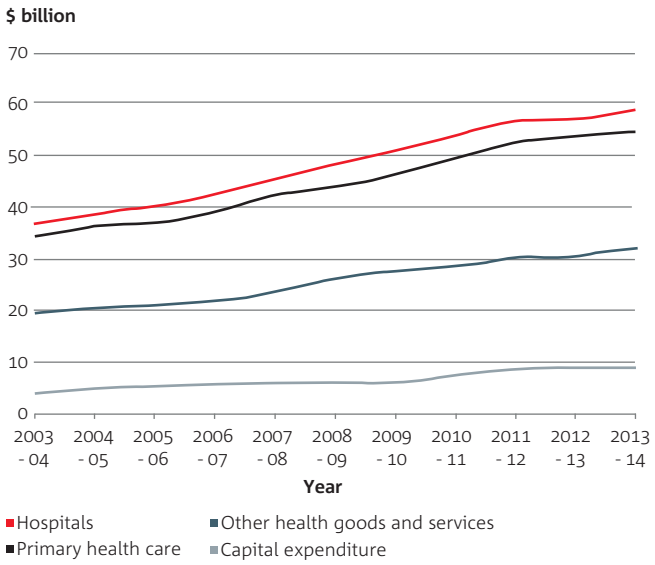


Note: Inflation-adjusted prices expressed in terms of 2013-14 prices – September, 2016.

Source: Australian Institute of Health and Welfare (AIHW).

When Australian Prime Minister Gough Whitlam launched our first universal social insurance scheme, Medibank, in 1973 there were around seven working aged taxpayers to support Australia's older retired population. Today there are under five and by the middle of this century this is expected to fall below three. The bottom line is we – or should I say our children – will simply run out of sufficient taxpayers to support the retired and that healthcare is "eating" federal and state budgets. Inevitably, we must shift funding responsibility away from the public purse towards private funding mechanisms. This is no different to the dilemma we faced with pensions and the initiative we took with compulsory superannuation.

Total health expenditure, by broad area of expenditure adjusted for inflation 2003-2004 to 2013-14



Note: Inflation-adjusted prices expressed in terms of 2013-14 prices – September, 2016.

Source: Australian Institute of Health and Welfare (AIHW).

I'm not so optimistic to believe I'll see it any time soon but eventually we'll wake up to the reality that funding our lifetime healthcare is best treated as an individual responsibility with the important social objective of "universal coverage" underwritten by government. So in my world, all of us are required to have private health insurance (PHI) with government using its increasingly scarce tax resources to fund those who are at risk of being left out because of their high medical needs or low economic means. And in case you're thinking making health insurance compulsory sounds a bit radical keep in mind we are already forced to enrol and pay for our existing social insurance scheme called Medicare.

Under this new approach healthcare funding is made more contestable, efficient and fair in as much as high income earners aren't subsidised by other taxpayers. It's totally absurd that under Medicare high income earners are able to claim $35 for visiting a GP. Memo to Canberra – please redirect the $35 refund to a remote indigenous community desperate for better healthcare support.

I'd have to write a book to properly account for the level of inefficiency we are currently tolerating in healthcare markets. Yes we have doctors, dentists and hospitals as good as anywhere in the world yet the evidence of over-servicing, rampant cost variation, perverse incentives, low levels of automation and duplication of operating expenses is compelling.

The single biggest source of this inefficiency is the information asymmetry between the sellers and buyers of healthcare services and products. As consumers we typically don't have the knowledge necessary to consider and negotiate what the sellers have to sell. It's why our chances of having a knee replaced in Australia can vary five-fold depending on where we live or the cost of a prostatectomy by 100% depending on our choice of doctor. And we generally have no idea about the relative performance of doctors, hospitals and other clinicians to guide our choices. The performance data simply doesn't exist even though there's so much evidence to show that outcomes between doctors vary.

In this digital age however, we now have the ability to collect, synthesise and publish information to help people make more informed decisions about their health behaviour generally and when there is a need for treatment, their treatment options and choice of doctor. If I have a bad knee I want to more fully understand, for example, if weight loss and physiotherapy could lead to a better outcome. And if I do actually need surgery, who is the best doctor measured by the reported experience and physiological outcomes of previous patients. I'm also interested in costs and whether or not the doctor would charge me an out-of-pocket expense over and above what nib would pay them.

There are already a number of initiatives in the healthcare market taking us in this consumer-centric direction such as nib's Whitecoat and health tech start-up Medipass. Three years from now we'll look back and wonder how we actually purchased healthcare without the information, video content, performance criteria and functionality (e.g. bookings and card-less payments) these platforms will literally put in our hands via our mobile devices. Very importantly, it will also add to the value proposition for PHI especially among younger people who are so vital to arresting claims and premium inflation. We need younger people enrolled in PHI like never before if we are to lower claims and premium inflation.

Although some doctors currently fear the digital and sharing technology, they'll eventually get comfortable once they see the integrity of the data, how popular it is with their patients, how it helps people find them, lifts engagement with patients, reduces office costs and how it actually provides them with information about their performance to benchmark with peers (if you're to be a champion you have to know what your competition is achieving).

Another key source of inefficiency is regulatory failure in its various forms. Successive Commonwealth governments have to their credit, recognised how supporting PHI participation with “sticks and carrots” policy is so crucial given the dependency ratio threat. Yet we need a greater role still for PHI, none of which involves additional Government financial support rather than simple deregulation.

Our healthcare system is being impaired by regulations that limit PHI’s ability to provide medical cover for people outside of a hospital admission, force PHI to pay inflated prices for hospitals and medical devices, limit our ability to attract younger customers, blunt the incentive to invest in better managing people with chronic conditions and effectively create “price signaling” (through the annual government premium approval process). These regulations and several others require attention free of the partisanship that has regrettably hampered serious policy reform for decades.

I’m particularly keen on the idea of private health insurers being able to take responsibility for the entire healthcare needs of certain high risk populations such as the frail aged, chronically ill or those with other inherent disadvantage (e.g. remote indigenous communities). We would become the single budget holders for the funds expected to be spent by the Commonwealth and states and deliver more personalised, co-ordinated and I’m confident, better outcomes at lower cost. It’s not dissimilar to how funding for disability support under the NDIS now follows the client.

Mark Fitzgibbon is the Managing Director of private health insurer, nib holdings limited.

Adelaide is solving health industry challenges through collaboration

Advances in technology have spurred the growth of the health sector for over a hundred years: drug discoveries such as antibiotics and pain killers; techniques like dialysis and x-ray imaging; and methodologies such as randomised clinical trials.

New discoveries will be made but they will not be enough to solve all the challenges health systems will face in the decades to come.

The first challenge is disease linked to lifestyle. Poor nutrition, lack of physical activity, stress and substance abuse are already contributing to an increase in conditions like stroke, heart attack, diabetes, Alzheimer's, Parkinson's, and some oncologic conditions.

Secondly, these diseases are chronic, requiring ongoing care that must be typically delivered for many years, if not decades.

Thirdly, the life expectancy in the developed world has been increasing steadily.

This combination of lifestyle-related diseases, chronicity and demography generates an enormous, constantly growing challenge that is disruptive to the delivery of healthcare; costs are growing faster than the economy. The existing model is broken.

And while new discoveries in treatment are being made, the real innovative breakthrough will be in dealing with the complexity of the system needed to deliver effective, economically sustainable healthcare – getting new discoveries commercialised and to the market quickly and cost-effectively.

A multi-stakeholder approach is crucial to solving complex emergent problems in health. South Australia has an ideal scale paired with access to research, know-how and financial partners as well as a government willing to financially back companies delivering knowledge-intensive jobs. This gives the state the agility needed to quickly meet the new demands on health companies; it's a place where things can happen fast.

Somark Innovations is a medical device company with its R&D and manufacturing based in Adelaide. The company is creating an integrated end-to-end pre-clinical management system using visual identification, micro-RFID (radio-frequency identification) technology, data readers, data hubs and software that aggregates and analyses data.

The system's design creates connectivity between test animals and the systems that record and analyse the data, reducing human intervention and potential for error. This breakthrough requires fewer test animals, conducts trials faster ultimately leading to cheaper drug development.

The company, originally established in Sydney, moved to Adelaide because of the collaborative approach they can take in the city, while still targeting markets around the world.

This includes support from the South Australian Government, through Health Industries South Australia, which helped the company secure a grant and a loan funding early-staged commercialisation.

The company has located at Tonsley Innovation District, a dedicated community of like-minded hi-tech companies 20 minutes south of Adelaide's CBD. The district has been developed by the government on a 61-hectare former automotive manufacturing site, to help drive future industries as the state's economy transitions.

Somark Innovations has also partnered with the South Australian Health and Medical Research Institute (SAHMRI) to help test the new technology. South Australia's premier medical research institute, SAHMRI is located at Adelaide BioMed City, one of the largest life sciences clusters in the southern hemisphere.

Health Industries South Australia was established to help life sciences companies establish in Adelaide. The government agency has also found a role acting as a hub for the growing life sciences sector in the city, helping fuel collaboration between government, industry, research, NGOs, and the local health system, as well as serving as a bridge to partner organisations and companies interstate and overseas.

These partnerships in Adelaide are the type of innovation that will lead the health sector through the challenges to come.

This case study was provided by Health Industries South Australia.

ON AUSTRALIA'S HEALTHCARE FUTURE

PROF. DAVID PEIRIS

Director, Health System Science, The George Institute

Australians are amongst the longest living people in the world. But compared to other rich nations we are not living healthier lives. Indeed, we are spending nearly 11 years of our extended life expectancy in ill-health – the highest rate of any OECD country.[1] This can largely be attributed to growth in chronic diseases – now the leading cause of illness, disability and death in Australia

While economic prosperity and the development of a strong health system have yielded success in the fight against infectious diseases, there is a rising tide of non-communicable diseases such as cardiovascular disease, chronic respiratory disease, diabetes and their accompanying risk factors. Today, 73 percent of deaths around the world are attributable to chronic diseases[2] and cardiovascular disease alone accounts for around 30 percent of all deaths in Australia.[3] Diabetes is the world's fastest growing chronic disease – five percent of our population has diagnosed diabetes with many additional people undiagnosed or at high risk of developing diabetes.[4]

Though these maladies do not capture the public imagination like a deadly virus, they are equally sinister, if not more so, because of the complacency that can build up around their causes and treatments.

There are already signs that our health system is struggling to deal with these threats. For the first time ever, the proportion of GDP spent on health in 2016 rose to more than 10 percent. Despite being a universal health care system, Australians have higher out-of-pocket costs than most OECD nations. With rising prices for health care and increasing demand driven by chronic diseases, the sustainability of our high performing health system is under threat. Thus the question for us to consider isn't **if** the health system of tomorrow will look different than it does today; the question is **how**.

Fortunately, Australia is beginning to take a sober look at how our system might evolve to deal with these challenges. The Productivity Commission Review[5] released this August provided an in-depth assessment of the necessary evolution of our health system as a vital factor in Australia's economic performance.

How we respond will be important. If we're passive and reactive, the status quo will be preserved. Now is the time to invest in the innovation, design and implementation of new systems to set future generations on the path to healthy, prosperous lives. At the heart of this challenge is getting the balance right between quality, efficiency and acceptability to both consumers and providers of health care. These three dimensions are intimately related, though currently we do not always think of them so. This needs to change.

The elephant in the room that must also be recognised is the need for an equitable system. Despite high overall performance, Australia performs poorly relative to other rich nations for health inequalities.[6] This underscores the stark socioeconomic, and geographic variations in chronic disease rates and access to high quality health care across our country.

A study we conducted some years ago highlighted the inequities experienced by Aboriginal and Torres Strait Islander communities.[7] What we found went beyond simply an economic or geographic barrier to quality care among these communities. The root of the problem was deeper. The health professionals we surveyed gave countless examples of where patients received sub-standard care as they tried to navigate a complex health care system. The system is well constructed for the 'ideal user' who has all the skills and opportunities to reap its benefits. But the reality is that none of us are 'ideal users' and a health system that cares well for its most under-served populations is a win for all of us.

1. https://www.pc.gov.au/inquiries/completed/productivity-review/report/2-healthier-australians#c21
2. http://thelancet.com/journals/lancet/article/PIIS0140-6736(17)32152-9/fulltext
3. https://www.aihw.gov.au/reports-statistics/health-conditions-disability-deaths/heart-stroke-vascular-diseases/overview
4. https://www.aihw.gov.au/reports-statistics/health-conditions-disability-deaths/diabetes/overview
5. https://www.pc.gov.au/inquiries/completed/productivity-review/report/productivity-review-supporting5.pdf
6. http://www.commonwealthfund.org/publications/fund-reports/2017/jul/mirror-mirror-international-comparisons-2017
7. https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-12-369

Fixing health system disparities is important . But so are disruptive technologies. What will be the 'Uber' of health care?[8] Will mobile phones with clever artificial intelligence algorithms replace traditional health care? Will genomics and 3D pill printers produce personalised medicine tailored to our genetic circumstances? In the United States, Walmart is poised to become a dominant health care provider. Will 'retail care' come to Australia in the same way Netflix and Amazon are taking over entertainment and shopping? Such disruptors transform systems not just because their technologies are clever and their products are cheap, but because of their ability to design efficient systems that address real problems. Further, half a good idea that can be distributed on a massive scale is always going to trump an excellent idea that can't get beyond the research lab. How will we respond to these non-traditional health care providers? Regulate them out of the market, allow them to develop a parallel health system or strike a middle ground and integrate them with the mainstream system? We need a mature debate on what we want from our health system and how we will respond to change.

And, it's not just about disruption in how health care is delivered – it's also about how we pay for health care. Overcoming state, federal and private insurance funding siloes is essential, but how are private and public payers/providers actually working to integrate care? What would a multi-payer, integrated care model look like? One approach called "Accountable Care Organizations" or ACOs is a solution gaining traction in many countries. An ACO is an integrated model of care that works to enhance patient experience and improve health outcomes – all while reducing costs. Groups of physicians are expected to work together for a defined patient population to avoid duplication of services and collaborate to keep those patients healthy. If they can achieve high quality care at lower than projected costs they get to keep a share of the savings.

The ultimate test of any innovations and improvements in our health system will be the outcomes – there are three primary ones to consider.

First, patients' experience and expertise in managing their health is paramount. If we don't enhance these elements and eliminate the stubborn barriers to providing efficient, effective care, it doesn't matter how lofty our strategies are; they won't take root and affect any meaningful change in our health systems. If we're serious about consumer-centred care, then payment reform also needs to reflect that. So we'd best put into place systems that prioritise consumer needs — physical, social, financial and cultural.

Second, workforce sustainability is critical. The current model — with individual doctors at its centre — is on its way out. We must move toward models where teams of healthcare workers are empowered and responsible for the wellbeing of whole populations. We don't need expensive, busy and stressed doctors for all of the things they currently do. The pressing question for us is, how do we get teams enabled with the right mix of skills and remuneration models that work for everyone? The stars of a new workforce will be a diverse group of health professionals and lay community members. We also need to see social service providers such as housing, employment, disability services as integral to these teams because many challenges people experience with maintaining health and well-being cannot be addressed by the health care sector alone.

Third, the ultimate measures of success will be not just longevity but the quality of lives lived. An equitable, accessible, integrated system that generates maximum health gain with minimum wastage of scarce resources is the goal. The markers of progress in attaining this goal can be complex to measure but will provide a more comprehensive picture when assessing our performance.

We have much to be proud of with Australia's health system but there are signs of increasing strain. We have tried reforms before but progress has been slow and the question remains - are we ready to take a serious look at change? For those of us in the public health community, we are hopeful the answer will be affirmative.

Prof. David Peiris is the Director, Health Systems Sciences, The George Institute and Professor, Faculty of Medicine, UNSW Sydney

8. http://www.nejm.org/doi/full/10.1056/NEJMp1512206

Prize-winning invention could save millions of lives

Vincent Garvey had no experience of dialysis – but his prize-winning invention is on track to save millions of lives.

A prize-winning invention could slash the cost of treating Australians with kidney disease and take life-saving treatment around the world. Senior researcher Professor John Knight of The George Institute for Global Health reveals how an international competition uncovered this breakthrough technology.

Without dialysis or a transplant, chronic kidney disease is a death sentence. Currently, more than seven million people with no access to treatment die every year.

"The millions of avoidable kidney deaths around the world each year are mostly down to the cost of treatment – and they inspired our search for the world's first really affordable dialysis system," says Professor John Knight, a children's kidney specialist and senior researcher at The George Institute for Global Health.

A US$100,000 prize

In 2015, The George Institute launched a worldwide international competition with a prize of US$100,000 in collaboration with the International Society of Nephrology, the Asian Pacific Society of Nephrology and the Farrell Family Foundation. The goal? A portable, solar-powered machine that could:

- match the performance and safety standards of traditional dialysis machines
- purify water from any source on the spot
- be manufactured for less than US$1000 and have low operating costs.

"The winner, Vincent Garvey, is a serial inventor but he had no previous experience with dialysis," Professor Knight explains. "He just saw an opportunity to help save lives."

Changing lives in Australia

Most of the preventable deaths from kidney failure occur in developing countries but, even in Australia, dialysis takes a huge financial and personal toll.

"In this country, dialysis costs $75,000 per person per year," says Professor Knight. "We're very fortunate that this cost is covered by the community though the health system but treatment makes it very difficult to hold down a job and, if you live outside a major urban area, the cost of transport and accommodation can be quite a shock."

Aboriginal and Torres Strait Islander peoples face a unique set of challenges: "They're 20 times more likely to suffer from chronic kidney disease than all other Australians, and to suffer when they're younger," says Professor Knight. "Many live in remote communities and they may have no choice but to relocate to a city for their treatment, which can be extremely stressful for them and for the whole family. Vincent's invention could easily be used at home or in a local medical centre, transforming the lives of many Aboriginal kidney patients."

How does it work?

Dialysis machines take over the work of the kidneys when they can no longer function.

"The most well-known system is haemodialysis, which uses a blood pump and a filter to remove toxins and extra fluid from the body," Professor Knight explains. "The other system – just as safe and effective – is peritoneal dialysis (PD), which uses the membrane that lines the abdominal cavity as a filter with the help of a sterile cleansing fluid. This is usually changed three times a day, seven days a week."

PD is potentially cheaper but, as each patient needs three two-litre bags of the cleansing fluid every day, manufacturing and delivery costs are high.

"The fluid itself is easy and inexpensive to make – it's basically salt water with a pinch of sugar," says Professor Knight. "Vincent invented a way of creating it on the spot and filling empty bags under sterile conditions at the point of care."

Very early days

The system is currently in the early stages of development.

"To help Vincent get the product to market, we created an Australian company – Ellen Medical Devices – and employed a local engineering firm – the ide Group – to build and test a prototype," says Professor Knight. "This should be up and running here in Sydney by the end of the year."

The dialysis fluid will then be sent to a laboratory for testing before field trials with kidney patients can begin.

"If all goes well, we'll register the Affordable Dialysis System as a medical device with regulatory bodies in Australia and overseas and have it on the market by 2021," he adds.

Australia's strength in innovation

The new system has already received industry recognition – it reached the finals of this year's prestigious Eureka Prize for Innovation in Medical Research.

"I think the high standard of the entries underlines the fact that, in terms of medical technology and devices, we Australians are continuing to punch well above our weight," says Professor Knight. "The other finalist developed an innovative way of identifying different types of multiple sclerosis, and the winner's blood test for bowel cancer is about to go to market in the United States.

"The biggest challenge for the Australian research community is how to move from a bright idea to a commercial product."

NAB is committed to supporting Professor Knight and his team on their journey to market.

"As their partners in growth, we're pleased to help wherever we can, including raising awareness of the important job they're doing," says David Nash, Senior Business Banking Manager at nabHealth.

Community awareness is critical. As a not-for-profit organisation, The George Institute depends on public support.

"A few people who heard our story on the radio were moved to donate a significant amount of money – enough for us to build the prototype," says Professor Knight. "It's thanks to a handful of visionary individuals that we've been able to get this far, so we welcome all support."

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Science fiction is becoming science

Science fiction is becoming science fact at NSW's Hunter Medical Research Institute (HMRI) as sophisticated scanning techology is adapted from military use to allow more accurate and less obtrusive ways to diagnose disease.

With an acute stroke occurring every 10 minutes in Australia, a revolutionary detection device called the Strokefinder MD100 helmet is being trialled for the first time in critical response settings.

The helmet is compact, portable and affordable, enabling rapid deployment in Emergency Departments and Ambulances. Above all, it's fast to operate, performing multiple brain measurements in 60 seconds.

The patient's head rests on the cushion-sized base and is sequentially scanned by antenna pads emitting low-energy microwaves similar to that of mobile phones – these pulses scatter in brain matter, detecting the type and location of the stroke through wave propagation.

Neuroscience researchers and clinicians at HMRI and John Hunter Hospital, along with Sweden's Medfield Diagnostics, are exploring the potential for life-saving stroke therapies to be administered as soon as possible – possibly even pre-hospital by paramedics in remote and rural communities, connected via advanced telehealth.

Lead researcher Professor Chris Levi explains that "time is brain" when responding to stroke.

"The faster we begin to dissolve the clot, the more brain can be salvaged. But we must be sure it's not a haemorrhagic stroke because the treatment paths are vastly different," Professor Levi says. "This technology, though still in research phase, allows us to image the brain very early, hopefully within what's called the 'golden hour' after a stroke occurs."

While the Strokefinder's imaging system was adapted from defence applications, a multidisciplinary medical team is now refining the detection capabilities and algorithm, comparing the all-important accuracy against their world-leading CT and MRI techniques.

HMRI and the Hunter Stroke Service are responsible for the field testing, study design, patient recruitment, clinical evaluation, brain imaging, data and statistical analysis.

Potential savings for the Strokefinder have been estimated at $10,000 per detection as, in NSW alone, the economic burden of stroke is around $800 million in direct healthcare costs and $2.9 billion indirectly.

In another project at HMRI, James Bond-style spyware employed by international counter-terrorism agencies is helping to find genetic answers for children with undiagnosed intellectual disabilities.

HMRI researcher Dr Tracy Dudding-Byth has harnessed cutting-edge facial recognition software developed by Professor Brian Lovell from the University of Queensland to match faces of non-identical children within the same syndrome sub-group.

Her new FaceMatch system measures distinctive characteristics and contours, detecting subtle changes that aren't obvious to the human eye.

Clinicians investigating rare genetic disorders currently take photographs of children's faces and manually share them at conferences in the hope of finding another child with similar distinguishing features. The success rate is just 25%, given there are over 7000 rare diseases and many more unknown.

Most families have endured what's described as a diagnosis odyssey.

To expand FaceMatch's global footprint, HMRI IT developers are building a new web-based portal that allows parents and doctors around the world to upload photographs and descriptive terms. Once a match is made, the respective DNA data for the two children will be shared and analysed for common traits.

Dr Dudding-Byth is hopeful it will lead to more targeted gene therapies. "We're hoping this project can help crack the genetic code and help us discover new genes to better understand the basis of intellectual disability," she says.

hmri.org.au

This case study was provided by Hunter Medical Research Institute.