

Innovation in Aotearoa New Zealand's healthcare system—how to make it happen

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ABSTRACT

To date, innovation in Aotearoa New Zealand healthcare services has varied around the country. As we move into a health system restructure, it is important to reflect on what has worked to date and how we can take these elements into the new system. In this paper we describe the approach at Waitematā District Health Board (DHB) including the establishment of an Institute for Innovation and Improvement. We highlight what we view as the key elements of an innovation enabling environment and suggest measures of success.

There are many different definitions of innovation, although most include the elements of novelty, application and benefit.^{1,2} In health services, innovation can simply be doing something differently, and better than how it is generally done or has previously been done—it could be a new process, device, technology, system or service. It is not just having the idea of how to do something differently (the idea or invention) but also getting it embedded into standard clinical practice (the implementation). If it is not in practice and having an impact, then it is still just an idea.

It is often acknowledged that the implementation and dissemination of innovation is the most difficult part of the process.^{3,4} This is said to be impacted by three clusters of influence: (1) perceptions of the innovation including uncertainty, salience, complexity, trialability and observability; (2) characteristics of the people who need to adopt it—often depicted on a scale from early adopters through to laggards; and (3) “contextual” or organisational and system factors.⁴ Some of the specific barriers to innovation implementation in Aotearoa New Zealand healthcare identified recently were: disconnection between industry, research and the health system; inability to prioritise funding for innovation; government rules of procurement; clinical and organisational resistance to change; a high burden of proof for new treatments in evidence-based medicine; and, limited innovation capability and opportunities within Aotearoa New Zealand.⁵

Many of these barriers lie beyond the ability of those in health services to change. In a recent

report, the Productivity Commission stated that district health boards (DHBs) are important but mostly inactive in supporting healthtech innovation, and that opportunities for mutual benefits for the healthtech sector and the health system are being lost as a result.⁶ They state that:

“The main reasons for lack of support from DHBs are their lack of mandate and incentive to participate in innovation, the lack of targeted innovation funding, and rigidities in their procurement processes. Also, health policy provides no effective strategy on innovation and learning to guide DHBs.”

Some aspects of the enabling environment, however, sit within the health services themselves.^{7,8} Berwick (2003) developed seven critical success factors for the dissemination of healthcare innovation: surveillance to find sound innovations; find and support innovators; invest in early adopters; make early adopter activity observable; trust and enable reinvention; create slack for change; lead by example.⁴ At Waitemata DHB, we have been creating an enabling environment for innovation implementation with our Institute for Innovation and Improvement (known as “i3”). This paper outlines what we have focused on to date, measures for how we can assess success, and what we have learnt. It is hoped that this may usefully inform how we deliberately structure and embed an enabling innovation environment in a reformed healthcare system for Aotearoa New Zealand.

Innovation at Waitematā DHB

In 2014 Waitematā DHB initiated the Leapfrog Programme—a Chief Executive sponsored programme of strategic innovation projects that would make a large impact in the medium term across the entire organisation. Learning from visits to international exemplar organisations and leaders (including Intermountain Healthcare, Beth Israel Deaconess Medical Center, the Scripps Research Institute, an innovation hub in Norway, the Qulturum Jönköping County in Sweden, Trafford Community Care, and the Scottish Patient Safety Programme), the Institute for Innovation and Improvement (i3) was established by the DHB in 2016, creating an engine room of people-resource focused on digital, data, design, and clinical leadership, to support services to improve patient outcomes and patient and whānau experience.⁹ The i3 intentionally integrated innovation and improvement to ensure innovation is not about technology for technology's sake, rather that process and service improvement drive everything we do, focusing on ensuring high quality of care and improvement of health outcomes. The innovation- and improvement-enabling environment was extended across the organisation including other programmes, notably a Māori Health Pipeline and primary-community programmes.

Over the ensuing years, through multiple projects and workstreams, the steps towards an innovation enabling environment have included the following key features:

- A vision of where we are heading with clear priorities aligned with the organisation's priorities and values, and a requirement that partners have an aligned sense of purpose.
- Executive leadership with a Chief Executive (CE) committed to the i3's vision and purpose, the Director of the i3 reporting to the CE and being a member of the Executive Leadership Team, and CE sponsorship that ensures innovation and improvement is protected and prioritised and not overshadowed by "the requirements of the day".
- Integration of innovation, quality improvement and clinical governance to ensure the focus of innovation is on systems and processes that improve the reliability, safety and quality of care, and strong engagement of clinicians. For all innovations we ask "how will this help deliver better, high quality care and health outcomes?", and every project is sponsored by a clinical leader.
- Funding and support—consistent leadership (Chief Executive and Board) support even in times of austerity when others may view i3 as non-essential, along with committed baseline funding for a critical mass of staff reflecting the scale of the entity (i.e., no requirement for the i3 to self-fund), and business case approval for projects based on value add to the organisation (which has included reductions in paper, postage, storage and reducing long term spend on large expensive IT systems).
- The removal of silos and building partnerships—in particular, the integration of innovation, service design, quality improvement, data, digital/IT and research/evaluation—all working together on initiatives moving us towards the same vision. This is underpinned by i3 leaders that combine managerial, clinical, operational, and digital and data experience and who are closely connected internally with clinical governance (patient safety and quality) structures, and externally with a broad range of national and international networks.
- A continuous pipeline of new ideas and people—this includes staff on the ground within health services, fresh perspectives from students, new graduates, other disciplines and industries, academics, companies and start-ups, a diversity of people in our communities, and patient groups. This has been achieved through a Fellows Programme of 12-month roles in i3, internships, studentships, academic partnerships, consumer representation, co-design projects and programmes such as "Engineers in Clinical Residence". It also includes horizon scanning for the best innovations that have been implemented internationally and nationally with significant impact.
- A network of frontline healthcare workers ready for change and willing to lead it—a broad and diverse network of people working at the frontlines of healthcare who are not only interested and open to new ideas, but who are able to ground them in

the reality of their daily working lives. They are also able to improve ideas to ensure that they will work in our context. This has been fostered through Senior Medical Officer (SMO) roles and sabbaticals in i3, prioritising clinical leads for projects, clinical IT experts who are available to listen and work alongside frontline workers, the i3 Fellows Programme, and the establishment of a Clinical Digital Academy (CDA) to train clinicians in data and digital health.

- An engine room of people with a diverse range of skills including change management, quality improvement, systems engineering, co-design, project management and clinical experience, who are closely connected to people working at the frontlines, with local relationships and understanding of both the ideas and local contexts, who make things happen supported by our IT and data teams.
- Data to drive the identification and quantification of the issues to measure the impact of innovations, and feedback loops to the staff and services through accessible dashboards, analytics support, the integration of artificial intelligence to support clinical decision making, user-friendly data tools integrated with electronic clinical records in the hands of clinicians, along with active use of population health registers to identify gaps in systems and connect people to preventive services (screening, immunisation and treatment).
- Early quick wins focused on providing value for clinicians, in terms of making their daily work lives easier and having well designed clinical systems to deliver safe, high quality care—establishing their support and acceptance of further change.

Measures of success

Measuring whether this model is successful in creating an innovation enabling environment within the DHB is not straightforward. Existing implementation science frameworks tend to focus on two aspects: (1) the implementation of an individual initiative with respect to aspects such as adoption, fidelity, penetration, effectiveness and sustainability;^{10,11} or (2) whether determinants of implementation were supportive for a particular innovation, such as champions, innovation-values fit (extent to which targeted users perceive that use of the innovation will foster fulfilment of their values), management sup-

port, implementation policies and practices (the extent actions ensure user skills, create incentives and/or identify and address barriers to use), financial resource availability, implementation climate (employees' shared perceptions of the importance of innovation implementation within the organisation), and implementation effectiveness.¹²

To measure an innovation enabling environment we describe below a more pragmatic set of measures that take into account existing frameworks and critical success factors but assess innovation as a system rather than discrete parts. The proposed measure set reflects our innovation definition: an environment that continues to enable new or different things/ways of working to be put into standard practice and have a positive benefit. This includes:

1. “new” things (systems, processes, tools, technologies) have been put into practice and changed the way people work or services are delivered;
2. there is a pipeline of new ideas and trials underway;
3. new staff want to work there or to lead initiatives due to a culture of innovation and continuous improvement;
4. improvements in population and individual health outcomes alongside positive patient and whānau experience of their health services, particularly reductions in health inequities;
5. responsiveness to Māori and equity.

Additionally, the global pandemic adds the opportunity to look at the ability to adapt to changes in context or new threats to health. These proposed measures of success are considered for Waitematā DHB in Table 1. We acknowledge that the population and individual outcome measures described below cannot be causally linked to an innovation environment; these measures are merely descriptive of improvements over time or compared with other DHBs.

It is important to note that Waitematā DHB's innovation and improvement programme has not required extraordinary financial investment. Waitematā DHB is one of the only DHBs that has been able to deliver a break-even budget and, at the same time, has delivered an exceptional strategic innovation programme (the Leapfrog Programme) for under approximately \$15m, at least one sixth of the cost of implementing a single vendor electronic health record system.

Table 1: Proposed measures of success in establishing an enabling environment within Aotearoa New Zealand health services.

| Proposed success measure | Examples from across Waitematā DHB (referenced in public Board Reports ¹³ and the i3 website ⁹) |
|---|---|
| Significant new systems/processes/services/tools/technologies embedded in clinical practice that have changed the way things are done | <p>The implementation of:</p> <p>ward nurses using iPad minis for drug administration and vital signs/nursing assessments that underpin the Patient and Whānau Care Standards Programme,</p> <p>an electronic eVitals system linked to communication tools enabling a comprehensive deteriorating patient programme with automated electronic early warning scores for all patients, decision support (e.g., sepsis prompt) and alerts in electronic whiteboards and clinician devices,</p> <p>electronic ordering systems for tests and procedures with integrated clinical decision support (including Choosing Wisely¹⁴ recommendations),</p> <p>data-driven, evidence-based clinical pathways (for example appendicitis, acute cholecystitis, chest pain, and fractured neck of femur) supporting continuous quality improvement,</p> <p>a one page digital inpatient summary (“Snapshot”) pulling from multiple different systems that is quicker than accessing the individual systems, with digital notes for ward rounds and consultations that are searchable,</p> <p>an outpatients improvement programme that includes new models of care (telehealth, patient self referral on symptoms (SOS), clinical pathways) enabled by robust clinical data (eOutcomes), digital tools (patient online booking and electronic clinic room booking and scheduling), and paperless clinics meaning clinicians can conduct clinics from anywhere and send e-orders to community laboratories and prescriptions to community pharmacies,</p> <p>improvement of patient experience through digital post, emailing letters, questionnaires and helpful information to patients using an in-house designed Emailer tool,</p> <p>improvement of clinical handover and communication with smartphone systems for paging with two way communication between the ward and clinician that integrate patient safety tools (e.g., ISBAR communication tool and early warning scores), and between ward/clinical area for Orderlies task management,</p> <p>aggregated data that links multiple datasets which can be visualised and interrogated directly by clinicians and services, and can be used to inform service redesign (e.g., establishing an orthogeriatric service), process improvement (e.g., streamlining clinical document transcription), clinician decision making and continuous quality improvement (e.g., implementing a multidisciplinary fractured neck of femur pathway). Our digital data environment has enabled the development and implementation of artificial intelligence (AI) (e.g., mortality risk and rehabilitation response algorithms) and spurred the development of an AI governance framework,</p> <p>electronic patient experience and patient-reported outcomes measures (PROMs) that can be entered electronically by patients and results are embedded in the clinical portal (patient's electronic health record) and seen in real time,</p> <p>community clinicians able to access and enter data into all systems from patient homes.</p> |

Table 1 (continued): Proposed measures of success in establishing an enabling environment within Aotearoa New Zealand health services.

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| A pipeline of new ideas and trials underway with academics/universities and start-ups/companies | <p>Trials with companies including Orion Health, The Clinician, BlueMirror, Data Robot, Aranz Medical Ltd, Zoom, Smartpage, Fronde,</p> <p>Trials of internal new developments such as apps and a paediatric device,</p> <p>Academic partnerships with PrecisionDrivenHealth, the MedTech Centre of Research Excellence, Good Health Design AUT, National Institute for Health Innovation (NIHI) – research projects under these partnerships and separately, including student projects</p> <p>Internal Artificial Intelligence (AI) development projects and governance, and development of an AI Lab.</p> |
| Great people wanting to work with us and a culture of innovation and continuous improvement amongst all staff | <p>Since conception there have been:</p> <p>~40 i3 fellows, 10 Masters interns, 47 summer students (>120 apply for studentships each year),</p> <p>The Clinical Digital Academy (CDA) has trained 32 clinicians in IT and led to 7 digital fellows,</p> <p>7 Senior Medical Officers (SMOs) have had part-time roles and sabbaticals in i3,</p> <p>The DHB is consistently rated by Resident Medical Officers (RMOs) as the best digital experience,¹⁵</p> <p>i3 fellows, SMOs, and CDA alumni go back into their service and are supported to innovate and improve, work on i3 projects, and be champions within their service.</p> |
| Improvements in patient outcomes and equity, patient and whānau experience | <p>Each project is evaluated on its own merit (e.g., average of ~\$150 savings to patients for telehealth outpatient appointments, 88% would use telehealth again, and time/paper/cost savings for digital systems),¹⁶</p> <p>Waitematā DHB has some of the best health outcomes across DHBs eg. highest life expectancy in New Zealand at 84.2 years and increasing, with the gap between Māori and non-Māori closing;¹⁷ the lowest hospital standardised mortality (HDXSMR ratio of 0.65 across both hospitals 2020-21);¹⁸ second-lowest rate of amenable mortality with rates more than halving for Māori over the past decade;¹⁷ one of the lowest rates of hospital-acquired complications including bloodstream infections, pressure injuries surgical complications, neonatal birth trauma (2.4% of admitted patients vs 3.4% for peer hospitals);¹⁹ the top performer in hip fracture clinical care 2021 (ANZHFR 2021 New Zealand Golden Hip Award).²⁰</p> |

Table 1 (continued): Proposed measures of success in establishing an enabling environment within Aotearoa New Zealand health services.

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|------------------------------------|---|
| Responsiveness to Māori and equity | <p>Growth in Māori workforce by 31% (from 368 to 484 over five years) due to multiple initiatives including scholarship programmes, paid Health Care Assistant (HCA) training, and dedicated Clinical Nurse Specialist roles,</p> <p>Similar workforce initiatives, including ten Pacific Science Academies in schools, have seen the Pacific workforce increase by 33% (356 to 476) over the last five years,</p> <p>A Māori Health Pipeline Programme of projects with academic and community partners that are governed and led by Māori to accelerate Māori health gain and close the life expectancy gap, including the abdominal aortic aneurysm (AAA)²¹ and atrial fibrillation (AF) screening programme (first screening programme to be designed and targeted for Māori and only programme internationally to have screened women); Te Oranga Rūkahukahu lung cancer screening (LCS) (first Indigenous-led LCS programme in the world);²² alternative models for cardiac and pulmonary rehabilitation; HPV self-testing; breast cancer data match “500 women campaign”²³,</p> <p>The establishment of Kōtui Hauora, Northern Region Iwi-DHB Partnership Board, and the first DHB Chief Advisor Tikanga role, which has led to the development of a Māori research framework for the implementation of Māori-led research and innovation,</p> <p>The DHB has the second highest Māori life expectancy in New Zealand (80.8yrs), with a rate of increase in Māori life expectancy that is twice that of non-Māori. The life expectancy gap for Māori is 3.8 years, Māori mortality rates for cancer and cardiovascular disease have decreased by 27% over 10 years (2008–2018), housing related hospital admission rates for Māori have decreased by 77% (2010–2020), and Māori wahine maternal birth injury rates have decreased by 40% (2009–2018).^{14,24}</p> |
| Ability to adapt to COVID-19 | <p>Trained i3 staff were immediately deployed to COVID-19 projects in our DHB, and also regional and national developments such as:</p> <p>adapting the clinical portal to include a COVID-19 pathway and banner alerts for COVID-19 status and vaccination status,</p> <p>establishing community laboratory test e-ordering from all sites (testing stations, hotels, GPs, hospitals) and community e-prescribing for paperless clinics for hospital specialists,</p> <p>establishing a regional datastore and dashboards for managing COVID-19 across the region and linked nationally, initially tracking testing, inpatient COVID-19 status and hospital/ICU occupancy, followed by the national vaccination dashboard and most recently dashboards to manage COVID-19 in the community including the development and integration of a hospitalisation risk algorithm,</p> <p>involved in the clinical design for national developments including the Border Clinical Management System/COVID Community Care Module, national electronic ordering system for COVID-19 swabs at testing centres, the self-recording of rapid antigen test (RATs) results in My COVID Record plus the national collection of point-of-care RATs from all channels (consumer, GP, pharmacist, others).</p> |

Discussion

The planning phase for major health system reform and restructure is an opportune time to reflect on what we think works and should be embedded in Aotearoa New Zealand's new health system. The health reform vision is: "to build a system that achieves pae ora | healthy futures for all New Zealanders" with five areas of focus to achieve this vision including: "Excellence, ensuring consistent, high-quality care everywhere, supported by clinical leadership, innovation and new technologies to continually improve services."²⁵

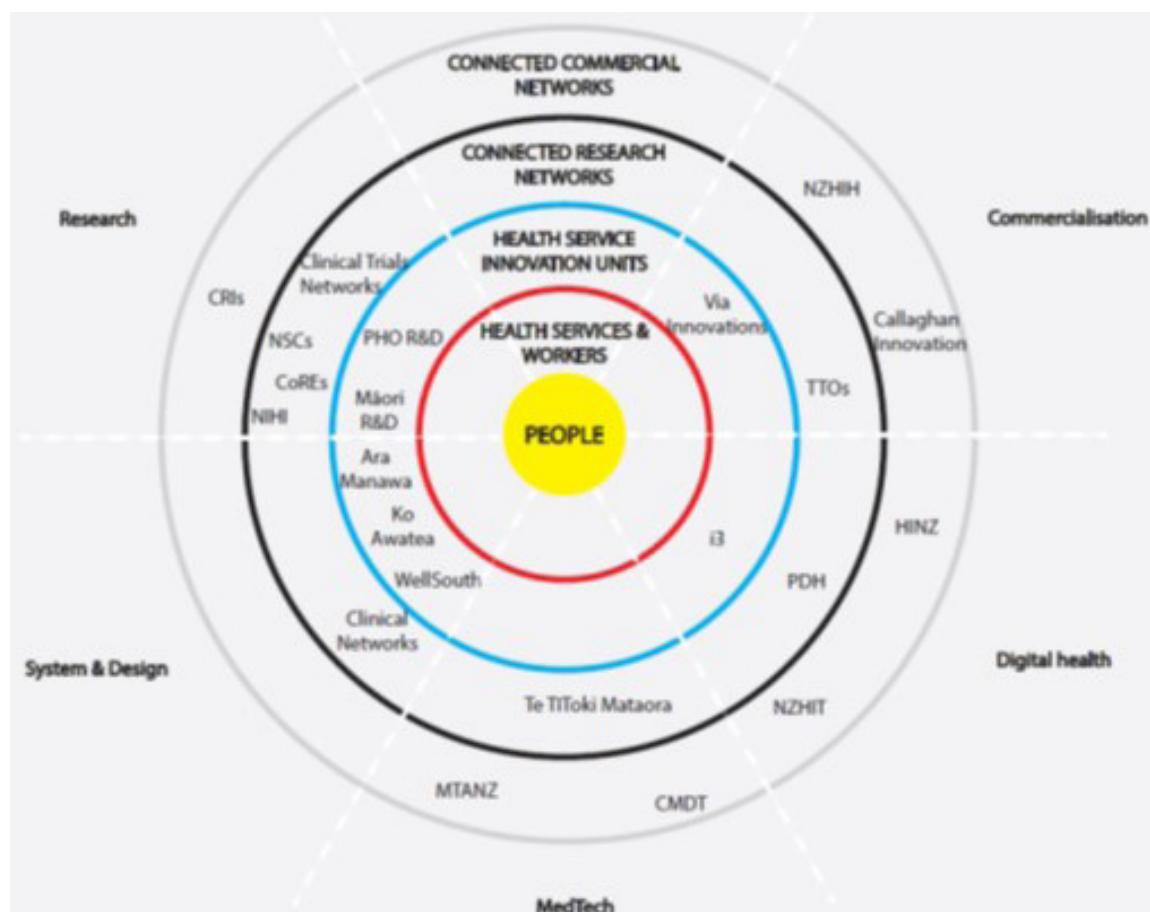
To do this, we need to create an overarching continuous improvement environment with people working together to innovate and improve systems and processes that underline high quality care and patient experience.

From Waitematā DHB's experience, the key elements for creating such an environment are:

executive leadership and clinical governance; provision of a door into the health service for those with aligned public good purpose; pipelines for new people, perspectives and ideas; career pathways, training and support for clinicians and others to lead innovation implementation; an engine room of people with diverse skills to support development and implementation that is deeply connected with the frontline health services; integration of data, digital, service design, quality improvement, innovation and research, all working towards shared goals; and strong networks with the broader innovation ecosystem (Figure 1).

We have described measures to evaluate the benefits and to inform continuous improvement of an innovation enabling environment at Waitemata DHB. We reiterate that it is difficult to draw any direct correlation from an enabling environment for innovation to improvements in health

Figure 1: A simple view of the current health innovation networks in Aotearoa New Zealand.



Key: CRIs Crown Research Institutes; NSCs National Science Challenges; CoREs Centres of Research Excellence; NIHI National Institute for Health Innovation; PHO Primary Health Organisation; R&D Research and Development; MTANZ Medical Technology Association of NZ; CMDT Consortium for Medical Device Technologies; NZHIT New Zealand Health IT; PDH Precision Driven Health; HINZ Health Informatics New Zealand; TTOs Tech Transfer Offices of Universities; i3 Institute for Innovation and Improvement; NZHIH New Zealand Health Innovation Hub.

outcomes and there are many other reasons for Waitematā DHB's relatively high standard of population health, mostly related to the socio-economic determinants of health. Measuring the benefits of an innovation enabling environment is challenging and is something that we need to continue to learn about and develop.

We hope that others around the country will add to the discussion with their experience of what has worked well in their contexts. There are lessons from across Aotearoa New Zealand about programmes and processes to take into the new healthcare system structure. It is our view that Te Whatu Ora (Health NZ) and the Te Aka Whai Ora (Māori Health Authority) should join up the existing exemplars of enabling innovation environments, their teams and their broader innovation networks (Figure 1), to optimise an innovation and improvement network that directly supports and works with the new structure. What has not worked well previously, in our opinion, is creating separate entities that sit outside the healthcare structure to "do" innovation for the healthcare system, and not integrating innovation, data and digital with quality improvement and clinical governance.

This proposal also appears to be supported by the recent move to re-integrate NHST (driving digital transformation of the NHS) and NHS Digital back into NHS England. The recommendations from the recent independent review of data, digital and technology in the NHS by Laura Wade Gery,²⁶ accepted by the UK Government, include bringing together innovation and improvement, more closely linking data and digital to the business, building a pipeline of future talented leaders that combine clinical, managerial, digital and data experience, and building a transformation engine ["factory"]:

"To achieve the Long Term Plan aim, and respond to the rapid acceleration in digital adoption, NHSEI needs to 'transform the way it transforms' and improve how it supports innovation in the delivery of care. At the core, this involves the creation of a scalable capability that integrates clinical, operational and technological resources to transform patient pathways and service delivery.

This capability builds real expertise in the art and science of transformation, learning continuously from experience. It needs to embed modern digital and

transformation tools and techniques, and adopt a user, patient and citizen centred approach. It will use 'agile' change methodologies and operate through small, focused multi-disciplinary 'service' teams whose missions have longevity to build the right experience and continuity and technical solutions...The focus is relentless on delivering improvements in outcomes based on rapid deployment and continuous improvement rather than large scale traditional system programmes, although supported by underlying data and technology infrastructure."²⁶

Other international models may also be worth learning from, and others in the ecosystem are looking to exemplars, such as the Consortium for Medical Device Technologies (CMDT) developing an Australia New Zealand BioBridge with the Liverpool Innovation Precinct in Sydney.²⁷ We need to ensure learnings from international examples are adapted to our context: our position as a small country with a good health service, a strong and unique global pandemic response, a vibrant Indigenous culture of innovation currently with an upswing of Māori business R&D⁶ and leading developments in important issues such as Indigenous data sovereignty, and a potential pendulum swing back to centralisation. It is time to bring all these elements together under our new national health system, making the most of this opportunity to remove the silos and perverse incentives that have hindered innovation and improvement implementation in the past.

In addition, the authors would like to add two further areas for development: a "thinktank" function providing continuous horizon scanning (including literature review and discussions with international networks) and ensuring the ongoing close relationship with regional and national direction for IT, data governance, and health service quality; and a Māori specific innovation pipeline at all levels—locally, regionally and nationally. This would be led by Māori for Māori, and would purposely develop and support Māori innovations to thrive. At Waitematā DHB this has been enabled by governance at the Iwi-DHB Partnership Board level, leadership and support at a management level from the Chief Advisor Tikanga and the Chief Executive, and investment in Māori researchers and research projects. This must reflect the principles of Te tiriti o Waitangi, reinforced in the findings to date of the Waitangi Tribunal Inquiry into Health Services and Out-

comes and in Whakamaua: Māori Health Action Plan 2020–2025—that is, the principles of tino rangatiratanga, equity, active protection, options, and partnership.^{28,29}

Conclusions

“The Government should use its intended major health system reform to improve the mandate, funding and incentives for DHBs to participate in the healthtech innovation ecosystem. This change would be to the mutual benefit of the healthtech sector, and the efficiency, effectiveness and accessibility of New Zealand’s health and disability system.” – Productivity Commission⁶

A new national healthcare system structure will require an innovation and improvement focus in order to “do things differently” and produce different, and better, results than the current system. We need to reflect on what has worked well to date and what is happening internationally—embracing the potential to combine the best features with the new opportunities a “re-start” can bring.

“To create a future different from its past, health care needs leaders who understand innovation and how it spreads, who respect the diversity in change itself, and who, drawing on the best of social science for guidance, can nurture innovation in all its rich and many costumes.” – Don Berwick, IHI⁴

COMPETING INTERESTS

Nil.

ACKNOWLEDGMENTS

We would like to acknowledge all those who have worked in the Institute for Innovation and Improvement, the Health Information Group, and on the Leapfrog Programme; in particular, Stuart Bloomfield, Andrew Cave, David Ryan, Delwyn Armstrong, Lara Hopley, Chris Southen, Sharon Puddle, without whom none of this would have been possible. We would like to acknowledge Karen Bartholomew and the team leading the Māori Health Pipeline and Workforce programmes. We also wish to acknowledge Dame Rangimārie Naida Glavish for her leadership and guidance on Māori tikanga, and the Waitematā DHB Board for their long-term support for this work.

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www.nzma.org.nz/journal-articles/innovation-in-aotearoa-new-zealands-healthcare-system-how-to-make-it-happen

REFERENCES

1. Lansisalmi H, Kivimaki M, Aalto P, Ruoranen R. Innovation in Healthcare: A Systematic Review of Recent Research. *Nursing Science Quarterly* 2006; 19 (1): 66-72.
2. Varkey P, Horne A, Bennet K. Innovation in Health Care: A Primer. *Am J Med Qual* 2008; 23: 382-8.
3. Arora A, Wright A, Cheng M, Khwaja Z, Seah M. Innovation Pathways in the NHS: An Introductory Review. *Therapeutic Innovation & Regulatory Science* 2021; 55: 1045-58.
4. Berwick D. Disseminating innovations in health care. *JAMA* 2003; 289(15): 1969-75.
5. Summary Outputs from a Transition Unit Innovation Workshop. 24th September 2021. Attended by author RW.
6. New Zealand Productivity Commission. 2021. New Zealand Firms: Reaching for the frontier. Final Report. 2021. ISBN 978-1-98-851961-6 (online). Available from: <https://www.productivity.govt.nz/assets/Documents/Final-report-Frontier-firms.pdf>
7. Jacobs S, Weiner B, Reeve B, Hofmann D, Christian M, Weinberger M. Determining the predictors of innovation implementation in healthcare: a quantitative analysis of implementation effectiveness. *BMC Health Services Research* 2015;15:6.
8. Omachonu, V.K. and Einspruch, N.G., 2010. Innovation in healthcare delivery systems: a conceptual framework. *The Innovation Journal: The Public Sector Innovation Journal*, 15(1), 1-20.
9. I3: Institute for Innovation and Improvement. Our Work. Accessed on 1/03/2022. Available from: <https://i3.waitematadhb.govt.nz/our-work/>
10. Glasgow R, Harden S, Gaglio B, Borsika R, Smith ML, Porter G, Ory M, Estabrooks P. RE-AIM Planning and Evaluation Framework: Adapting to new Science and Practice with a 20-year Review. *Frontiers in Public Health* 2019; 7: 00064 DOI=10.3389/fpubh.2019.00064
11. Chaudoir S, Dugan A, Barr C. Measuring factors affecting implementation of health innovations: a systematic review of structural, organisational, provider, patient and innovation level measures. *Implementation Science* 2013;8:22.
12. Helfrich C, Weiner B, McKinney M, Minasian L. Determinants of Implementation Effectiveness. *Medical Care Research and Review* 2007; 64(3):279-303.
13. Waitematā District Health Board. Board Reports – CEO Reports, Hospital Advisory Committee Quality Reports. Available from: www.waitematadhb.govt.nz/about-us/leadership/board-meetings/. For specific example, <https://www.waitematadhb.govt.nz/assets/Documents/committees/2021/HAC-December-2021.pdf>
14. Health Quality and Safety Committee. Choosing Wisely Recommendations and Resources. Available from: www.hqsc.govt.nz/resources/choosing-wisely/recommendations-and-resources/
15. Quarterly RMO (Resident Medical Officer) Run Feedback reports for the Auckland DHBs (not publicly available).
16. Waitemata DHB. Telehealth Trial Summary Report

2019. Available from: www.telehealth.org.nz/assets/Uploads/1907-Waitemata-Telehealth-Trial-Summary-Report-Final.pdf
17. Waitemata DHB. Waitemata DHB Annual Reports. Available from: www.waitematadhb.govt.nz/about-us/dhb-reporting/annual-reports/
18. Waitemata DHB Hospital Advisory Committee (HAC) (Board Committee) papers. Available from: www.waitematadhb.govt.nz/about-us/leadership-committee-meetings/
19. Health Quality and Safety Commission. Hospital Acquired Complications Rates. Available here: www.hqsc.govt.nz/our-data/quality-and-safety-markers/ and www.hqsc.govt.nz/our-data/quality-dashboards/
20. Australia and New Zealand Hip Fracture Registry. Goldn Hip Award 2021. Available from: <https://www.buzzsprout.com/1739857/9605400-secrets-to-success-waitemata-district-health-board?t=0> and [https://www.waitematadhb.govt.nz/assets/Documents/board/2021/Board-150921.pdf](http://www.waitematadhb.govt.nz/assets/Documents/board/2021/Board-150921.pdf)
21. Waitemata DHB. Quality Accounts. Abdominal Aortic Aneurysm (AAA) Screening Pilot for Māori. Available from: <http://www.qualityaccounts.health.nz/quality-initiatives/quality-initiatives/aaa-pilot-for-maori/>
22. Waitemata DHB. Te Oranga Pukahukahu – Lung Health Check. Available from: [https://www.waitematadhb.govt.nz/healthy-living/te-oranga-pukahukahu-lung-health-check/](http://www.waitematadhb.govt.nz/healthy-living/te-oranga-pukahukahu-lung-health-check/)
23. BreastScreen Aotearoa. Information for Primary Care: 500 Maori Women Campaign – Breast Screening DataMatch Project. Available from:
- <https://aucklandpho.co.nz/wp-content/uploads/2019/09/Information-to-primary-care.pdf>
24. Ministry of Health. Maternity Clinical Indicator Trends in New Zealand. Available from: minhealthnz.shinyapps.io/maternity-clinical-indicator-trends/
25. Department of the Prime Minister and Cabinet. Our health and disability system. Building a stronger health and disability system that delivers for all New Zealanders April 2021. Available from: <https://www.futureofhealth.govt.nz/assets/Uploads/Publications/health-reform-white-paper-apr21.pdf>
26. Independent report. Putting data, digital and tech at the heart of transforming the NHS. Department of Health and Social Care, UK Government. Published 23 November 2021. Available at: <https://www.gov.uk/government/publications/putting-data-digital-and-tech-at-the-heart-of-transforming-the-nhs>
27. MedTech CMDT. BioBridge. Accessed on 1/03/2022. Available from <https://www.cmdt.org.nz/biobridge>
28. Waitangi Tribunal. Hauora: Report on Stage One of the Health Services and Outcomes Kaupapa Inquiry (Pre-publication version), Chapter 10 of Wai 2575 Waitangi Tribunal Report 2021. Accessed on 1/03/2022. Available from <https://waitangitribunal.govt.nz/inquiries/kaupapa-inquiries/health-services-and-outcomes-inquiry/>
29. Ministry of Health. 2020. Whakamaua: Māori Health Action Plan 2020-2025. Wellington: Ministry of Health. Available from: <https://www.health.govt.nz/publication/whakamaua-maori-health-action-plan-2020-2025>