Office of the Prime Minister's Chief Science Advisor
Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

Title:

REPORT: Capturing the benefits of AI in healthcare for Aotearoa New Zealand - Key messages

Author:

OPMCSA

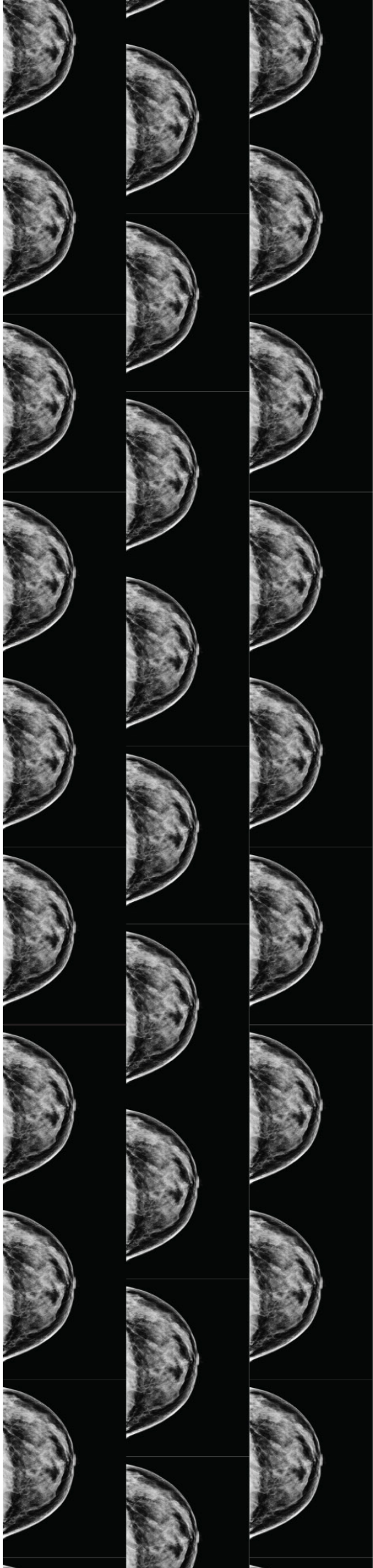
Output type: PDF				
Pages: 45 pp				
Date: Dec-2023				
Language: English				
Review: Peer reviewed				
Versions				
Record number:	*Version:*	*Date V1 created:*	*Date:*	*Printed version*
PMCSA-23-12-04-V3	V3	30-Oct-2023	14-Dec-2023	Y
DOI:	10.17608/k6.OPMCSA.24814107			
ISBN:	-			
Archive page link: https://dpmc.govt.nz/our-programmes/special-programmes/prime-ministers-chief-science-advisor-archives/archive/gerrard-2021-2024				
Notes: Delivered to the Government pre-election (October 2023) – publicly released 15 December 2023				

Capturing the benefits of AI in healthcare for Aotearoa New Zealand

A rapid report from the
Prime Minister's Chief Science Advisor
Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

Key messages

October 2023



October 2023 version 3

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FOREWORD

Kia ora koutou,

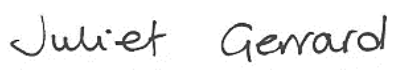
This report was requested by Prime Minister Hipkins in 2023 and was produced at pace for delivery of draft recommendations ahead of the 2023 election (terms of reference can be found in the full report). With a focus on healthcare delivery, this report was produced with Ian Town, the Chief Science Advisor to Manatū Hauora | Ministry of Health and co-chair of our expert panel.

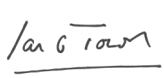
Employing AI technologies in healthcare has far-reaching impacts. There are ways in which these technologies could enhance the healthcare system very soon, for example improving back-office operations or diagnostic support. The case studies featured in the full report offer a glimpse of current and near-future capabilities to start a conversation about how to introduce AI to our healthcare system.

Deploying the right AI technology has the potential to address some long-standing inequities in healthcare that will have positive impacts felt more widely than the healthcare system itself. Coupled with these opportunities are a series of complex ethical and legal issues. We understand that key health agencies are already planning work programmes which will go beyond the issues touched on in this report to ensure that AI is deployed effectively and safely in the health system. It is our hope that this report might support robust discussion amongst policy writers and decision-makers to consider the best path to enable technology to support human care.

The successful deployment of AI into our healthcare system will depend not just on the technology itself, but on the wider healthcare system and system settings that are crucial to underpin smooth implementation. This necessitates a thorough understanding of our landscape at present (spanning legislation, policy, infrastructure, data, research, and workforce) coupled with a clear vision and cross-sector agreement for the future of healthcare. We recognise how rapidly the AI technology landscape is likely to evolve. As such, we have limited our recommendations to a timespan of five years, acknowledging there will be a need to re-evaluate both the AI and healthcare landscapes on an ongoing basis.

We thank our amazing expert panel whose experiences span healthcare, academia, technology development, ethics, philosophy, tikanga Māori and governance. We are also grateful to our reference group, which included academics, industry experts, entrepreneurs, and government agencies from both national and international settings. Finally a huge thank you to the writing team for putting the collected thoughts in order.





Professor Dame Juliet Gerrard FRSNZ HonFRSC

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Professor Ian Town FRACP

Chief Science Advisor to Manatū Hauora | Ministry of Health

ACKNOWLEDGMENTS

Our panel

We gratefully acknowledge the efforts of our panel whose expertise and guidance have shaped this report.

Dame Professor Juliet Gerrard (Co-Chair) - PMCSA

Professor Ian Town (Co-Chair) – Manatū Hauora | Ministry of Health

Professor Ali Knott – Te Herenga Waka | Victoria University of Wellington[iii]

Professor James Maclaurin – Te Whare Wānanga o Ōtākou | The University of Otago

Dr Karaitiana Taiuru (*Ngāi Tahu, Ngāti Kahungunu, Ngāti Toa*) – Taiuru & Associates

Megan Tapsell (*Ngāti Whakaue, Ngāti Pikiao, Ngāti Raukawa ki te Tonga*) – AI Forum NZ[i]

Dr Robyn Whittaker – Te Whatu Ora | Health New Zealand and Waipapa Taumata Rau | The University of Auckland[ii]

Professor Michael Witbrock – Waipapa Taumata Rau | The University of Auckland[iv]

Dr Vithya Yogarajan - Waipapa Taumata Rau | The University of Auckland

[i] Frontline diagnostics board member

[ii] Chair National AI & Algorithm Expert Advisory Group for Te Whatu Ora; Affiliated with the MedTech IQ Tāmaki/Te Tītoki Mataora Programme; Affiliated with Precision Driven Health

[iii] Working on a commercial contract with Soul Machines

[iv] Small stockholding in Volpara and Fisher & Paykel Healthcare

Our reference group

We thank the many academics, industry experts, entrepreneurs, and government agencies who formed our reference group. To those who met with the team, provided introductions, and generously contributed time, energy, and suggestions to this project, we are thankful for your contributions.

Though we have incorporated as much feedback as possible, not all suggestions were in agreement and not all could be incorporated. Our acknowledgement of people who helped us with this project in no way indicates their endorsement of the project itself. We have done our utmost to keep track of everyone who has contributed to this work. Please accept our sincere apologies for any inadvertent errors or omissions. Any mistakes in the report are our own.

AI Forum New Zealand | Te Kāhui Atamai Iahiko o Aotearoa

Artificial Intelligence Researchers Association

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Chrisana Archer

Angela Ballantyne

Tom Barraclough

Kiya Basabas

Paul Benden

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Collin Bjork

Rebecca Bonnevie

Elsamari Botha

Sarah Box

Elizabeth Broadbent

Drew Broadely

David Brougham

Simon Brown

Ariane Chan

Kin Lung Chan

Andrew Chen

Peter Chong

John Clayton

Markus Luczak-Roesch

Mataroria Lyndon

Julian Maclaren

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Authors

Professor Dame Juliet Gerrard FRSNZ, HonFRSC (Co-chair)

Juliet has held the position of Chief Science Advisor since July 2018. She has advised the Prime Minister on a broad range of subjects. She aims to create a trusted bridge between science, society, and government. She is also a Professor at Waipapa Taumata Rau | University of Auckland.

Professor Ian Town FRACP (Co-chair)

Ian is the Chief Science Advisor to the Ministry of Health. He has worked extensively on the development and implementation of the New Zealand Health Research Strategy and played a central role in New Zealand's COVID-19 pandemic response working with the PMCSA and the Director-General of Health to bring the latest evidence and research to decision-makers. More recently he has led the COVID-19 Vaccine Technical Advisory Group providing regular advice to the Director-General about vaccine strategy, efficacy, and safety.

Dr Rebecca Benson

Rebecca is a Senior Research and Policy Analyst. Her background is in quantitative social science, and she has worked at the intersection of research and policy at University College London, King's College London, and Queen Mary University of London. Rebecca earned her PhD in Public Policy at the University of Texas at Austin and has a Master of Public Health from Te Whare Wānanga o Ōtākou | University of Otago.

Dr Emma Brown

Emma is a Senior Research and Policy Analyst. Her background is in Engineering. Emma earned her PhD at Waipapa Taumata Rau | University of Auckland in the Chemical & Materials Engineering department.

Carolle Varughese

Carolle is a Research Analyst and Writer. Her background is in public policy, education, and physics. Carolle completed her Master of Public Policy at Waipapa Taumata Rau | University of Auckland, focusing on space policy in New Zealand.

VISION – PRIMARY HEALTH CARE IN AOTEAROA 2035

Jade is a GP in Newmarket and is part of a team practice in the heart of a bustling local community. At lunchtime one Wednesday, Jade calls her grandad to check how he is doing. He asks why she's not at work and laughs when she says she's on her lunch break. They didn't have lunch breaks in his day. He was a GP who retired early in the 2020s, completely burnt out. Her mum remembers the brutally long days he worked during the COVID-19 pandemic and the time it took to clear the backlog of non-urgent medical tasks and follow-ups afterwards. She spent a long time trying to persuade Jade to think of alternate career options. But thankfully, the workload is manageable for those in the health sector now. The smooth rollout of artificial intelligence support across the New Zealand public health system in the late 2020s completely changed the game. At the end of her medical training – which heavily utilised AI, preparing her for AI-supported practice – Jade was excited to be accepted into the GP training programme. This is now one of the most sought-after careers for graduating doctors who enjoy building relationships with their patients in local communities.

In this practice, Jade can access a full range of AI support modules. The basic ones are available throughout Aotearoa New Zealand, with all GPs trained to understand their role in human-centred medicine. The advanced modules are only available in hospitals or large practices in the major centres, with specialist training needed. So Jade also supports rural GPs and their patients remotely. In her practice, most patients arrive having already done a preliminary consultation with the personalised AI healthcare module on their phones. Biometric data is collected on a smartwatch, issued by the practice if the one they normally wear isn't compatible with the software. If patients have a particular condition or set of risks, specialist monitoring is set up in their home.

When Hēmi arrives for his appointment, Jade already knows that he has been having issues with his heart rate and blood pressure for some weeks now. The AI has suggested he call in because he has been working on his fitness and sometimes feels very faint after exercise. Jade logs into his file and sees what Hēmi has been told. He is a patient who has opted to receive quite a lot of technical detail as he is very health literate, but the system still has deeper information accessible to Jade. He definitely needs his medication adjusted, and the AI offers a range of possible treatments for Jade to discuss with Hēmi. This is a very efficient conversation, as he had already done some reading and made some preliminary decisions, and so the consultation is there to discuss these and provide some reassurance.

Jade adjusts the medication in the systems and alerts Hēmi's pharmacist to assess the dosage and any potential interactions by the time that Hēmi gets there. There is also time for Jade to ask some more general questions about his wellbeing, and how things are going in his life. Jade knows there are often additional important personal issues that people do not enter into their health record and prefer to discuss face to face. It turns out there are some stress factors that he can talk through with Jade, including his wife's health.

Hēmi's wife Ngahuia has been struggling with a wound on her big toe that won't heal. This is likely exacerbated by her diabetes, which Hēmi worries she is not managing well. While Hēmi is in the consultation with Jade, Ngahuia talks to Colin. Colin is one of the nurse practitioners at the practice

and provides patient support, teaching, and monitoring. Ngahuia and Hēmi had their appointments booked for the same time by the AI timetabling system, which was able to access both their schedules and those of the GP and nurse. This system seamlessly books their appointments to enable them to attend simultaneously. While assessing the integrity of the wound, Colin teaches Ngahuia to take care of the toe at home. Ngahuia indicated that she needed some reminders about what she learned, so Colin asks the clinic's AI assistant to send Ngahuia a virtual simulation about wound management around her big toe. He also chats with Ngahuia about her blood sugar management plan and her concerns about specialist monitoring of her wound at home. Unlike Hēmi, Ngahuia has been reluctant to adopt biometric data monitoring and sharing, so the only data available is from six monthly blood tests. Colin assures Ngahuia that she can receive care as she feels most comfortable. On the way home, she talks to Hēmi again about how his data-sharing supports his health and wonders whether she might trial using the data-sharing system in the future.

Hēmi is also pondering how widely to share his data. His heart issues are likely to include a genetic predisposition, and understanding the risk might be useful for his family. Jade took Hēmi through the options for sharing his data in the whānau-sharing system. Patients can opt in or out of the system, acknowledging that not everyone wants their siblings and cousins to know their medical history. Still, the data-sharing mechanism means that family members' GPs can be given general risk factors without any specifics, allowing treatment to be optimised for particular genetic risks without personal data being compromised. A similar iwi level data sharing system is also available which patients can opt in or out of. Hēmi decides whānau sharing is a good option for the health of his wider family. With all the basic data, scheduling, and diagnostics handled by the AI, there was more time to discuss the benefits and concerns of data-sharing. Hēmi doesn't go to the doctor very often, but when he does, he enjoys a trusting relationship.

Jade's next patient, Sheila, is concerned about her upcoming mammogram, especially after her mum tells her horror stories about the extent of breast compression during the procedure that she asserts are essential to get a good image. Jade explains that in the early days, it was indeed quite an uncomfortable experience, but the image analysis is now much more sophisticated and in three dimensions, which means that optimal compression is much less painful. The AI systems first introduced in the early 2020s are now much more sophisticated, and each mammogram is compared in detail to the patient's previous image, carefully separating natural changes in breast density from unexpected findings. Abnormalities can now be highlighted and assessed very quickly by an experienced radiologist, supported by AI. Jade takes time to talk Sheila through the process and explains how early detection means that very few women now suffer from advanced breast cancer. These days invasive biopsies are much less likely to be required, thanks to the sophistication that AI has brought to image analysis. She also talks Sheila through the protections in place for her children, whose data won't be shared beyond the immediate family until they are old enough to consent to this themselves.

Jade also offers Sheila the option for some genomic screening. The full set of genes associated with breast cancer is increasingly well understood. Sheila's family opted not to enable whānau-sharing with their personal data, but she can still opt to have her genetic information factored into her breast cancer health programme. It gives her a good handle on her personal risk factors and the optimal frequency of mammograms for her. Some women have mammograms every six months and others every five years, enabling the service to target those at highest risk.

Jade doesn't share the latest research findings because they are a long way from being implemented into clinical practice but is excited by the latest developments in precision medicine that were flagged in the news section of the AI diagnostic module. An early clinical trial on women with a particular mutation has just been carried out, showing that hormone replacement therapy which includes a specific inhibitor for one of the proteins that result from the mutation lowers the risk of specific breast and ovarian cancers. Jade is not expected to be able to keep up with the rapidly growing body of research; instead, the system provides her with a literature synthesis as well as recommendations and alerts.

Jade's next patient is new to the practice. Akshita has recently emigrated from the UK where the NHS offers much less advanced options than here in New Zealand. In an extended 30 min appointment, Jade explains how things work here and offers Akshita the option of having blood tests and a full medical exam to populate her baseline data in the system. She talks Akshita through how AI at the clinic can feed her personalised biometric data into the health system from a wristwatch in real-time. Jade emphasised that all data-sharing is strictly opt-in where personal health information can be used in tools that are approved for use in her clinical care, while de-identified aggregated data are used to directly inform the improvement of health services for all. Akshita is somewhat reassured that the data is tightly held for medical purposes only. Having generally low trust in the government, she goes away to think about which option she will take and the degree to which her data and AI will support the relationship with her GP. Jade showed Akshita the health system's AI chat tool in case she thought of any questions about her data and consent later. She is impressed that the AI can translate into any language.

Next up is Fred, who recently had a hip replacement and is here to discuss his rehabilitation. Although the operation was only a month ago, he seems very mobile as he enters Jade's office. Ahead of the operation, Fred had a series of scans, which gave the surgeon a precise understanding of the shape of his hip joint. The scans generated a blueprint for a bespoke 3D-printed implant that was seamlessly inserted during the operation using laser-guided robotic placement. Taking the guesswork out of the surgery significantly reduced the duration of the operation and the detrimental impact of the anaesthetic, making the surgery much better tolerated. Both Fred and Jade are excited about Fred's improved mobility, which has enabled him to start thinking about going for longer walks again and increasing his general fitness. Jade supports his idea of joining a community walking group, which will also improve his mental health. Fred was left alone since he lost his partner, and one of the worst impacts of his hip problems was reducing his social activity, triggering depression. Fred seems positive as he plans to reconnect with his mates.

Jade suggests that Fred check in with Colin about his health management. On chatting with Fred, Colin notices that he is getting a little forgetful in taking medication and installs a memory-jogging app on his watch. In fact, Colin uses a similar memory jogging app himself. His system prompts him to ask about the gap in Fred's biometric data due to him forgetting to put on his watch. Colin suggests an alternate memory-jogging system, which might make it easier to remember things. Fred already has a device providing an instant connection device to medical support on a screen near his bed, which he can access by pressing a button. Run by AI, the avatar on the screen knows Fred well, and they have a good relationship. It reminds him of basic daily tasks and automatically alerts the practice if there are any new concerns. Colin suggests they get the AI to remind Fred to put on his watch each morning.

The last patient of the day for Jade is a Telehealth appointment with Karen who lives on Great Barrier Island. Karen normally sees a local GP when she can afford to but has been referred to Jade before the GP drops by her place to assess whether she may have COVID-19. Karen is on home dialysis and has developed a nasty cough and a temperature over the last couple of days. Jade is trialling a new AI module that listens to a patient's voice and cough and gives a probability that the cough is indeed caused by COVID-19. There's a nasty new variant this year, so the health system is on alert. Karen chats to Jade, and the AI listens in and thinks there's an 85% chance it might be COVID-19—helpful information to relay to the local GP. Fortunately, predicting severe infection from COVID-19 (or other infectious diseases) and particularly the need for hospitalisation has become quite accurate over the last few years. Since performance measures are regularly and accessibly communicated to the public, their conversation reassures Karen. Jade knows that the local GP has undertaken the AI module on early detection of deterioration in patients with underlying health conditions like Karen. While there, Jade asks Karen if she'd like a retinal scan to confirm that her high blood pressure is being managed as well as checking for new problems such as diabetes. She agrees and puts her eye close to the camera on her phone, which is especially adapted for high-resolution retinal images. The AI runs a quick diagnostic, and everything looks in order, which is reassuring. Jade lets Karen know this, and her GP will be in touch later that day to deliver a COVID-19 test and give advice on the cough.

Before heading home, Jade asks the AI to run through the day, check all the notes, and alert her to any anomalies or omissions. She reviews her schedule the next day, and asks whether she should come in before 9 am to prepare for any appointments. One patient's file suggests a high uncertainty in the AI diagnostics, so Jade asks the AI to schedule 20 minutes for her to look at this ahead of time, and heads home to her family dinner with Grandad, confident that nothing is forgotten.

EXECUTIVE SUMMARY

In the wake of COVID-19, pressures on our health services and our healthcare professionals are immense and well-publicised. Though far from a panacea, artificial intelligence (AI) offers opportunities to strengthen the health system, support healthcare professionals, and improve the health of all New Zealanders. Taking a broad perspective of AI and its promise to improve health outcomes, we imagine an Aotearoa New Zealand in which the benefits of AI have been captured, at least in primary care, in our Vision.

The horizon of this rapid report is the near future, providing an overview of feasible opportunities within this time frame. We explored the possible benefits that AI may provide within the next five years and ways we can plan, manage, and deliver better outcomes in administrative areas, care delivery and health equity, population health and policy, and research. The report also features case studies from New Zealand and around the world to give a sense of the opportunities. Additionally, through the engagement process we were able to hear about the journey for some of our local case studies, and some of the hurdles they had to navigate are captured throughout the report.

In common with other countries, there are, of course, some challenging issues with which to engage as we adopt AI, including ethics, consent, governance, equity, and the risks of a digital divide. Our discussions also highlighted some themes unique to New Zealand such as digital infrastructure, nurturing data as taonga, population dynamics, and enabling access. We provide recommendations to help build an ecosystem that can fully capture the benefits of AI in the New Zealand health sector.

Principles

Drawing on the expertise of philosophers and ethicists on our expert panel, the 17 principles in this report sit within five themes.

Implementing Te Tiriti o Waitangi and recognising tikanga Māori

Globally, collective rights for Indigenous populations are recognised and affirmed by the United Nations Declaration of the Rights of Indigenous Peoples (UNDRIP). New Zealand gave its support to the declaration in 2010, acknowledging Māori as tangata whenua and affirming a commitment to the common objectives of the declaration and Te Tiriti o Waitangi.[i] Te Tiriti and its principles require consideration on an ongoing basis as the breadth of applications for AI in healthcare delivery continues to evolve.

[i] Te Tiriti o Waitangi is a founding document of government in Aotearoa New Zealand following the earlier signing of He Whakaputanga Rangatiratanga o Nu Tireni in 1835. The Waitangi Tribunal asserts that the sovereignty captured in the latter document was not erased or superseded by the drafting and signing of Te Tiriti.

Safe and effective AI

AI must be safe, not exposing patients to increased levels of risk. It must be effective in achieving the goals set out in the *Pae Ora | Healthy Futures Strategies 2023* to achieve health equity and improve health outcomes for all. This will require: the development of frameworks for assessment of AI in various healthcare contexts; better understanding of the limitations and risks of AI systems; and the development of rules and governance frameworks across the health system.

AI for equity

If we are to make good on the Pae Ora strategies, our deployment of AI must improve equity in access and in outcomes. There must be ongoing audit and evaluation of potential biases and prioritisation of use cases that enhance equity. While inappropriate use can lead to inequity, early evidence suggests that AI is capable of enhancing equity by lowering barriers to knowledge, reducing the effect of human bias on care, enhancing access to healthcare, and increasing the productivity of healthcare professionals. If such productivity gains prove viable, it is essential that they be harnessed to increase the equity of healthcare provision.

Effective control of AI

Where AI is supervised by humans, it is essential that its supervision be effective. Increasingly, we will not always want to supervise all AI as confidence, capability, and trust builds. There will be low risk domains in which supervision is not cost effective and, as AI becomes increasingly powerful, we will be less competent at supervising it.

Evaluated and trusted AI

The use of AI in health contexts must be both trusted and trustworthy. People should understand the role that AI plays in their care. Significant effort is being put into explaining the nature and reliability of technology. But, by its nature, generative AI is less explainable. In some cases, its trustworthiness is best secured by effective and well communicated audit and evaluation, rather than by communicating the mechanics of its operation and the nature of the vast amount of data, sometimes sensitive, on which it is constructed.

Responsible AI

Effective use of AI requires clear rules about liability and responsibility.

Background

For this report, we use AI to mean technologies that simulate human intelligence: the ability to learn, reason, self-correct, and create new content. Importantly, although we are talking about the ability to mimic or augment human intelligence, there will be tasks where AI outperforms humans. We distinguish between predictive and generative AI at some points throughout the report as the technical, practical, or governance implications may differ:

- Predictive AI: systems that learn to map inputs onto outputs, through supervised learning, using training examples that illustrate the mapping

- Generative AI: systems that learn to generate or complete complex patterns (e.g., text or images), through exposure to large numbers of patterns during training

Adopting AI into the health system will require strong governance to ensure technologies benefit rather than harm our people and our health system. Examples of early governance structures are emerging. For example, within Te Whatu Ora| Health New Zealand, the National AI and Algorithm Expert Advisory Group (NAIAEAG) is responsible for reviewing proposals to develop or put into practice any new models of AI in our national health services. Various voices are represented within the advisory group including experts in AI, ethics, clinical, research, Māori health, data, digital, privacy, legal, and innovation. Proposals are considered against an assessment framework that considers various themes and perspectives.

Another emergent part of the governance structure is the *Therapeutic Products Act 2023*, which will come into force in 2026. The Act applies to some types of AI which will be considered 'software as a medical device'. Among other things, the Act enables a regulatory framework to require certain AI products used in healthcare to meet requirements for safety, quality, and performance. A regulatory body is being established and will provide market authorisation, licences, and permits for making software available. The criteria for authorisation are not yet established and will directly impact the effectiveness of the Act. This regulator, and the health governance system more generally, will need to balance various regulatory tensions. We hope this report is useful for their mahi.

The approach to governance of AI in healthcare in Aotearoa New Zealand will need to engage with Te Tiriti o Waitangi and relevant ethics frameworks. Kāhui Matatika o te Motu | National Ethics Advisory Committee provide ethical advice to the New Zealand health sector, and the World Health Organization has provided ethical guidance specific to the use of AI in healthcare. Lastly, the implications of the *Artificial intelligence and the Information Privacy Principles* set out by Te Mana Mātāpono Matatapu| Office of the Privacy Commissioner will provide a useful guide.

Addressing healthcare needs using AI

Existing AI technologies offer the possibility of improving the quality of care people are able to access in our health system while making the system itself more efficient. One of the low-hanging fruits in this regard is the automation of some of the administrative tasks that take up a lot of human resources. An example is scheduling an operation, where the rosters of several clinical staff and the availability of both a physical space and several specialised tools must be co-ordinated. Typing up notes and routine communications with patients are other administrative tasks where AI could reduce the time spent by humans.

Computer vision – which refers to machine perception of visual images – is a field with many applications that can augment clinical judgment, resulting in more accurate diagnoses and treatment, and faster provision of results to patients. Medical images are commonly used in healthcare to identify problems or abnormalities: X-rays, CT, MRI, and mammograms produce visual representations for interpretation by radiographers; gastroenterologists use endoscopies and colonoscopies to image our digestive tracts; dermatologists examine our skin for abnormalities; and allied health professionals examine microscope images. In all these cases, clinicians are using their training and experience to interpret what they see, and they don't always get it right. AI tools can be

trained to examine these images and in the right circumstances can be more accurate than humans, and take less time. Augmenting human judgment with AI may result in faster and more accurate results from many types of medical imaging.

Another example of the opportunities AI can offer to the health sector is in the field of biomedical research. At present, this is best exemplified by Alphafold, a tool which can accurately predict the folded structure of a protein from the sequence of amino acids. This allows scientists to predict the protein's function, enabling more rapid drug development with obvious implications for the health sector.

One of the main reasons to explore the use of AI in the health sector is the potential for very high return on investment. In a sector with staff shortages and limited funding, tools that can achieve high levels of health improvement and/or remove some of the most burdensome tasks undertaken by human resources can make meaningful differences to what can be achieved. In order to realise this return on investment, any AI tools adopted must be evaluated to ensure they meet the needs of the sector and health system users.

Considerations for our Aotearoa New Zealand context

Te Tiriti o Waitangi requires that the Crown protect the rights and interests of Māori and to govern in partnership with tangata whenua. Adoption of AI in the health sector must give effect to te Tiriti, by, among other things, partnering with Māori in its implementation and recognising that Māori data are taonga. This view is reinforced by supranational organisations, namely the United Nations in its Declaration on the Rights of Indigenous People. The health sector has acknowledged the Hauora report finding that health disparities experienced by Māori are violations of Te Tiriti.

As a new technology, AI has the potential to provoke scepticism and fear. If clinicians and the public are distrustful of AI, it is unlikely to maintain social license and we risk not being able to realise the benefits of its use in the health sector. International data suggests that New Zealanders tend to be less positive about AI than others globally. However, local research suggests that when using our data to build AI healthcare tools, we tend to be positive about the opportunity to 'give back', as long as there are sufficient assurances around data security. We are not aware of any studies of New Zealand clinicians' trust in AI, but international evidence suggests that an effective communications strategy clearly articulating the evidence-based benefits clinicians can expect through the use of AI technology is likely to be useful. More broadly, it is likely that the AI literacy of the public, clinicians, and those tasked with making decisions about AI adoption, will need to be improved. Along with including AI in medical education, improving the wider public understanding of AI may also be helpful in increasing trust.

An important consideration in adopting new technologies is health inequities: differences in health that are avoidable and unjust. In its Pae Ora strategies, Manatū Hauora has laid out its vision for an equitable health system, with specific strategies for priority groups[i] who are underserved by the

[i] The priority groups identified by Manatū Hauora are by no means the only communities who experience inequity in accessing healthcare, nor are they the only groups for whom AI can improve health access. The possibilities for AI to improve equity in health access by making decisions free of human bias, identifying patterns of unequal treatment, and providing new modes of care delivery can benefit all these groups.

status quo: Māori, Pacific people, people with disabilities, rural people, and women. Manatū Hauora has developed distinct health strategies for each of these groups, but for our purposes thinking about the ways in which AI could address or exacerbate inequalities, these categories often intersect and compound disadvantage, and any AI tools aiming to reduce inequity would ideally address intersectional disadvantage.

Although AI is unlikely to address the structural causes of health inequities, there is great potential for it to impact on some of the proximate causes. To the degree that AI is more accurate in diagnosis and treatment, groups who systematically experience worse accuracy in current practice are likely to benefit. AI could also lead to fairer allocation of resources, and remove some barriers to accessing healthcare that lead to health inequities. We do know that AI technologies are prone to reflect, and may amplify, human bias and discrimination, but with appropriate mitigation like monitoring for signs of bias, we can ensure that adoption of AI monitors bias and improves health equity.

Where to from here?

The development, deployment, and adoption of AI within the healthcare sector requires robust dialogue at a systems level to create an enabling ecosystem. Indeed, the impact of AI will depend on more than just the technical capability of the tools. The wider AI ecosystem, spanning regulatory settings, the talent pipeline, commercial incentives, data repositories and governance bodies are all crucial aspects that will impact on the health sector's ability to benefit from emerging technology. Ensuring strong relationships between actors in the public sector, privacy sector, relevant agencies, research institutions, health system, and consumer groups will provide useful support to inform the evolving AI and healthcare landscape.

Recommendations

This report makes 22 recommendations that are grouped within eight major themes. These themes are summarised here, while our specific recommendations highlight where some of the work could be carried out and provide suggestions on levers that might support this work.

Mapping the landscape in Aotearoa New Zealand

Many aspects of the healthcare landscape will evolve with the ongoing deployment of AI in healthcare delivery in New Zealand. Examples include back-office efficiency, image analysis, research, and technology development. It is important to maintain an awareness of the needs and opportunities within our national context.

Maintaining the human element of care

While there are clear opportunities for improvements in efficiency and data processing, the extent to which AI systems might augment our current healthcare service delivery is unclear. Establishing an understanding of the crucial human elements of healthcare delivery will support decision-makers to deploy AI technologies in the appropriate supporting areas.

Enabling adoption

Adopting AI systems into our healthcare system will not happen on its own, but needs the appropriate policy settings, educational provision, and funding to enable effective adoption of AI technology that will support improved health outcomes for New Zealand.

Establishing confidence and trust

Establishing a sense of confidence and trust in AI technology is important. Effective engagement with the public, various tiers of the healthcare workforce, and those in research and development fields will help to build confidence. Clear understanding of AI limitations and associated risks, coupled with the appropriate frameworks for assessment and governance will support establishment and maintenance of confidence and trust across the healthcare sector.

Tackling inequity

The adoption of AI in healthcare should not just replicate our current health outcomes. We can ensure that AI technology facilitates better outcomes for everyone in New Zealand. This necessitates developing an understanding of where our greatest health needs are and ensuring that we deploy the technologies most suitable for closing equity gaps.

Te ao Māori

Unique to the Aotearoa New Zealand context is Te Tiriti o Waitangi. Relevant iwi, hapū, whānau and Māori organisations should be included in decision-making processes as partners alongside the Crown. Partnership should be evident throughout all stages of project life-cycles spanning conception, planning, governance, design, and implementation.

Data and systems

We cannot talk about AI without also talking about data and inference. Implementation of AI technologies within our healthcare system requires inference from large data sets. This raises issues about data collection, data privacy, data sovereignty and cyber security, and about the safety, reliability, and effectiveness of the inference this data enables.

Exploring future opportunities

AI introduces various opportunities to improve outcomes in our healthcare system. Our investment choices can create the right environments to foster research and innovation that enable us to take advantage of new and exciting opportunities.

PRINCIPLES

The frameworks and challenges of ethics around AI in healthcare presented in this report are important background, but do not provide clear guidance for policy makers on their own. Our panellists, Professor James Maclaurin and Dr Karaitiana Taiuru, articulated principles for using predictive and generative AI in Aotearoa New Zealand. Given the rate of progress in the development of AI, principles should be revisited annually or as often as seen fit by relevant authorities. The principles may be useful for developers, medical professionals, patients, users, and regulators. We acknowledge that some principles create tensions. These are helpful to frame policy choices.

A. Implementing Te Tiriti o Waitangi and recognising tikanga Māori

Globally, collective rights for Indigenous populations are recognised and affirmed by the United Nations Declaration of the Rights of Indigenous Peoples (UNDRIP). New Zealand gave its support to the declaration in 2010, acknowledging Māori as tangata whenua and affirming a commitment to the common objectives of the declaration and Te Tiriti o Waitangi. Te Tiriti and its principles require consideration on an ongoing basis as the breadth of applications for AI in healthcare delivery continues to evolve.

Principle 1

Mana whakahaere: effective and appropriate stewardship or kaitiakitanga over AI health systems recognises Māori data are a taonga and subject to Māori data sovereignty principles determined by Te Tiriti. This includes individual and collective rights with whānau, hapū, iwi, and Māori organisations.

Principle 2

All AI systems will embed Māori leadership, decision-making, and governance at all levels of the systems life-cycle spanning inception, design, release and monitoring.

Principle 3

Mana motuhake: Enabling the right for Māori to be Māori (Māori self-determination); to exercise authority over their lives, and to live on Māori terms and according to Māori philosophies, values and practices which are framed by te ao Māori (the Māori world), enacted through tikanga Māori (Māori philosophy & customary practices) and encapsulated within mātauranga Māori (Māori knowledge).

Principle 4

Mana tangata: AI systems will support equity in health and disability outcomes for Māori (individuals and collectively) across their life course and contribute to Māori wellness.

B. Safe and effective AI

AI must be safe, not exposing patients to increased levels of risk. It must be effective in achieving the goals set out in the *Pae Ora|Healthy Futures Strategies 2023* to achieve health equity and improve health outcomes for all. This will require: the development of frameworks for assessment of AI in various healthcare contexts; better understanding of the limitations and risks of AI systems; and the development of rules and governance frameworks across the health system.

Principle 5

Health delivery entities must have policies regulating the use of AI.[i] Such policies should specify an assessment process for AI tools to go through before use and an ongoing evaluation process for accuracy, efficacy and safety, addressing issues such as ease of use, bias, security, and data sovereignty.

Principle 6

Assessments of AI for use in healthcare should be made with an opportunities lens, making comparisons between the performance and reduction of mental and physical harm of AI and alternatives available within the Aotearoa New Zealand health system.

C. AI for equity

If we are to make good on Pae Ora, our deployment of AI must focus on enhancing equity in access and in outcomes. There must be ongoing audits and evaluation of potential biases and prioritisation of use cases that enhance equity. While inappropriate use can lead to inequity, early evidence suggests that AI is capable of enhancing equity by lowering barriers to knowledge, monitoring human bias, enhancing access to healthcare, and increasing the productivity of healthcare professionals. If such productivity gains prove viable, it is essential that they be harnessed to increase the equity of healthcare provision.

Principle 7

AI tools should be designed and implemented to address health inequities, by prioritising the health needs of disadvantaged groups including those identified as priority groups by Manatū Hauora and other groups as appropriate.

Principle 8

All use of AI should be subject to ongoing audit and evaluation for bias.

[i] Manatū Hauora| Ministry of Health has the Health Information Governance Guidelines and other entities will need to adapt or develop their own policies

Principle 9

The permissibility of AI use should be judged relative to the actual healthcare that individuals are likely to receive, not to an ideal level of treatment and support.

D. Effective control of AI

Where AI is supervised by humans, it is essential that its supervision be effective. Increasingly, we will not always want to supervise all AI as confidence, capability, and trust builds. There will be low risk domains in which supervision is not cost effective and, as AI becomes increasingly powerful, we will be less competent at supervising it.

Principle 10

Where AI is supervised:

a) All AI-generated information relevant to treatment must be independently checked before it is acted on
b) Supervisors must be competent to make the decisions that we are asking AI to make, i.e., the operation of an AI must be within the scope of practice of those tasked with its supervision
c) Everyone who uses AI in a clinical setting should be trained in its use, for example, the circumstances in which a given AI tool is likely to be more and less accurate, and in relevant principles of prompt engineering

AI may be used unsupervised where:

d) The use is low-risk and its performance is subject to ongoing audit and evaluation showing that it increases accuracy, equity, or patient satisfaction or that it decreases cost without sacrificing accuracy, equity, or patient satisfaction

Or

e) The use is medium-risk and its performance is subject to ongoing audit showing that it is demonstrably more accurate and/or unbiased than the human decision-makers it is replacing

E. Evaluated and trusted AI

The use of AI in health contexts must be both trusted and trustworthy. People should understand the role that AI plays in their care. Significant effort is being put into explaining the nature and reliability of technology. But, by its nature, generative AI is less explainable. In some cases, its trustworthiness is best secured by effective and well communicated audit and evaluation rather than by communicating the mechanics of its operation and the nature of the vast amount of data, sometimes sensitive, on which it is constructed.

Principle 11

The trustworthiness of predictive AI should continue to be secured by using relevant and representative training data, maintaining transparency, and retaining human oversight (as construed by the most up to date guidance for our national context such as the *Principles for Safe, and Effective use of Data and Analytics* jointly developed by Te Mana Mātāpono Matatapu | Privacy Commissioner and Tatauranga Aotearoa | Stats NZ, and *Artificial intelligence and the Information Privacy Principles* set out by the Privacy Commissioner).

Principle 12

The trustworthiness of generative AI should be underpinned by ongoing well-communicated audit and evaluation. Such audit should address accuracy, bias, fitness for purpose, privacy, data security, and data sovereignty.

Principle 13

Aotearoa New Zealand should explore methods for mitigating bias and for securing data sovereignty, particularly Māori data sovereignty. These might include the development of generative AI in New Zealand which either stands alone or works with commercial AI based in other countries. Health data of people in New Zealand must not be collected, defined, stored, or processed in systems that are not subject to New Zealand law.

Principle 14

New Zealand should develop a strategy to widely communicate the benefits and risks of the public using generative AI as an alternative to consulting healthcare professionals.

F. Responsible AI

Effective use of AI requires clear rules about liability and responsibility.

Principle 15

The use of AI as a 'practitioner co-pilot' can be mandated in domains in which its performance is subject to ongoing audit and evaluation showing that it is more accurate and no more biased than human decision-makers.

Principle 16

Health organisations are responsible for decision-making (as per principle 5) about the purchase, provisioning, audit, evaluation, and authorisation of AI systems.

Principle 17

Practitioners supervising AI are responsible for its operation and they remain liable for decisions made using AI generated advice, and for meeting requirements of the *Health Practitioners Competence Assurance Act 2003*.

RECOMMENDATIONS

Guided by our panel of experts, we have developed 22 recommendations grouped within eight themes. The themes are summarised here and are not listed in any particular order of importance. The recommendations highlight where some of the work could be carried out and specific considerations that might be of interest for decision makers and policy writers.

Mapping the landscape in Aotearoa New Zealand

Maintaining the human element of care

Enabling adoption

Establishing confidence and trust

Tackling inequity

Te ao Māori

Data and systems

Exploring future opportunities

Theme 1: Mapping the landscape in Aotearoa New Zealand

There are many aspects of the healthcare landscape that will evolve with the ongoing deployment of AI in healthcare delivery. Examples include back-office efficiency, image analysis, research, and technology development. It is important to maintain an awareness of the needs and opportunities within our national context.

R1: Assess the various needs in clinical settings that can be addressed by AI

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations:
a) Canvas national healthcare settings to ensure that the various needs (i.e., staff, individual patient, whānau, and community) are understood. This could: i) Highlight local, regional, and national needs to identify and prioritise the appropriate deployment of AI healthcare interventions ii) Be utilised to inform research and development efforts b) Ensure ongoing horizon scanning to maintain an awareness of emerging technologies in AI and healthcare and the extent to which needs in clinical settings might be addressed	c) Monitor and evaluate evolving healthcare needs across settings. This could: i) Support the identification of areas for future deployment ii) Enable New Zealand to lead developments in areas of particular priority to our national healthcare needs	• R1:a could be undertaken jointly by agencies such as: ○ Manatū Hauora | The Ministry of Health ○ Te Whatu Ora | Health New Zealand ○ Te Aka Whai Ora | Māori Health Authority ○ The regulatory body established for oversight of the *Therapeutic Products Act 2023 (TPA)* [i]

[i] https://www.legislation.govt.nz/act/public/2023/0037/latest/DLM6914502.html?src=qs

R2: Understand the impact of our legislative settings on the development and deployment of AI for healthcare delivery in New Zealand

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Review current policy and legislative settings to understand their impact on research, development, and implementation of AI systems within healthcare settings in New Zealand. This should: i) Highlight enablers and barriers for the deployment of AI in healthcare settings (both public and private) ii) Identify policy/legislation for review b) Develop an understanding of various capabilities of AI technologies and develop a robust framework to support appropriate regulation. This could: i) Distinguish AI technologies according to type and output (for example, operational efficiency improvements compared to self-learning AI and diagnostic support) and establish the extent to which regulations are required for distinct applications ii) Ensure independent testing requirements for the evaluation of impact and safety	c) Assess whether the evolving AI in healthcare landscape is appropriately supported by legislative settings d) Ensuring ongoing monitoring of relevant safety signals, performance, and quality of AI-enabled technologies e) Continuous horizon scanning to maintain awareness of AI-enabling technologies (e.g., quantum computing, VR, etc) to inform regulatory settings	• R2:b could be led by Manatū Hauora with support from other relevant agencies such as Te Whatu Ora and Te Aka Whai Ora • For R2:b, where AI applications are already well understood and evaluation mechanisms well established, regulation should promote best practice(s). Where there is not yet a well-established best practice for evaluation of particular AI tools, regulation should limit adoption until such a time that evaluation best practice is well established • R2 should take into consideration principles 5, 10 and 15 • There should be ongoing monitoring of rules and regulations established to support the TPA and the implications for AI in healthcare

R3: Understand the distribution of capabilities across the public and private sectors

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Complete scan to understand current and potential public and private capabilities that will inform longer term resource and capability planning. This should highlight where specific AI healthcare expertise sits within our current NZ ecosystem	b) Monitor and evaluate research and development findings from relevant institutions and the extent to which developments have supported aspirational mid-to-long term goals c) Evaluate public and private capabilities to determine: i) Potential opportunities to collaborate across public and private settings ii) The extent to which capabilities should be enhanced to close potential gaps in healthcare needs specific to New Zealand iii) The size of the technical workforce to conduct evaluation and authorisation of new AI-enabled technologies	• R3:c (iii) The Therapeutics Products Regulator could require appropriately trained staff to effectively evaluate and regulate relevant technologies

R4: Understand the national AI research and development landscape for healthcare

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Identify current national AI and healthcare research capabilities across universities and CRIs. This could: i) Provide clarity around research and development outputs from New Zealand that have the potential to be implemented in our healthcare industry ii) Provide short-to-medium term clarity around future research needs for New Zealand and our research partners	d) Monitor and evaluate research and development outputs from relevant institutions and the extent to which developments have proven safe, effective, and equitable in clinical settings e) Evaluate research findings and establish future AI research needs f) Evaluate computing capabilities and appropriateness for future demands	• R4:a could be undertaken by various agencies/institutions including but not limited to: ○ Manatū Hauora ○ Te Whatu Ora ○ Te Aka Whai Ora ○ Hīkina Whakatutuki | Ministry of Business, Innovation & Employment (MBIE) ○ Universities

iii) Provide clarity on tertiary AI courses available across institutions iv) Support the establishment of aspirational mid-to-long term goals for healthcare delivery in New Zealand and related research and development b) Undertake regular horizon scanning to establish an understanding of future potential areas for research & development c) Understand enablers and barriers experienced by technology developers in the AI healthcare sector. This should: i) Be used to inform the ongoing development of suitable legislative settings ii) Inform discussion around support tools/services that might help to reduce complexities		○ Research institutions/organisations • Mapping of national capabilities could highlight areas where Aotearoa New Zealand might have a competitive advantage in AI healthcare. This might look like a database that is regularly updated with details of AI and healthcare related research in New Zealand and could be undertaken by an agency such as MBIE • Mapping of national capabilities should be undertaken alongside R1 to ensure we are developing expertise that is guided by our healthcare needs • R4:a,b and d should consider resourcing and leadership capabilities for research and development of AI for healthcare delivery. • R4:b should be undertaken in conjunction with R5:b

R5: Understand the international AI research and development landscape for healthcare

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Identify international AI and healthcare research capabilities across jurisdictions. This could provide short-to-medium term clarity around potential collaborative efforts and/or key partnerships to be	c) Monitor and evaluate research and development, and regulatory outputs across jurisdictions (for example, Therapeutic Goods Administration (TGA) in Australia)[i]	• R5:a could be undertaken by various agencies/institutions including but not limited to: ○ MBIE ○ Universities

[i] https://www.tga.gov.au/

established across government agencies and research institutions b) Undertake regular horizon scanning to establish an understanding of future potential areas for research & development		• R5:b should be undertaken in conjunction with R4:b

Theme 2: Maintaining the human element of care

While there are clear opportunities for improvements in efficiency and data processing, the extent to which AI systems might augment our current healthcare service delivery is unclear. Establishing an understanding of the crucial human elements of healthcare delivery will support decision makers to deploy AI technologies in the appropriate supporting areas.

R6: Ensure relevant targeted information is available for decision makers at all levels of the healthcare system

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Understand comfort levels of healthcare staff and the public about the use of AI in healthcare delivery. This work should: i) Canvas a diverse range of voices within the community ii) Inform governance bodies and decision makers of the healthcare desires and levels of comfort within their respective communities distinguished by application. For example, patients may be fine with an AI scheduling system but might prefer to know if AI has been used in image diagnosis iii) Identify the factors that contribute to comfort levels	d) Understand evolving trust levels of healthcare staff and the public around the use of AI in healthcare delivery. This work should: i) Capture any changing attitudes among the public as trust in AI technology is built ii) Identify factors that contribute to changing attitudes iii) Inform decision makers of levels of comfort within communities and likely future needs	• R6 should take into consideration principles 5,12,14,15,17 • Those in governance and decision-making roles should maintain awareness of developments in AI to ensure decisions are informed by the most relevant and up-to-date information

iv) Identify at what stage of receiving healthcare that patients desire to know that AI has been used b) Understand experiences of AI technology developers around the development and deployment of AI for healthcare in New Zealand. This work should: i) Canvas a diverse range of technology applications ii) Inform governance bodies and decision makers of developers experiences and the extent to which New Zealand is a desirable market to partner with c) Understand the ongoing interactions between clinicians and AI and healthcare delivery		

R7: Develop an understanding of crucial human elements of healthcare delivery

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Distinguish different types of AI technologies and their capabilities to assist, augment or replace the human element of patient interaction. This should: i) Inform decision-making around the deployment of AI technologies across healthcare settings ii) Inform the development of evaluation, deployment, and supervision criteria b) Identify tasks (both clinical and administrative) where deployment of AI might safely free up the time of healthcare professionals and ensure that default	d) Maintain an awareness of emerging AI applications to enhance healthcare delivery by augmenting and/or replacing humans to free up time for healthcare professionals to carry out higher priority work	• R7 should take into consideration principles 8, 10, 14, 15 and 17 • R7:a should be considered alongside feedback from R6:a

settings allow for the most efficient process in any given context. (Examples include, but are not limited to, high-volume/repetitive tasks such as scheduling appointments or sending reminders) c) Identify and distinguish AI technologies that will require supervision in clinical settings from those that will not		

Theme 3: Enabling adoption

Adopting AI into our healthcare system will not happen on its own. The appropriate policy settings, targeted information provisions, and resourcing to enable effective adoption of AI technology that will support improved health outcomes for Aotearoa New Zealand will be key to seeing effective outcomes.

R8: Establish guiding principles and practices for adoption of AI in our healthcare settings

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Establish and/or adopt guiding AI principles appropriate for Manatū Hauora, Te Whatu Ora and Te Aka Whai Ora, and consistent with strategic national objectives (example Principles are included in this report) b) Ensure that healthcare workforce are adequately informed to understand newly adopted guiding principles for AI in healthcare settings c) Identify resources required for implementation of best AI practice across the health system d) Establish and/or adopt formal evaluation processes for pre- and post-	g) Re-evaluate principles and evaluation processes h) Technologies with post implementation evaluations that demonstrate clear efficiency improvements should be adopted more broadly as standard practice i) Automation should become default practice unless there is compelling reason not to ii) Evaluation for widespread adoption and standard practice should establish the extent to which successful technologies are	• The establishment of guiding principles and practices for the adoption of AI will also be key to establishing confidence and trust in the healthcare system. As such R8 should be factored into the communications strategy outlined in R10 • R8:e could be undertaken by various agencies including but not limited to: ○ Te Whatu Ora ○ The TPA regulatory body • R8:f(iv) could be informed by evaluation outcomes from R8:d • R8:f will need to be informed by legal framework for enforceable product standards

implementation of new AI health technology. Evaluation processes should: i) Take into consideration best evaluation practice for the technology in question (if best practice has been established) ii) Take into consideration system resourcing and the extent to which AI technologies are compatible with existing resources (for example if AI tools are more efficient at screening for breast cancers, is the system adequately resourced to cope with increased detection) iii) Where best practice for evaluation has not been established, the technology should be limited in its application with sufficient mechanisms to prevent use on an experimental basis outside of authorised clinical settings iv) Evaluation results can be communicated to the public (R10) to help facilitate public trust e) Ensure regular review (annually or as needed) of principles and practices for application of AI in healthcare settings f) Establish clear frameworks for liability and responsibility of AI when deployed in the healthcare system. This should: i) Distinguish by application/output	implemented across different settings as part of standard practice i) Support policy makers to stay abreast of international best practice (Food & Drug Administration (FDA), TGA or EU)	and responsibilities to be established by the TPA regulatory body

ii) Distinguish by level of supervision iii) Distinguish by level of associated risk iv) Establish clear criteria for insurance coverage		

R9: Understand the impact of funding models (research, adoption, and deployment) and the extent to which they enable development, adoption, and deployment of AI technologies within our healthcare system

Short-term (1-2 years)	**Mid-term (2-5 years)**	**Considerations**
a) Complete a gap analysis of research and development capabilities within New Zealand. This could inform the development of funding models that require and/or reward developments for supporting positive healthcare outcomes in New Zealand (considered in conjunction with the outcomes of R3:a) b) Consider establishing a suitable funding model to facilitate the deployment of AI healthcare research	c) Measure the proportion of locally-produced AI developments that are deployed in domestic healthcare settings compared with those that are exclusively seeking international markets. This should: i) Be used to maintain an understanding of AI capabilities being developed locally ii) Inform research funding policies that incentivise or require benefit to be delivered to the New Zealand healthcare system	• R9:a could be carried out by various agencies or institutions including, but not limited to: ○ Manatū Hauora ○ Te Whatu Ora ○ Te Aka Whai Ora ○ MBIE ○ Universities • R9:a could be informed partly by R4 • R9:a should be considered in conjunction with outcomes from R3:a • R9:a-c might necessitate the establishment of a research and development leadership body for AI in healthcare • R9 could inform R20

Theme 4: Establishing confidence and trust

Establishing a sense of confidence and trust in AI technology is important. Effective engagement with the public, various tiers of the healthcare workforce and those in research and development will help to build confidence. Clear communication of AI limitations, risks and associated evaluation outcomes, coupled with the appropriate frameworks for governance, will support AI deployment and grow confidence and trust in AI-enabled technologies across the healthcare system.

R10: Develop an effective communication strategy

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Enable the delivery of relevant targeted information to stakeholders (public, healthcare workforce, research, and development workforce etc.) to build awareness of and confidence in AI technologies. This might include: i) Present and future potential for improved healthcare outcomes ii) Clear communication around benefits and limitations of AI iii) Associated risks of members of the public using AI as an alternative and/or replacement to consulting with a healthcare professional iv) Inevitability of errors (including types of errors, rate of errors, and comparison of error rates in settings where AI is not in use) v) National and international use cases b) Ensure that targeted information and training is available to AI in healthcare	d) Develop forums and operational teams to evaluate stakeholder confidence related to the use of AI in the healthcare system and consider necessary adjustments to any communications. This could be used to inform future communication strategies on a wider range of topics	• R10:a should be consistent with principles 12 and 14 • R10:c should engage with the relevant agencies to ensure activities are compliant with relevant regulations such as the TPA. Communication mechanisms could look like: ○ Public forums ○ Social media content ○ Accessible material in healthcare settings ○ Accessible material on healthcare websites • R10:d could be carried out by a relevant agency and/or independent research group

governance and decision-making bodies at all levels c) Ensure transparency around evaluation and implementation processes/frameworks to provide confidence in decision-making processes		

R11: Identify resourcing requirements to ensure that training and targeted information are developed and provided to the appropriate stakeholders

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Complete a scan of the healthcare workforce (and training pipeline) to determine relevant targeted information necessary for stakeholder groups (to compliment R10:a) b) Understand future resourcing and capability requirements and establish pathways to build relevant skill sets c) Monitor AI companies that indicate potential capability for AI technology to provide training of healthcare staff and/or health students d) Consult with training providers (including universities, accreditation bodies etc.) to develop evaluation mechanisms and criteria where adoption of AI tools for training of clinical staff and/or students would be acceptable and appropriate	f) Ensure continuing provision of training and support for the use of AI in healthcare g) Monitor evolving AI and healthcare landscapes to determine further areas for deployment of AI training capabilities	• R11:a should ensure resourcing pathways established are consistent with, and complimentary to, the Manatū Hauora Health Workforce Strategic Framework[i] and the Te Whatu Ora/Te Aka Whai Ora Health workforce plan 2023/24 • R11:d-f should be mindful of supervision requirements outlined in principle 10

[i] https://www.health.govt.nz/publication/health-workforce-strategic-framework

e) Develop an understanding of future AI training needs for health students and healthcare practitioners		

R12: Understand the wider implications of AI technology on healthcare delivery

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Carry out assessment of factors such as cultural and environmental impact b) Ensure access to technical resource for government agencies responsible for ensuring data privacy c) Determine appropriate frameworks for establishing dynamic informed consent	d) Evaluate mid-term impact on cultural and environmental factors	• R12:b might include agencies/official bodies such as: ○ Te Mana Mātāpono Matatapu | Office of the Privacy Commissioner ○ The Government Chief Privacy Officer

Theme 5: Tackling inequity

The adoption of AI in healthcare should not just replicate our current health outcomes. AI technology deployed in our healthcare settings should facilitate better outcomes for everyone in Aotearoa New Zealand. This necessitates developing an understanding of where our greatest health needs are and ensuring that we deploy technologies that help to close equity gaps.

R13: Ensure that the adoption and deployment of AI in healthcare settings improves health equity

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Include appropriate, New Zealand-specific, equity metrics in any evaluation of AI tools. These metrics might include: i) The tool's effectiveness across various population groups	e) Evaluate mid-term impact on health equity metrics	• R13: a(i) might be monitored by Te Whatu Ora and Te Aka Whai ora, and overseen by Manatū Hauora at a system-level • R13:b and c should be consistent with principle 7 • Ensure that AI tools support the provision of healthcare in a way that is no more biased

ii) The burden of disease the tool is designed to address across different population groups b) Require an equity impact and bias assessment before launching any AI tool in the public healthcare system c) Develop a framework for ongoing systematic evaluation of AI tools to understand the impact on health inequity (including annual reporting) and bias. This should: i) Be flexible to assess various types of AI ii) Inform decision-making bodies, funding bodies, research institutions and the technology development sector d) Develop frameworks and/or principles for AI development that highlight the need to address inequity and bias in healthcare delivery from the starting point of the development process		than human decision-makers (consistent with principle 15) • Quantitative metrics of inequity should be considered when establishing the appropriate communications strategy (R10). Effective communication of metrics could help to generate an informed public discussion • Ensure that evaluation outcomes from R13 are captured and communicated back to stakeholders through the appropriate channels. This should ensure ongoing transparency and work to maintain confidence and trust

Theme 6: Te ao Māori

Unique to the Aotearoa New Zealand context is Te Tiriti o Waitangi. Relevant iwi, hapū, whānau, and Māori organisations should be included in decision-making processes as partners alongside the Crown. Partnership should be evident throughout all stages of project life-cycles spanning conception, planning, governance, design, and implementation.

R14: Ensure adequate representation of Māori as Tiriti partners at various levels of the healthcare system

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Develop appropriate frameworks relevant to the deployment of AI in healthcare delivery in partnership with relevant iwi, hapū, whānau, and Māori organisations to give effect to Te Tiriti b) Develop a strategy to build Māori capacity including investment into workforce training, data access, data-sharing with appropriate Māori health providers, etc	c) Evaluate short-term healthcare outcomes against evaluation framework to determine the extent to which the principles of Te Tiriti have been upheld d) Evaluate Māori workforce capability against healthcare needs	• Oversight for this could be supported by various agencies and groups including: ○ Manatū Hauora ○ Te Whatu Ora ○ Te Aka Whai Ora ○ Relevant Māori authorities

R15: Establish the principles of Māori data sovereignty and their implications on the use of AI in healthcare settings

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Develop engagement between relevant ministries and relevant Māori authorities to ensure that the application of Māori data sovereignty principles with respect to AI in healthcare delivery is carried out appropriately b) Establish engagement forums that enable robust discussions around	e) Ensure the ongoing maintenance of Māori data sovereignty with respect to AI in healthcare delivery	• Effective partnership with Māori, whānau, hapū, iwi, and Māori organisations presents an opportunity for Aotearoa New Zealand to lead globally in addressing Indigenous AI health-related issues • R15:b should enable discussions amongst Māori leaders, and between Māori leaders and the appropriate government agencies

practical applications of the principles of Māori data sovereignty. Discussions might include: i) Empowering relevant iwi, hapū, whānau and Māori organisations to determine metrics of health, wellbeing and hauora for their own communities ii) Ensuring Māori control over Māori data and considerations of potential outcomes iii) Establishing appropriate tikanga for collecting, classifying, storing, accessing and using Māori data iv) Appropriate mechanisms of co-design as partners to Te Tiriti		

R16: Develop actions to build sufficient Māori capabilities across various workforces including data science, healthcare and governance

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Understand the current representation of Māori in the data science, healthcare, and AI development industries b) Develop a strategy to build Māori workforce capacity including investment into workforce training, data access, data-sharing with appropriate Māori health providers, etc	c) Ensure continuation of strategy to build Māori workforce capacity including investment into workforce training, data access, data-sharing with appropriate Māori health providers, etc	• R16 could be supported by various agencies and institutions including but not limited to: ○ MBIE ○ Universities ○ Relevant Māori authorities

Theme 7: Data and systems

We cannot talk about AI without also talking about data and inference. Implementation of AI technologies within our healthcare system requires inference from large data sets. This highlights issues such as data definition, data collection, data storage, data privacy, data sovereignty and security as well as the safety, reliability, and effectiveness of the inference these data enable.

R17: Ensure processes are put in place to maximise quality of national data collection

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Identify areas of inadequate health data and ensure strategic priorities are set to address data shortages that would support the deployment of AI in healthcare delivery b) Identify computing requirements to enable on-shore data storage, model hosting, and technology development c) Expand the healthcare data strategy to consider factors relevant to data collection and data use for AI. This could include: i) The potential for individuals to opt in or opt out ii) The mechanisms for consent and the impact of individual consent on people groups (e.g., whānau, communities) d) Ensure robust data collection mechanisms and understand implications of AI tools being used for populations that are underrepresented in current data sets	f) Ongoing measurement of data quality and the appropriateness for AI applications	• New Zealand has some unique data sets and ability to link national data sets through the Integrated Data Infrastructure. This presents an opportunity for New Zealand with a competitive advantage for AI in healthcare delivery.

e) Explore mechanisms for data linking across data sets outside healthcare, being mindful of data sovereignty		

R18: Establish transparent protocols for health data access for the development and implementation of AI within the healthcare system

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Establish protocols for data access and use for AI related development and implementation. This should: i) Consider principles of Māori data sovereignty (see R15) ii) Include guidelines for testing of AI tools using national data sets		• R18 could be supported by relevant agencies and bodies including but not limited to: ○ Manatū Hauora ○ Te Whatu Ora • R18 could be supported through engagement with the soon to be established TPA regulator

Theme 8: Exploring future opportunities

AI introduces various opportunities to improve outcomes in our healthcare system. Creating environments that foster research and innovation can enable us to take advantage of new and exciting opportunities.

R19: Resource AI in healthcare research needs

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Support for research should span all relevant areas such as data science and health professional training	b) Monitor and evaluate outstanding healthcare needs and the extent to which current resourcing is sufficient to achieve future aspirations for AI in healthcare delivery	• R19 should support needs outlined in R1, R4 and R5

R20: Develop a Centre of Research Excellence for AI research with a specific focus on healthcare delivery

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Determine resourcing and responsibility for Centre of Research Excellence b) Establish international research and development capabilities and develop strategic relationships c) Specific research strategy should be defined based on (1) need within the healthcare system, (2) capacity and capability within domestic research capabilities (or in existing research partnerships), (3) likely impact of research outcomes (4) likely time to deployment and (5) ease of deployment/implementation	d) Monitor success and support continuing research	• Centre of Research Excellence should be developed in partnership with the health system to ensure guardianship of health data that can be used for research and development, and to ensure research addresses relevant health system needs • R20:c could be informed by MBIE's Te Ara Paerangi | Future Pathways initiatives • R20 could be supported by agencies like Te Amorangi Mātauranga Matua| Tertiary Education Commission

R21: Understand enablers and barriers to AI development, commercialisation, and deployment

Short-term (1-2 years)	Mid-term (2-5 years)	Considerations
a) Understand from existing AI companies the factors within the research and development space that served as enablers for development, adoption, and deployment of their AI technologies b) Understand from existing AI companies the various enabling technologies that facilitate enhanced AI development	e) Continue to support deployment of novel AI technologies	• Mechanisms for connecting with AI companies might be supported by groups such as the AI Forum of New Zealand

c) Generate targeted information that provides advice to start-up companies attempting to deploy AI healthcare technology in New Zealand d) Generate advice for AI companies to navigate the legislative environment e) Generate advice for AI companies to navigate commercialisation processes		

R22: Establish a range of networks to allow stakeholders to discuss relevant issues relating to AI in health care delivery

Short-term (1-2 years)	**Mid-term (2-5 years)**	**Considerations**
a) Establish forums that: i) Span various stakeholder groups (e.g., occupation, iwi, ethnicity, locality, research, industry, government etc) ii) Highlight factors that are at the forefront of the public conversation, immediate concerns to be addressed and clear opportunities to capitalise on b) Establish annual expo (or something similar). An expo should: i) Allow those from the research and development sector to showcase current and future potential ii) Be used to inform the healthcare profession of available emerging AI technologies iii) Enhance public visibility of emerging technologies	e) Maintain and support continued development of relevant networks	• R22 could be supported by various agencies and institutions including, but not limited to: ○ MBIE ○ Manatū Hauora ○ Te Whatu Ora ○ Te Aka Whai Ora ○ Universities ○ Te Apārangi | Royal Society of New Zealand ○ Relevant Māori authorities

c) Establish support roles and/or networks for AI businesses. Support should: i) Provide advice to businesses about deployment of technology in the New Zealand healthcare environment ii) Provide mechanisms to support SMEs with regulatory costs d) Establish links with key players in the global AI ecosystem e.g., Microsoft, Amazon, etc		

Prompt: Surrealist painting of an emergency department in New Zealand with robots. Created using Stable Diffusion on huggingface.co

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