



Te Mata Ira

Guidelines for Genomic Research with Māori

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Te Mata Ira: Guidelines for Genomic Research with Māori

*Me ātahaere mā ngā ngaru,
kei tōtohu i te aroha o Tangaroa*

Introduction

Māori ethical frameworks recognise that all research in New Zealand is of interest to Māori and outline community expectations of appropriate behavior in research to deliver the best outcomes for Māori. Research contributes to the broader development objectives of society. Ethics has a specific role in guiding key behaviours, processes and methodologies used in research.

This document outlines a framework for addressing Māori ethical issues within the context of genetic or genomic research. It draws on a foundation of mātauranga (Māori knowledge) and tikanga Māori (Māori protocols and practices) and will be useful for researchers, ethics committee members and those who engage in consultation or advice about genomic research with Māori in local, regional, national or international settings.

Genomic Research

Genomic research represents a new frontier for health research, providing the platform for the introduction of personalised or precision medicine and pharmacogenomics.

While genetic research looks at the function of specific genes, genomic research looks at the functions of groups of genes and their interactions with the environment.

Technology is constantly evolving and next generation 'omics' research including proteomics, metabolomics, transcriptomics, and epigenetics is becoming part of the health research environment. While this guidelines focus on genomic research they will be relevant to these new types of biomedical research.

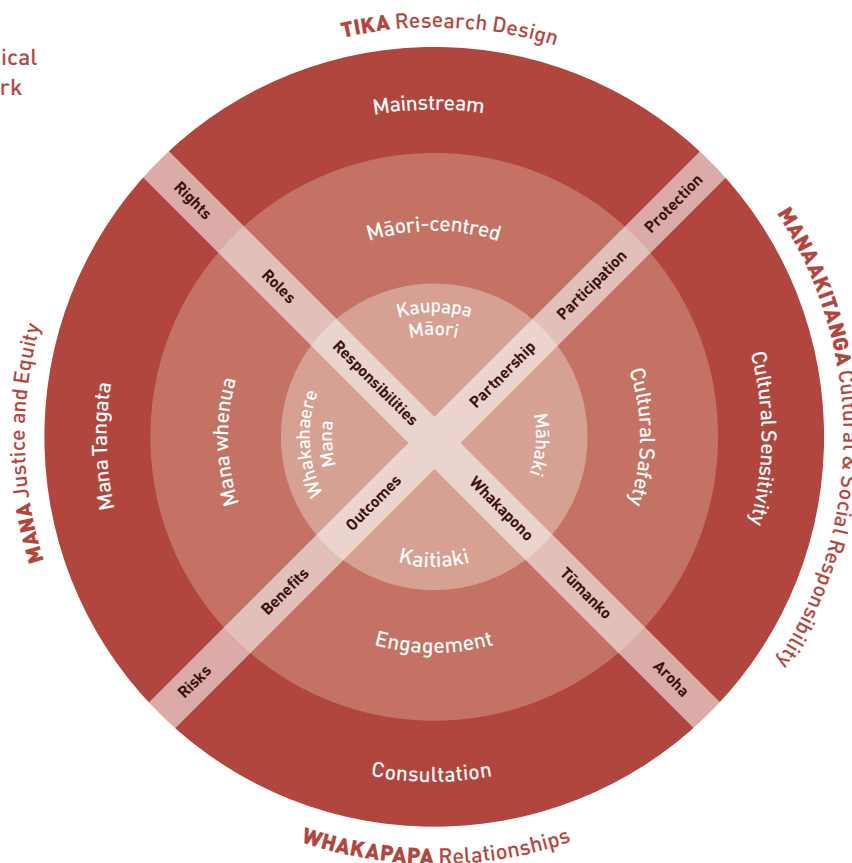
Te Ara Tika

Te Ara Tika Guidelines for Māori Research Ethics: A framework for Researchers and Ethics Committee Members (Hudson et al, 2010) brought together various strands connecting tikanga Māori, the principles of the Treaty of Waitangi, Māori research ethics, and the health research context in a way that could be understood and applied in a practical manner by researchers and ethics committees (Hudson et al., 2016).

The purpose of the Te Ara Tika guidelines was to explain key ethical concepts for Māori; to support decision-making around Māori ethical issues; to identify ways to address Māori ethical concerns; and to clarify the roles of Māori ethics committee members.

The Māori ethics framework within Te Ara Tika references four tikanga based principles whakapapa (relationships), tika (research design), manaakitanga (cultural and social responsibility), and mana (justice and equity) as the primary ethical principles in relation to research ethics. Te Ara Tika provides the framework for researchers to engage with Māori communities and issues that are important to them.

Figure 1:
Māori Ethical
Framework



Te Ara Tika also identified a range of areas that required special ethical consideration including the collection and use of human tissue, genetic research, ongoing storage in tissue banks, the establishment of cell lines, tissue being sent overseas, and future unspecified use.

Te Mata Ira

Given the increasing prevalence of genomic research, creation of research biobanks, and the international nature of research collaborations, it was timely that the Health Research Council funded the Te Mata Ira research project to explore Māori views on genomic research and biobanking.

General Māori objections to genetic research¹ are tempered in the context of health research when there is direct benefit to Māori whānau². While not all whānau or Iwi will agree to participate in genomic research there are an increasing number that are choosing to engage with genomic researchers. One of the aims of the Te Mata Ira project was to identify ways to protect the interests of Māori participants and groups that choose to participate in genetic or genomic research.

Te Mata Ira translates to ‘the different faces of a gene’ and acknowledges that Iwi or Māori groups would have different ways of understanding or relating to genetic and genomic research. The project sought input from Māori across a diverse range of settings including whānau, hapū, Iwi, Māori health workers, Māori researchers, social scientists, biomedical scientists, and Indigenous researchers³. It also engaged with non-Māori scientists, researchers and biobank managers and administrators to both gauge what they understood about Māori concerns and assist with identifying potential solutions.

The project identified key themes relevant to genomic research for Māori, and for Iwi⁴.

Māori	Iwi
Protection of Māori rights and interests	Tissue removed for a range of reasons (clinical and research)
Focus on Māori health priorities	Whānau make decisions, hapū and Iwi support interests
Robustness of genomic research methods	Experience loss of control (over time)
Control over samples and data	Accountability of research organisations
Expectations of consultation	Iwi governance over projects is expected
Expectations of consent	Communication about progress and results is essential
Ongoing feedback and communication	Outcomes for participants, Iwi and communities
	Education is important

Table 1: Key Themes Relevant To Genomic Research

1 Cram (2005), Hook (2009), Rochford (2011).

2 Durie (2008), Du Plessis et al. (2004), Roberts & Fairweather (2005), Tipene-Matua (2006), Tipene-Matua & Wakefield (2007), Tupara (2012).

3 The information collected through the Te Mata Ira research project informs the content of these guidelines.

4 Iwi that provided input to the Te Mata Ira project included Ngāti Hine, Ngāti Porou, Ngāti Rakaipaaka, Southern Runaka o Ngāi Tahu, and Ngāti Whatua ki Ōrakei.

Purpose

The purpose of the Te Mata Ira Guidelines for Genomic Research with Māori is to describe the cultural foundation informing ethical approaches to genomics; to inform decision-making around ethical issues when conducting genomic research with Māori; and outline best practice approaches for addressing Māori ethical concerns.

The Te Mata Ira Guidelines on Genomic Research with Māori are designed to be read in conjunction with Te Ara Tika Guidelines for Māori Research Ethics. Te Ara Tika provides generic advice for all health research and the Te Mata Ira guidelines provides more specific guidance for the context of genomic research (and other 'omics' related biomedical research).

Background to the Guidelines and the Framework

The Te Mata Ira Framework is designed to build on the guidance provided by Te Ara Tika because the Māori ethical issues identified in that document are relevant to all research, including genomic research. The Te Mata Ira framework aligns with the key principles of Te Ara Tika and considers their application to genomic research from consultation to research and post-project transformation. These stages within the research process provide distinct opportunities to engage Māori communities in specific discussions about the research project and the results.

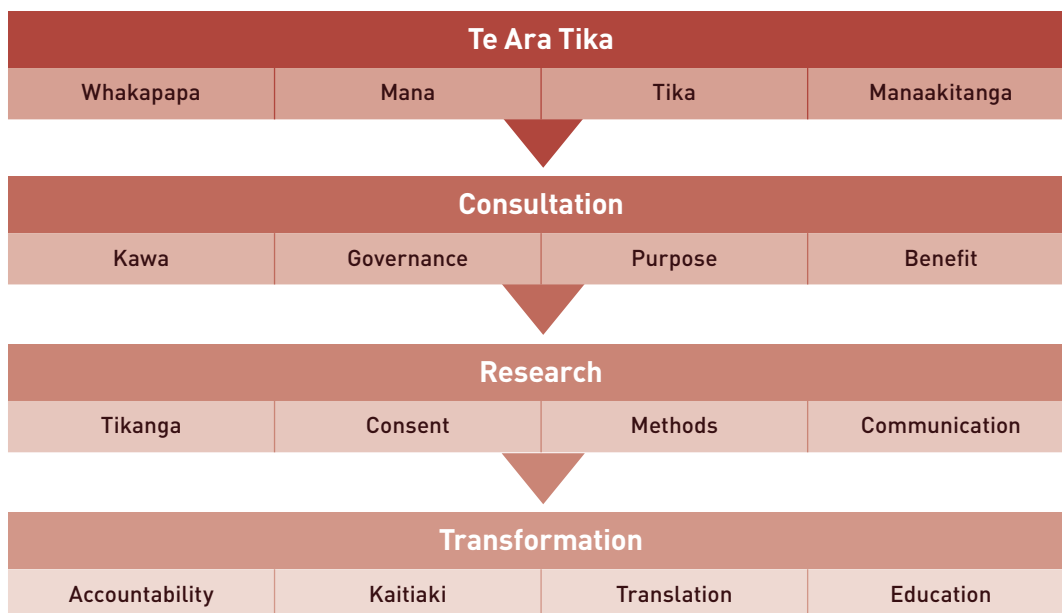


Figure 2: Te Mata Ira Framework for Genomic Research with Māori

Within Te Ara Tika, whakapapa (genealogy) refers to the nature of relationships between the researchers, communities and participants. Kawa (principles) and Tikanga (protocols) provide a framework for cultural engagement and contribute to the levels of accountability. The recognition of Mana (power, control) supports the realisation of justice and equity. The mana of participants and their communities can be enhanced through the use of community governance and consent mechanisms, and involvement of kaitiaki (guardians). Tika (right, correct) is associated with the research design and this can be considered in relation to the purpose, methodology and translational components of a research project. Manaakitanga (to look after, care for) represents the cultural and social responsibility where the benefits, communication and education are key pathways to realising community outcomes.

Cultural Foundation

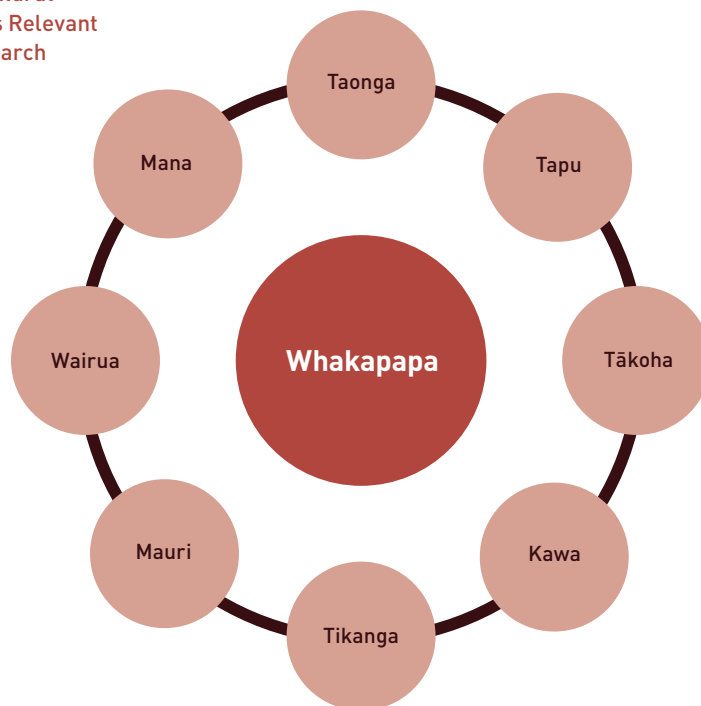
Cultural worldviews are embedded with a logic that prioritises specific values and shape appropriate ethical behaviour. Māori ground their thinking about genomic research and biobanking in a Māori worldview through a range of culturally significant reference points reinforced through kawa and tikanga.

Ethics is about values, and ethical behaviour reflects values held by people at large. For Māori, ethics is about 'tikanga' – for tikanga reflects our values, our beliefs and the way we view the world.

Māori recognise that genomic research is an on-going endeavor and that a range of decisions need to be made throughout the period of the project. Māori reiterated the importance of identifying and acknowledging cultural values and concepts, and engaging with the community in the development of appropriate ethical boundaries for genomic projects.

The cultural foundation outlines key cultural concepts that inform Māori understandings of genetics and how they apply to the context of genomic research. The descriptions will also support initiatives to improve genetic literacy within Māori communities.

Figure 3: Key Cultural Values/Concepts Relevant to Genomic Research



A whakataukī was created by two kaumātua⁵ that participated in the Te Mata Ira project. The whakataukī uses the metaphor of a wave to represent the challenge for Iwi and researchers when engaging with genomic research with Māori communities. Whether you are riding on the wave or facing an on-coming wave you should tread carefully to safely negotiate the event.

*Me ātahaere mā ngā ngaru, kei tōtohu
i te aroha o Tangaroa
Tread carefully in challenging waters*

Protecting Whakapapa

Whakapapa is a key reference point for Māori when talking about health and genetics. Whakapapa was described as the connection between people and creates a responsibility for both future and past generations. Whakapapa is often used as a framework to describe a range of connections including genealogy, social and ecological relationships, cultural histories, family traits, and ancestral inheritances. At a physical and spiritual level, whakapapa is embodied within the DNA of a person and therefore the storage and use of human tissue for genetic/genomic research becomes a culturally significant activity. When individuals consent to participate in genomic research, the biological material and personal information they contribute is a key part of the research endeavor, which Māori consider to be culturally significant. As such, a core responsibility for whānau, hapū and Iwi is to ensure that whakapapa is protected, in part, by managing the access and use of information relevant to whakapapa. The protection of whakapapa is a key consideration for Māori especially when engaging in genomic research

Whakapapa is used to explain both the genesis and purpose of any particular kaupapa (topic/purpose). Whakapapa is an analytical tool for not only understanding why relationships have been formed but also monitoring how the relationships progress and develop over time (mai i te whai ao ki te ao mārama). Within the context of decision-making about ethics, whakapapa refers to quality of relationships and the structures or processes that have been established to support these relationships. In research, the development and maintenance of meaningful relationships between researcher and research participant forms another axis of consideration for evaluating the ethical tenor of a research project and its associated activity.

5 Huata Holmes, Kai Tahu and Moe Milne, Ngati Hine.



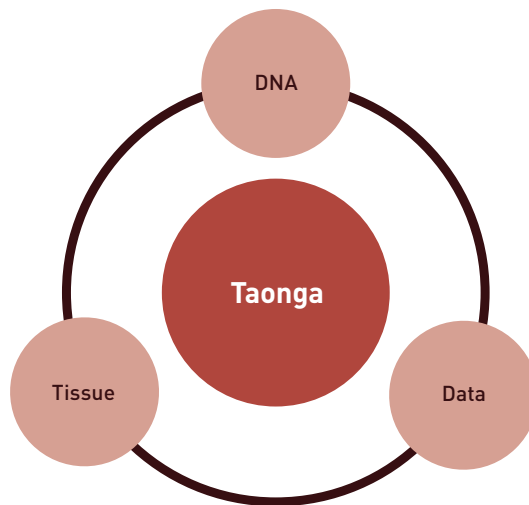
Figure 4: Aspects of Whakapapa

He Taonga, He Tapu

The concept of taonga refers to something precious or significant. The term taonga can be applied to valued objects, significant resources, or important entities. Taonga should be looked after in an appropriate manner to preserve their integrity and value as well as respect the tapu that has been imbued into them. Tapu refers to the sacred or special nature of an object and implies that the object must be actively protected or managed.

Human tissue is considered a taonga and DNA from any genetic origin that connects to whakapapa is also considered a taonga. Iwi recognise the value of DNA for its cultural and spiritual significance as well as its usefulness as a resource for research. Genomic data, as a representation of peoples' biological material, is also considered a taonga and a highly valuable strategic asset for Māori.

Figure 5: Components of Human Tissue that are Considered Taonga



Tākoha

Koha is often conceptualised as a gift. Tākoha is a form of gifting that recognises the tapu associated with a gift and indicates that conditions are to be applied to the taonga being gifted. Tissue consented for use in genomic research is considered a gift or donation however when applying the concept of tākoha the gift refers to the ‘responsibility’ to look after the tissue.

Kawa for Genomic Research

Kawa and tikanga provide the primary interface for accessing repositories of cultural knowledge and experience that can be used to inform ethical deliberations. Kawa refers to the core values and ethical principles that underpin a Māori worldview. The creation of kawa to inform genomic research provides researchers with a set of statements to inform the decisions they make once they have been gifted the responsibility to look after Māori tissue and DNA. The kawa have a dual function in that they represent both ethical principles that can inform decision-making as well as desired outcomes for the participants and communities.

I. Kia tau te wairua o te tangata

Wairua is a core philosophical concept that pervades all aspects of Māori society and is a central element of cultural protocols. It refers to the spiritual dimension and within Māori models of health it is a key component of a person’s wellbeing [Durie 2005, Ahuriri-Driscoll et al., 2012]. Wairua is a concept to consciously address as it could both influence relationships and outcomes of genomic research as well as be impacted by them. An injury to a person’s wairua negatively affects their wellbeing so ensuring whānau are comfortable with their involvement in genomic research is of importance here.

‘**Kia tau te wairua o te tangata**’ refers to the ‘**level of comfort**’ that participants and communities have in the research project.

The level of comfort changes over time so a variety of different actions contribute to achieving this outcome. These actions might include engagement with Iwi, use of cultural protocols during consenting process, encouraging whānau support, communicating research results, transparent governance, and accessible researchers.

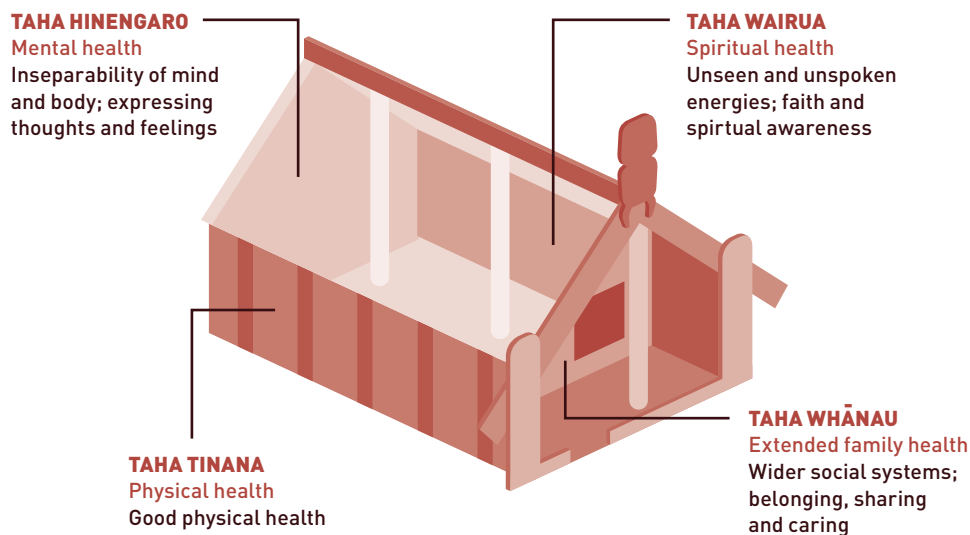


Figure 6: Te Whare Tapa Wha – Māori Model of Health and Wellbeing

Examples

He Kamaka Waiora at the Waitemata and Auckland DHB's provides cultural support to patients and staff across the hospital services through kaumatua and kaimanaaki roles. An example was given where the Chief Advisor Tikanga was asked to support a Māori patient that had received a new lung in a transplant procedure. The patient was not doing well post-operatively and the Chief Advisor Tikanga asked whether the whānau had conducted any ceremonies to farewell the old heart and welcome the new one into the patients body. The whānau agreed that this would be appropriate and once completed the patient made a speedy recovery.

Dr Melanie Cheung led work at the Neurological Foundation Human Brain Bank to look at how core Māori values can guide the process of working with human tissue. One of the cutting edge methods used on tissues samples in the laboratory involves growing cells from post-mortem and post-operative brain tissue. The development of appropriate tikanga for the laboratory supports culturally safe practice for both researchers and whānau. The process of seeking guidance of kaumātua, kuia, whānau, hapū, and iwi resulted in the use of specific karakia, waiata, kai and wai to whakanoa samples as they enter the laboratory environment.⁶

⁶ Cheung, M. J. (2011). Cellular and Cultural Studies of Human Neurodegenerative diseases. (PhD Thesis, University of Auckland).

II. Kia pumau te mana o te tangata

Mana commonly refers to power, control or prestige. Different types of mana (mana atua, mana whenua, mana tangata) describe different levels of control and responsibility for decision-making. There are recognised rights for Māori collectives (whānau, hapū or Iwi) to engage with researchers in consultation around the appropriateness of a genomic research study for their community. Whānau have rights to choose whether they engage in genomic research and/or provide samples for genomic research and expect that hapū/Iwi will support them as required in the context of that relationship. Iwi assistance may also be necessary to ensure whānau can access research information, access services, or provide cultural support as whānau make difficult decisions. To address the power imbalance inherent in the participant-researcher relationship, community members see hapū and Iwi entities using their mana whenua status to support and protect their interests.

‘Kia pumau te mana o te tangata’ refers to the ‘level of control’ that participants and communities have in relation to the research project.

The level of control that communities and participants have in the context of their relationship with the research team changes over the course of a project. Their level of influence tends to be greater during the consultation (in the case of communities) and consent (in the case of participants) phases of the project, and reduces over time. Efforts should be made to engage and empower participants and communities of interest through out the life of the project to achieve this outcome.

Examples

The University of Otago and a North Island Māori stomach cancer kindred (represented by the Kimihauora Research Unit and a Trust) entered into two agreements, a patent joint venture agreement and a research agreement. The research agreement specified that the research was a joint venture, outlined the roles of the two parties in the research and noted that all biological samples and information related to the whakapapa remained the property of the whānau. It further specified that the University researchers must provide quarterly progress reports to Kimihauora. The patent agreement specified that a management committee be established to oversee any commercialisation process. The committee would comprise two whānau representatives and two University representatives. Patent rights would be held equally between the two parties. The University agreed to meet patenting costs alone, on the condition that they would be recovered should there be any future revenue flow.

Dr Merriman, Department of Biochemistry, University of Otago (UoO) presented a paper in July 2012 to the Ngati Porou Hauora Charitable Trust (NPHCT) Board regarding a proposed variation to data analysis plans for the 'Genetics of Gout in Tairāwhiti' project (begun 2007) and which would also be applicable to the 'Genetics of Gout and Co-morbidities: genes and environment' project (begun 2013). Approval was sought such "that the whole genome provided by the NPH gout research participants to date is determined and stored as computer-data (rather than DNA in solution) in the secure IT systems of the Biochemistry Department at the University of Otago". The Board responded with one condition being that 'An agreement is signed between the Ngati Porou Hauora Charitable Trust and the University of Otago that provides a framework for the use, storage, and protection, of whole genome sequence data from participants in the two gout genetics projects'.

III. Kia hiki te mauri o te kaupapa

Mauri is a core concept underpinning the Māori worldview. It can be described as the 'life essence' and is applied to both animate and inanimate objects. Maintaining the mauri can be thought of as maintaining the genetic or biological integrity of an organism or system. Ensuring that mauri is maintained or enhanced improves the level of public trust and accountability between genomic researchers and Māori communities.

'**Kia hiki te mauri o te kaupapa**' refers to the '**level of integrity**' present within the systems that contribute to the research endeavour.

The level of integrity in the systems that support research and the transformation of services (research organisations, ethics committees, funding bodies, health system) is integral to the level of support and trust that Māori communities have in research. Researchers have a responsibility to build an understanding of genomics and develop trust with Māori communities through their activities and actions. Greater levels of transparency and communication about their research projects will contribute to the realisation of this outcome.

Examples

Recent changes in the process of ethical review for Health and Disability research led the Māori Research Review Committees to develop a framework for Māori review of research in DHB's. Standardisation has several potential advantages including increased efficiency of time, energy and resource, as well as improved national consistency while still allowing for consideration of local context and collaboration with manawhenua. The framework makes an important contribution to ensuring the rights of Māori are upheld in the research setting (Simmonds, 2015).

The NETwork! project is a collaborative research group working with communities, clinicians and researchers to advance understanding and treatments for Neuro-Endocrine Tumours. It has developed a dedicated website⁷ which it uses to better communicate with research partners around New Zealand, and keep them up to date with the overall progress of the project. As part of the development of this website, the decision was made to provide a Māori translation in order to make the information about the NETwork! project more accessible. We hope that this will facilitate informed participation by Māori patients and their whānau. Māori participation is essential to the getting a clearer picture of Neuroendocrine Cancer in NZ, and facilitating the development of a suitable multidisciplinary framework that will ensure benefits from the study flow on to all New Zealanders. The Te Reo translations were provided by Dr David Jansen, who helped with the intricate task of translating some of the technical explanations of our project. David is Ngāti Raukawa and a qualified medical practitioner. His main focus is on running clinical teaching and Te Reo programmes throughout New Zealand and in 2006 he produced a phrase book of Māori medical terms.

Tikanga for Genomic Research

Tikanga refers to the specific protocols or processes that people follow to ensure that their values and principles are maintained. Tikanga provides a framework through which Māori can actively engage with ethical issues and consider the effect research may have on their values or relationships.

Na te tapu i puta mai te tikanga⁸

As a taonga, the protocols for dealing with human tissue, DNA and data in research should address both physical and spiritual components within the research process. Tikanga will ensure that the kawa (principles) outlined above are operationalised and the relationships between the researchers and the participants and communities are enhanced. There are three key stages within the research process where different tikanga could be applied to address cultural and ethical expectations.

7 www.network.ac.nz.

8 Quote from cultural wananga held during Te Mata Ira project.

Figure 7: Key Stages where Tikanga can be Applied



I. Te Tuku i te Taonga (sharing of the gift)

Te Tuku i te Taonga refers to the point in time when a participant consents to their tissue/DNA/data being used as part of a research project. At a fundamental level the consent process establishes a relationship between the researchers and the participant. The process creates expectations of reciprocity, determines the parameters of the consent and also establishes levels of comfort and safety across both physical and spiritual dimensions.

Consent in the spiritual dimension relates to the process of wātea or whakawātea. In the research context it might involve the use of karakia by cultural experts (tohunga) to clear the way by removing anxieties that participants or communities might have about involvement in genomic research. This could happen at a project level (similar to the use of karakia to open a new building) or at the participant level (similar to the use of karakia by a hospital chaplain for a person before a significant operation). Addressing the spiritual dimensions of consent can also be supported by access to whānau support, as well as the use of Māori language and protocols during the recruitment and consent process.

Consent in the physical dimension builds on existing practices involving the use of patient information sheets and consent forms. It is important that these documents address the full range of important issues (e.g. use of tissue, use of data, conditions of consent, benefit-sharing, governance and future use arrangements).

Example

Te Roopu Kaitiaki was established to support the participation of Māori within the LiLACS research project. The members of Te Roopu Kaitiaki were selected from tribes across Aotearoa with the brief of ensuring that Māori people and their language and culture would be acknowledged and valued throughout this research⁹. Te Roopu Kaitiaki supported the translation of information sheets, questionnaires, and consent forms into Māori and these were available for the LiLACS participants. The process although challenging was enriching for the research team as Kēpa¹⁰ observes;

Translation by Te Roopu Kaitiaki o Nga Tikanga requires Māori language that is used by the oldest old Māori rather than fluent Māori language that combines English grammatical and phonological structures and Māori vocabulary. By creating a translation process that has never been used before and by being courageous enough to do so knowing full well that such a process may be disliked and rejected at any time, critical issues, distinctive interactions and innovations can be identified for study design and methodology in health and ageing research (p. 280).

II. Te Hau o te Taonga (the spirit of the gift)

Te Hau o te Taonga is a concept that refers to the expectations associated with the use of the tissue/DNA/data. Te Hau o te Taonga arises in the context of gifting land where the land is given for a specific purpose and the expectation that it will be returned if no longer required for the intended purpose. In the context of genomic research it supports the notion of tākohā and the responsibility to make decisions about the use of the taonga in a way which adheres to the parameters of consent, and respects the spirit in which the gift was given. Most decisions about the use of tissue/DNA/data occur after the point of consent so it is important to give consideration to the ways in which the kawa for genomic research will be operationalised (Henare, 2015).

The spiritual dimension of Te Hau o te Taonga relates most directly to principle 'Kia tau te wairua o te tangata', the level of comfort that participants and communities have in the project. Identification of a kaitiaki (guardian) to support decision-making is one way to ensure the spirit of the gift is maintained as new possibilities emerge during the research project. Providing participants and

9 Dyall, L., Skipper, T. K., Kēpa, M., Hayman, K., & Kerse, N. (2013). Navigation: Process of building relationships with kaumātua (Māori leaders). *The New Zealand Medical Journal*, 126(1368), 65.

10 Kēpa, M., Kēpa, C. A., McPherson, B., Kameta, H., Kameta, F., Port, W., . . . Reynold, L. (2014). E kore e ngāro ngā kākano i ruia mai i Rangiātea: The language and culture from Rangiātea will never be lost in health and ageing research. *AlterNative*, 10(3), 276–287.

stakeholder communities with updates is a way to ensure they are informed about the progress of the project. This addresses the issue where participants feel that they lose control over time.

The physical dimension of Te Hau o te Taonga relates most directly to the principle 'Kia pumau te mana o te tangata', the level of control that participants and their communities have in the project. At a participant level it relates to the level of information and ability to withdraw consent. At a community level it relates to roles in the governance of the project and the ability to track and audit the use of tissue/ DNA/data.

Examples

An Aboriginal Governance Committee for a research project looking at genetic contributions to rheumatic heart disease in Aboriginal communities established a Living Protocol to ensure that the cultural and spiritual significance of tissue was being recognised as the samples, DNA and data was shared between the research partners. The Living Protocol outlines 'good manners' in relation to the use of samples, DNA and data and provides statements that can be included in material transfer agreements and data use agreements.

Tissue is considered by Aboriginal and Torres Strait Islanders to be sacred as it is a physical manifestation connecting collective stories of origin, identity and authority with aspirations for the future. A person's uniqueness arises from their connection to country and kin. The rights and obligations created with community through the gift of tissue extends to every recipient [user] of that tissue.

The Neuro-Endocrine Tumour NETwork! project is establishing a collaboration of cancer clinicians and scientists to develop a national framework for managing neuroendocrine cancer that couples clinical practice with a translational research model to improve outcomes for patients with NET cancer. As a key aspect of the project is to collect NET cancer specimens from historic samples and from patients who are newly diagnosed with NET cancer. As the samples could be used for a number of different studies NETwork! has established a Governance Group and an Incidental Findings Committee to provide oversight in relation to the studies that get conducted and how information arising from them is used. Māori are represented on all of these committees including the research team.

III. Te Whakahoki i te Taonga (return of the gift)

Te Whakahoki i te Taonga refers to the point in time when the genomic research project is complete and the responsibility for looking after the gift is returned to the community. This process is an expression of respect for relationship and provides an opportunity to report on all uses of the tissue/DNA/data and outcomes of the project. It also allows the research team to check in with the community about their level of comfort and satisfaction with the research process and openness to continuing a research relationship.

The spiritual dimension of Te Whakahoki i te Taonga relates to the communities level of comfort with the project at its conclusion, and assesses the project against the expectations of reciprocity anticipated at the beginning (Te Tuku i te Taonga). The metaphor of a 'kawe mate', where photos/taonga of a recently deceased person are taken to marae for whānau to grieve over, is associated with the acknowledgement and return of whānau members. The concept of a 'kawe taonga' emerged to recognise that often the actual tissue/DNA would not be able to be returned to participants and communities but a representation of those taonga in the form of reports or other information could be formally provided to the relevant communities.

The physical return of reports or provision of access to raw data is an important consideration for research teams to demonstrate respect for the community and providing opportunities for them to re-consent for future use and participation or consent to 'exit' the relationship supports the principle 'kia pumau te mana o te tangata' (level of control).

Examples

A kaumatua from Ngāti Whātua spoke about the instructions given to the 28th Māori Battalion, a group of Māori soldiers that fought in World War 2. The elders realised that not all of them would return from the battles and were told that it was okay to bury the fallen on the other side of the world but that they should bring back a memento or something that belonged to the person so that the whānau could grieve for them. This is not unlike a kawe mate where a person is buried in a urupā in one region but a photo of them is taken to other regions so whānau from those places can also express their grief in a culturally appropriate manner.

The kaumatua used this story as an analogy for the taking of tissue for research and suggested that while it may not be possible to return biological material to participants it was important that something came back. This might be the results of the study and he reiterated the importance of it being done in the right way. If discussions about the project had taken place with whānau or hapū then it should be in a formal manner on the marae.

*Me hoki rangatira mai mā te upoko, ehara mā te rārā.
One should return through the front door,
not the side door.*

The Christchurch School of Medicine developed Guidelines for Disposal or Retention of Samples and Specimens for research involving Māori. The guidelines provide advice on what should be included in the information sheets and consent forms for the collection of samples including the option of disposal with karakia.

For disposal of identified Māori samples (i.e. samples taken from research participants who have requested to have 'remaining samples disposed with appropriate karakia' on the consent form) – at the end of the study the samples will be retained for the ceremony with appropriate karakia, then be disposed of immediately thereafter.

For any subsequent dissemination of Māori samples (e.g. to other labs participating in the study), those samples should also be identified with the appropriate sticker. The lab in receipt of the samples must be informed that any remaining sample material should be returned to the disseminating lab after testing is completed, or by a certain date, whichever comes first.

Te Mata Ira Framework for Genomic Research

When developing a genomic research project it is also important to prepare appropriately for engagement with whānau, hapū, Iwi, or Māori groups. Ideally, researchers should make use of different resources to familiarize themselves with Māori culture and ethics prior to engagement and that discussions should occur prior to the development of the research design. The kawa and tikanga outlined above as part of the cultural foundation provide some guidance around decision-making in the context of genomic research. This section outlines the context and key issues¹¹ that Māori have interests in discussing in relation to genomic research.

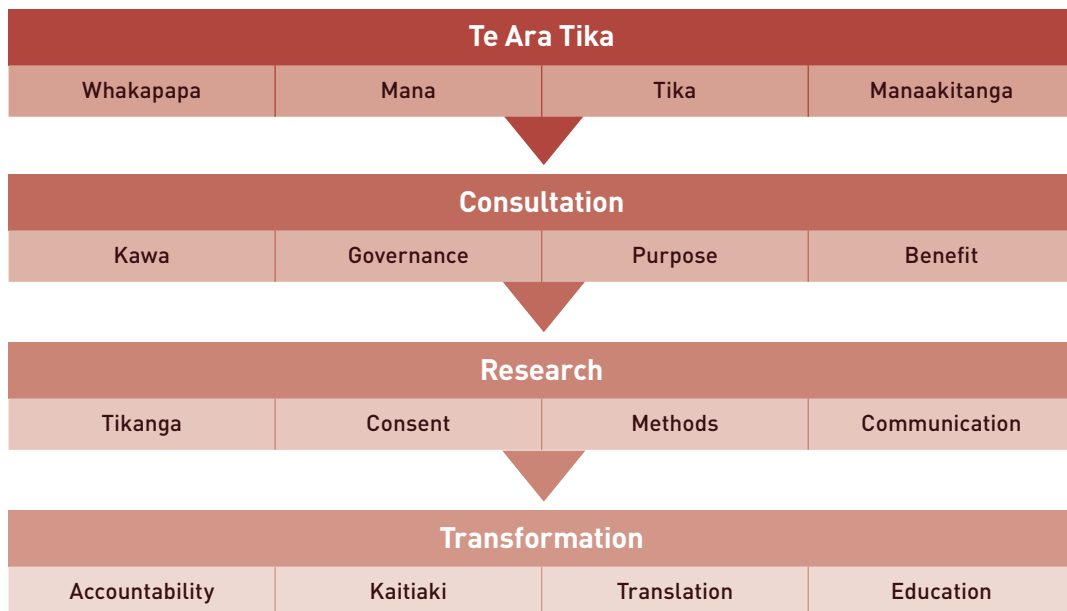


Figure 8: Te Mata Ira Framework for Genomic Research with Māori

Note: There are a range of resources that can provide context to Māori issues in research and genetics. These have been included in Appendix A.

¹¹ These issues were identified through the HRC funded Te Mata Ira research project.

Consultation Phase

Consultation^{12, 13} ensures that there has been a constructive critique of the proposed project and its potential impact on Māori, and also provides an opportunity for the community to consider the track record of the research team. Consultation assists with the development of clearly written information sheets, which specify that samples will only be used for the purpose for which they are taken¹⁴, provide a mechanism for reporting back results to appropriate parties¹⁵ and allow issues regarding the research scope and agenda^{16, 17} to be discussed. These are considered minimum requirements and should be reflected in the locality assessment and section F of the ethics application.¹⁸

The consultation phase is the only opportunity for whānau, hapū, Iwi or Māori entities to influence the direction or design of the research project. This phase tends to engage with Māori as stakeholders in the project rather than as participants and will contribute to community consent or mandate for the research project. While discussions in the consultation phase are likely to extend to research and transformation the immediate issues for deliberation relate to kawa, governance, purpose, and benefit.

Consultation			
Kawa	Governance	Purpose	Benefit

a) Kawa

Kawa can provide principles to underpin the relationship that develops between researchers and the community. The principles should underpin the use of samples/DNA/data and provide guidance around limits of use in a research environment that promotes the sharing of samples and data, including the right to say no. Identifying appropriate kawa (principles) in research with human tissue emerged as a key issue for Iwi as tissue is a taonga, there is a tapu associated with its use in genomic research. This tapu and kawa extends to the data as a representation of the tissue. While some kawa has been identified in this document

12 Ministry of Health (2006). 2.2.37, p. 9.

13 Ministry of Health (2006). Appendix 8, Partnership 381–382, p. 79.

14 Ministry of Health (2006). 2.2.33, p. 9.

15 Ministry of Health (2006). Appendix 8, Points to consider 386, p. 80.

16 Ministry of Health (2006). 2.0.23, p. 6.

17 Ministry of Health (2006). 2.7.82, p. 17.

18 Ministry of Health (2009). National Application Form for Ethical Approval of a Research Project v1, Section F, 'Cultural and social responsibility'.

it is important to understand that each whānau, hapū and/or Iwi may wish to apply their own kawa to the project.

The types of questions to expect from Māori entities relevant to kawa include:

- What type of relationship are you looking for?
- Can Iwi modify the focus of the research?
- What principles inform the research project?
- What principles are used to make decisions about the use of samples and data?
- How will Māori rights and interests in intellectual property be recognised?
- How can we ensure our tikanga is upheld?

b) Governance

While kawa helps identify the principles that inform the use of samples, DNA and data, the issue of governance refers to the people and processes that control access and use. Participation within governance processes is the primary means of protecting interests and limiting unauthorised use. Governance in the context of genomic research occurs at multiple levels and there are a range of decision-making bodies where Māori could participate, including project governance groups, community advisory boards, and institutional management committees. Māori will want to participate in any committee or decision-making process about access to DNA samples, genomic data, whakapapa information, or clinical data so they can be involved in setting conditions for access and use, and reviewing progress.

The types of questions to expect from Māori entities relevant to governance include:

- What governance arrangements are in place?
- For the project? For the biobank? (for samples consented for future use)
- How can we be involved in the governance of samples, research information and genomic data? e.g. Use for different purposes
- Who holds the research information and genomic data, for how long and who can access it?
- What rights do donors have to control use?
 - Through dynamic consent or re-consent
 - Will donors receive communication about each use?
- Who will own the research once it is completed?

c) Purpose

A key discussion with Māori stakeholders in the consultation phase of a research project relates to purpose. The purpose of the research, its intended outcomes, and the make up of the research team will all contribute to whether the project is supported. Projects contributing to Māori health priorities are likely to be favoured. It is also important to differentiate and be clear about the purpose of the initial project, potential purposes of future projects, and the purpose of any biobanking activity associated with the study.

The types of questions to expect from Māori entities relevant to purpose include:

- He aha te putake o te rangahau? What is the purpose of the research?
- Who is funding the research?
- Why is the research important for our community and for Māori generally?
- What impact will the research have?
- What outcomes are researchers aiming to achieve?
- Who is involved in the research team?
 - Are there any Iwi/Māori researchers?
 - What experience does the team have working with Māori communities?

d) Benefit

The benefits of the project should outweigh the risks to Māori and there should be direct benefits for the Māori participants and their communities. Equity and justice are ethical principles underpinning the importance of benefit-sharing. Research will also have a range of outcomes and part of the ethical deliberation is to consider the nature of the outcomes (risk versus benefit, short versus long term benefit) and their relative distribution (researchers, participants, communities, society). Researchers will legitimately benefit from being involved in research but consideration should be given to how participants and their communities might also benefit from participation. This might include capacity building and pathways for benefit sharing should commercialisation opportunities arise.

The types of questions to expect from Māori entities relevant to benefit include:

- What benefits will come from participating in the research?
- How will we benefit?
- What opportunities are there for our people to be involved or employed?

Research Phase

The research phase is more directly concerned with how Māori participants and their samples/DNA/data will be treated. The key issues for discussion in this phase include tikanga, consent, methods and communication.

Research			
Tikanga	Consent	Methods	Communication

e) Tikanga

Tikanga (cultural protocols) should inform the research practices within the project to ensure the cultural safety of participants and their communities. For example, tikanga can be applied in the context of engagement with communities, the collection and disposal of samples/DNA/data, and the future use of samples/DNA/data. Tikanga might also be applied to issues of data security and inform material transfer or data use agreements.

The types of questions to expect from Māori entities relevant to tikanga include:

- What happens to the samples that are collected?
- Can we track where the samples are and what they are being used for?
- What other whānau, hapū and lwi samples are part of the same project?
- Can we visit the research facility?
- How long are samples kept?
- What is the process of discarding samples?
- What tikanga could be applied and how?

f) Consent

The scope and specificity of the consent is a key consideration from a Māori perspective. There is a preference that participants consent for every use but discussions in the consultation phase may allow for specific project use, disease-specific use, or broad unspecified use. A distinction should be made between consent for specific research projects, and consent for future use (biobanking). There is an expectation that there will be specific consents for genetic or genomic analyses, access to clinical records, and use for possible commercialisation. Consideration should also be given to whether specific consents are required for the return of results (research, individual, incidental findings), anonymisation of biospecimens, and putting genomic information on open data sharing platforms. Broader, less specific consents may be acceptable when

balanced by stronger governance arrangements and/or dynamic re-consenting models that support a focus on participation in projects that support Māori health priorities. Similarly, the timing of consent could be staggered to allow people to consent to clinical trials or sub-studies in the first instance, and to consent for future use at the end of the initial study.

The types of questions to expect from Māori entities relevant to consent include:

- What choices do participants get to make?
- What are the parameters of consent?
- Would you like participants to consent for unspecified future use?
- Do you want access to clinical information?

g) Methods

The usefulness of the research will depend on the quality of the design, analysis and interpretation of the project. The involvement of Māori researchers and/or community experts is advisable for determining sampling protocols and the framing and interpretation of results. For projects that are looking at genomic comparisons between Māori and other groups, the technical design and analytical frameworks for these projects should be reviewed by external Māori researchers with expertise in genomics.

The types of questions to expect from Māori entities relevant to consent include:

- Has the project been reviewed by Māori experts?
- How will Māori be involved in the analysis and interpretation of data?

h) Communication

Communication was identified as a key issue for Iwi and should take place within all spheres of biobank activities and engagement with individuals through to communities. There can be multiple pathways for communication with both active and passive channels (for example; letters, newsletters and websites). Returning results should be communicated in an appropriate manner (to participants/ whānau and/or general practitioners) with due regard for issues of privacy and confidentiality. A process for the return of incidental findings that are significant or clinically actionable should be defined and agreed upon. Access to genetic counselling should also be facilitated and issues for biological relatives considered (by clearly communicating any level of risk). This is especially relevant for mono-genic conditions (like E-Caederin Stomach cancer gene; or ALD gene) but it will be important to develop ways to improve general genetic literacy of the community to deal with information about genetic risks for multi-genic conditions (e.g. Diabetes, gout, CVD).

The types of questions to expect from Māori entities relevant to communication include:

- How will updates and results be reported back?
 - When?
 - Who?
- How do Iwi access the results?
- Can individual participants access their results?
- How will you contact participants about incidental or clinically actionable findings?
- Who will be the primary contact for the project? And biobank?

Transformation Phase

The transformation phase is the period post-project where the impact of the research project can be realised. Improved outcomes for Māori health motivates the engagement of whānau, hapū and/or Iwi in genomic research projects and there should be active mechanisms to deliver on this goal. Key issues to discuss with Māori entities as part of the planning for the transformation phase include accountability, kaitiaki, translation, and education.

Transformation			
Accountability	Kaitiaki	Translation	Education

i) Accountability

Accountability in this context relates to the relationship between the research team and communities that supported the research project. Expectations for ongoing feedback and communication with participants and Māori communities are key ways in which research teams can demonstrate accountability. Samples and data should be used with due regard to the donors consent and for studies which contribute to Māori health priorities. Communities should be acknowledged when their data is included in secondary studies (with their approval) and they should receive study results from any secondary use of their samples or data. Research organisations are accountable to the participants and their communities for their decisions around future use of samples and facilitating benefit sharing mechanisms for commercialisation opportunities. Re-contact options that facilitate re-consent for secondary use may be one avenue to demonstrate this responsibility.

The types of questions to expect from Māori entities relevant to accountability include:

- How will researchers be accountable to the community?
- How are decisions made around which organisations can access the samples?
- Will there be any restrictions around access or use?
- How will donors be informed about use of their samples?
 - Use in projects
 - Results of projects
- Is there a mechanism for benefit sharing?
- If there is a problem, who can we talk to about the research and/or the researchers?

j) Kaitiaki

Kaitiakitanga is a form of guardianship with responsibility to look after specific resources. In the context of genomic research it relates to the use of samples, DNA and data (genome data, clinical data, and information about whakapapa). It is important to clarify who holds the role of kaitiaki within the research team and the community, and that they are aware of the responsibilities of that position to maintain 'te hau o te taonga'. Although communities should retain veto rights over how samples and data are used, and data sharing (for secondary use and open platforms) should only occur with the express permission of the participants and mandated representatives from the community, there are still a wide range of situations where decisions will be necessary.

The types of questions to expect from Māori entities relevant to kaitiaki include:

- *Ma wai e tiaki? Who will look out for our interests?*
- *Who will be responsible for the samples, information and data?*
- *What options are there for storing the samples?*
 - *Is there a Māori or indigenous biobank?*
- *How long can samples be used before renewing consent?*

k) Translation

Knowledge translation informs resource allocation and can support service development. These are key outcomes for Māori communities from research. The challenge for genomic researchers is to articulate how genomic research translates to improved health outcomes across the spectrum of public health and personalised medicine. The relevance of the research results should be shared

with participants and their communities, and clinically actionable results should be shared with clinicians and service providers using an ethically defensible plan¹⁹.

The types of questions to expect from Māori entities relevant to translation include:

- What are the steps to developing a clinically relevant outcome?
 - Diagnostic tools
 - Education and health promotion
 - Pharmaceutical interventions
- How does genomic research translate to health interventions?
 - Health service delivery
 - Clinical decision making
 - Type and dosage of medication
 - Public health messages
- When a genetic basis for disease is discovered, how do whānau talk about this?
 - What support can be accessed?

l) Education

Māori recognise that genomic research will become an important part of the health system in the future. Improving levels of genetic literacy amongst Māori communities and levels of cultural literacy amongst science communities is necessary to ensure beneficial outcomes for Māori health. A component of this is to better understand how genomic research translates to health interventions and what the steps are to developing clinically relevant outcomes. Similarly, when a genetic basis for disease is discovered, how do whānau talk about this and what support is available to assist with this process?

The types of questions to expect from Māori entities relevant to education include:

- What support is there for educating the community about genomic research and biobanking?
- Where can we access information to help us make decisions?
 - Whether to engage
 - What to do with the results
- What information and advice can we access to support our whānau?

¹⁹ Where research may discover or generate information of potential importance to the future health of participants, or their blood relatives, researchers must prepare and follow an ethically defensible plan to disclose or withhold that information.

Guidance Tables

The Guidance Tables have been developed to provide specific advice on three areas that researchers and communities have frequently queried; determining appropriate engagement, using appropriate methodologies, and identifying pathways for benefit sharing.

Appropriate Engagement

An important part of conducting genomic research with Māori communities is engaging with the right people. Māori have expressed an interest in being involved in research conversations at the earliest stage possible, however the nature of this engagement will vary from case to case. This may require a number of conversations to get the right level of input into the project and a robust process of engagement will involve Māori with expertise in research (preferably genomic research), Māori with an understanding of cultural protocols, and Māori with background in the context which the project focuses on (i.e. cardio vascular disease, diabetes).

Engagement always has a purpose and can be functional in terms of support for a project, or strategic in terms of developing a mutually beneficial relationship. Engagement in the research context is usually based around consultation, consent (individuals and collectives), and support. Genomic projects focused at different scales within the Māori population will need to determine the appropriate whānau, hapū, Iwi or Māori entities to engage with. The table below provides some examples of what level of consultation, consent and support are appropriate for different types of genomic research.

Study Focus	Example	Level of Consultation	Level of Consent	Level of Support
Tangata: General Population With/without Māori cohort	New Zealand Wide Gout Study, Growing up in New Zealand Study, Neuro-endocrine Tumour Study (NETwork!), LiLACS	Institutional and Representative	Individual consent	Māori Institutional support Iwi and agency endorsement Whānau support for individual consent
Whānau: Family Population	Familial Gastric Cancer, Adrenoleukodystrophy	Whānau and Iwi	Whānau consent for project Individual consent to participate	Marae, hapū and/or Iwi endorsement for project Whānau support for individual consent
Marae/Hapū/Iwi: Community Population	Rakaipaaka Health and Ancestry Study, Genetics of Gout in Ngāti Porou	Iwi and Institutional	Marae, hapū or Iwi consent for project Individual consent to participate	Iwi endorsement for project Māori institutional support Whānau support for individual consent
Pan-Iwi: Ethnic Population	Hauora Manawa: Heart Health Community Heart Study, Te Wai o Rona Diabetes Prevention Strategy	Multiple Iwi and hapū, Institutional and Representative	Multiple Iwi consents for project Individual consent to participate	Whānau support for individual consent Māori Institutional endorsement

Table 2: Appropriate Engagement

Appropriate Methods

The research design and statistical analyses chosen for the study have an effect on what the study is able to detect and how that information can be interpreted. There are a number of examples of genetic and genomic research studies that have caused harm to indigenous communities. The 'Warrior Gene' is a recent example which mistakenly linked social characteristics to an ethnic population based on weak genetic data that was poorly analysed and interpreted. The harm felt by pockets of the Māori community resulted in greater levels of mistrust amongst the Māori community towards genetic researchers. Researchers have an ethical responsibility to do no harm and need to consider this not only in relation to participants providing samples but also in terms of how their interpretation of data creates stories in/about/for the community. Therefore, appropriate analytical methods are needed, along with careful interpretations and communication of results.

Table 3 describes the different analytical methods for different types of study design. In general, less complex analytical methods are required for single gene (i.e., Mendelian) conditions that typically occur with whānau/whānui-level research. Gene effects for such conditions are typically very large, and thus easily handled using standard analytical methods. For more complex conditions, such as polygenic disease, much larger populations are needed. The suite of analytical methods need to more judiciously applied, beginning with designing a study with sufficient size to adequately test underpinning biological hypotheses. A variety of tools are available for this.

Data analyses also need to be considered carefully. More advanced analytical methods are constantly being developed, including methods that determine overall trait heritability (i.e., the total sum of all genes contributing to variation among study participants) in addition to the contribution of individual genes. Methods for analyses of lwi- and pan-lwi-level association studies should include estimation of both admixture and relatedness. A variety of methods are available which account for these phenomena, including methods that exclude candidate polymorphisms from simultaneous estimation of relatedness and association which can weaken power to detect true associations. The need to use 'best practice' analyses is obvious, however what this actually consists of frequently changes. We therefore advise researchers to constantly evaluate literature describing and comparing analytical methods, and to be able to justify analytical methods used. Moreover, data should be analysed using multiple methods: similar results from different methods is usually indicative of an underpinning biological basis to the observed data set (i.e., real gene effects).

In the recent past, disease heritabilities were not often calculated in candidate gene-based and genome-wide association studies of complex traits. Our view is that they *should* be: if a trait is not heritable then specific gene-trait associations are likely false positives, therefore of limited diagnostic or clinical relevance. Moreover, heritability estimates provide for a clearer representation of the total role of genes in disease, which can in turn dispel myths about the conditions. For example, currently in Aotearoa, New Zealand there is general acceptance of the role of genes in gout incidence, yet less acceptance of the role of genes in obesity and comorbidities such as Type 2 diabetes mellitus, despite similar estimated heritabilities in these conditions reported in overseas studies. Heritabilities can be estimated using relatedness estimated from genome-wide marker panels. Some caveats here are (a) more distant relatedness is less precisely estimated using such panels, thus some caution is needed when interpreting estimates of genetic variance and heritability, and (b) admixture can create errors in marker-based relationship estimation, thus needs to be accounted for when estimating kinship.

Study Focus	Examples	Designs	
<p>Tangata: General Populations</p> <p><i>With or without Māori cohort</i></p>	<p>NZ-wide gout case-control studies</p>	<p>Genome-wide association studies using case control or unstructured populations (for continuously distributed traits) (disease presence/absence):</p> <p>candidate gene-based SNPs, or</p> <p>genome-wide genotyping with SNP chips, or exome capture or whole genome sequencing.</p> <p>Designs should be appropriately powered (i.e., with adequate sample sizes) and estimate power of detection using appropriate methods. Designs should maximise power of detection of small effect SNPs.</p> <p>Power to detect loci needs to be considered: <i>how much of the genetic variance is explained by (non) detected variants? In other words, small studies will likely not detect most of the disease-associated variants? Of those variants that are detected in these studies, have they been replicated?</i></p>	
<p>Whānau: Family Population</p>	<p>Familial Gastric Cancer, Adrenoleukodystrophy.</p>	<p>Family-based designs are generally targeted at Mendelian traits and/or descendants of carriers of <i>de novo</i> mutations. Optimal design depends upon mode of gene action and penetrance. Generally involves either identity-by-descent or homozygosity mapping with either candidate genes, whole exomes or whole genome resequence. Populations need to be sufficiently large, particularly for detecting incompletely penetrant and/or recessive genes, which usually requires multiple siblings with recent common ancestors, as well as good clinical records.</p>	
<p>Hapū/Iwi: Community Population</p>	<p>Rakaipaaka Health and Ancestry Study, Ngati Porou Genetics of Gout in Ngati Porou</p>	<p>As for general population. Rare variants need to be validated in specific whānau where the variant is segregating.</p>	
<p>Pan-Iwi: Ethnic population</p>	<p>NZ-wide gout study in Māori</p>	<p>As for general population. Rare variants need to be validated in specific whānau where the variant is segregating.</p>	

Table 3: Appropriate Methods

	Statistical Analysis	Interpretation(s)
	<p>Data preparation: imputation of missing data points using appropriate reference populations. Ensure appropriate filtering on sequencing-derived data, especially if inferring rare variants.</p> <p>Methods for identifying genes associated with trait variation should:</p> <ul style="list-style-type: none"> • Test candidate SNPs as fixed effects • Control for population admixture • Control for co-ancestry via genomic relationship matrix estimation excluding candidate SNP in mixed linear model analyses. This is not necessary in some Bayesian methods. • Accommodate testing of multiple polymorphisms • Be computationally efficient • Estimate trait heritability • Provide unbiased estimates of SNP effects, • Be applicable to multiple (correlated) traits, and • Incorporate prior information where available (e.g., Bayesian methods) <p>Results should also be compared with results from other studies, and ideally be included in meta-analyses that typically involve combining the data from multiple studies.</p>	<p>Actual effects of individual disease associated DNA sequence variants are usually very small, and only contribute small amounts to risk.</p> <p>Having some of the 'disease gene(s)' does <i>not</i> mean those with the gene(s) will get the disease – rather, the likelihood of developing the disease is increased, i.e., that <i>relative</i> risk is increased, but usually not markedly for complex traits unless have many of the causative genes (and often with a family history).</p>
	<p>Various options for identifying disease-linked polymorphisms:</p> <ul style="list-style-type: none"> • Simple linear regression for continuous phenotypes, chi-square or Fisher's exact test for qualitative phenotypes. • homozygosity mapping for recessive Mendelian traits • Genome-wide IBD estimation for missing data and linked loci • Independent validation of associations, particularly with affected whānui • Imputation for genome-wide data using a relevant reference genome 	<p>For those carrying the disease-causing genes there is a high likelihood of condition/disease.</p>
	<p>As above, for general populations. Especially important that relatedness be incorporated in analytical methods used to estimate genetic effects. Admixture also needs to be taken into account, particularly if using linear mixed models. Genome wide estimation methods likely to particularly useful here, taking advantage of the spectrum of relatedness that occur within the populations.</p>	<p>As for general population. Additional consideration given to family history when interpreting results and estimating risk. Marker-based estimates of heritability will also provide a framework for assessing genetic vs non-genetic effects for specific conditions. These provide estimates of the genetic and environmental contributions.</p>
	<p>As above for hapū/Iwi. Especially important to account for admixture, owing to multiple ethnicities. Genome wide estimation also likely to have value here.</p>	<p>As for hapū/Iwi</p>

When communicating results care is also needed to avoid unwarranted reinforcement of negative stereotypes which typically occurs with the use of negative terms such as ‘deficits’, ‘elevated disease risk’ etc, as these can be considered to imply a genetic inferiority. Such notions are akin to Darwinian selection, which had previously provided early British colonists with a basis for discriminating against indigenous population in countries such as in New Zealand.

Benefit Sharing

Equity and justice are ethical principles underpinning the importance of benefit-sharing. Research will also have a range of outcomes and part of the ethical deliberation is to consider the nature of the outcomes (risk versus benefit, short versus long term) and their relative distribution (researchers, participants, communities, society). Researchers will legitimately benefit from being involved in research but consideration should be given to how participants and their communities might also benefit from participation through research, education and translational activities.

Research	Education	Translation
Participant/community access to additional health resources <ul style="list-style-type: none"> • tests • screening • expertise • genetic counselling 	Feedback to participants to <ul style="list-style-type: none"> • provide information about the contribution of genetic & environmental factors (i.e. consumption and exercise) to health incidence • increase levels of understanding about genetic conditions • information about whakapapa 	Improvements to health service delivery <ul style="list-style-type: none"> • access • screening • clinical decision making • personalised medicines
Capacity building <ul style="list-style-type: none"> • internships • scholarships • research positions • research workshops • relationships/partnerships with research providers 	Community workshops and hui to <ul style="list-style-type: none"> • provide information about the relevant disease • provide information about the contribution of genetic & environmental factors to health incidence • increase levels of understanding about genetic conditions • make informed consent processes more robust 	Improvements to health literacy in community <ul style="list-style-type: none"> • Supports conscious decision-making around genetic conditions (genetic literacy) • Activating healthy communities (health promotion)
Information for community <ul style="list-style-type: none"> • Research reports • Baseline data for future Iwi studies/interventions • Shared intellectual property 	Develop project resources (print/website) <ul style="list-style-type: none"> • Genetic literacy • Health promotion 	Support Information Sovereignty <ul style="list-style-type: none"> • Māori stewardship of data and information • Māori research capacity

Table 4: Benefits for Communities

Benefits to researchers

- Status and reputation
- Qualifications (Masters and PhD theses)
- Personal advancement – particularly enhanced publication records
- Increasing networks
- Broadened life experiences and skills

Benefits to participants

- Access to interventions
- Opportunity to share experiences
- Koha
- Acknowledgement in publications
- Copies of reports

Benefits to participant communities

- Research capacity – research skills, understanding research processes
- Access to interventions
- Collection and protection of existing intellectual property
- Knowledge advancement
- Copies of reports
- Sharing of new intellectual property

Benefit to Māori

- Community development, for example health promoting events
- Researcher development for example qualifications and research experience
- Knowledge advancement, for example research outputs, hui (meetings/ seminars) and wānanga (workshops/teaching sessions)
- Development of mātauranga Māori

Benefit to society

- Knowledge advancement for example research outputs, hui and wānanga
- Inclusiveness and diversity within the research system

Special Ethical Considerations

Incidental Findings

Tissue, DNA and data stored within biorepositories often ends up as a sample within a research project that produces an incidental finding. Incidental findings are results unrelated to the primary focus of the study but which may be significant for the individual's health. The nature of genomic research, which analyses a vast number of genes across the genome, will frequently produce incidental findings. The challenge is to determine whether the finding is statistically significant, clinically significant, and/or clinically actionable. Māori communities expect to be notified of any clinically significant or actionable findings. It is the responsibility of the research team to develop an ethically defensible plan²⁰ of how they will address incidental findings that emerge through their study.

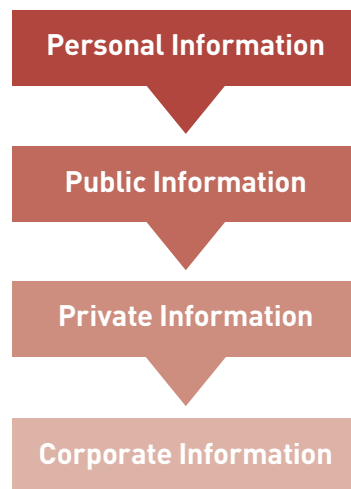
Data Rights and Interests

Internationally, human tissue samples and associated genomic data from Māori and Polynesian sources are becoming an increasingly valuable resource. Opportunities for benefit-sharing with Māori communities is connected to an acknowledgement that they have an inherent right to derive benefits from the use of their taonga. These rights have been articulated in the Mataatua Declaration and the UN Declaration on the Rights of Indigenous Peoples and also underpin recent discussions on Indigenous Data Sovereignty.

Māori have expressed a belief that they have rights to tissue and the genomic data associated with it, as well as an interest in the outcomes of research and applications of their data. There is also a belief that genomic data, like their clinical data, was personal information. Its use in the public domain as part of supporting research is to improve health outcomes for their community. While many recognise that the pathway to the delivery of benefit often involves commercial entities there are concerns about their personal information becoming corporatised through research activities. There is an expectation that those who contribute to research should receive direct benefits over and above those delivered to the general public.

²⁰ National Health and Medical Research Council (NHMRC). National statement on ethical conduct in human research. Canberra: NHMRC, Australian Government; 2007. Available from: <https://www.nhmrc.gov.au/guidelines-publications/e72> [Verified 21 May 2015].

Figure 9:
Information Flow



Data Linkage

Data is a representation of tissue and genetic information is a highly valuable strategic asset to Māori. There is some concern about the linking of datasets across different domains and there is an expectation of Māori involvement in governance over access to and the linking of data. The kawa developed for genomic research can also be applied to data governance, addressing 'wairua' through regular communication, 'mana' by providing direct benefits, and 'mauri' through transparent processes that enhance trust in the integrity of the system.

Glossary of Māori Terms

Disclaimer: Many of the descriptions used in this glossary are specific interpretations for the purposes of this document and do not denote the fullness of meaning normally associated with the word or term.

Awe māpara	Ink used for traditional tattoo
Hapū	Kinship group
Hui	Meetings, seminars
Iwi	Tribe
Kai	Food
Kaitiaki	Guardian/advocate
Kanohi ki te kanohi	Face to face
Karakia	Prayer, incantation
Kaumātua	Elder
Kaupapa	Topic, purpose
Kawa	Principles
Kuia	Female elder
Māhaki	Respectful conduct
Mana	Justice and equity, power and authority, control
Mana akiaki	Empowerment
Mana tangata	Autonomous individual
Mana whakahaere	Shared power and control of outcomes and dissemination
Mana whenua	Regional authority, customary title over land
Manaakitanga	To look after, care for
Mātaawaka	Māori living within the area not related to local iwi
Mātauranga	Traditional knowledge
Noa	Unrestricted
Tāmoko	Traditional tattoo

Tangata whenua	People of the land
Taonga	Precious, resources
Tapu	Restricted
Te Ao Māori	Māori world
Te Mata Ira	Faces of the genes
Tika	Right, correct
Tikanga	Protocols and practices
Wai	Water
Waiata	Song, singing
Wānanga	Workshops, teaching sessions
Whakanoa	To free from restriction,
Whakapapa	Genealogy, relationships
Whakatauki	Proverb
Whakawātea	To remove tapu
Whānau	Family, extended family, kin network

Glossary of Science Terms

Term	Definition
Admixture	Presence of intermarriage/interbreeding between genetically distinct groups. For example high levels of intermarriage between Māori and pākeha indicates extensive admixture in contemporary Māori.
Biomedical research	Research that is undertaken in a Biomedical context or with intended biomedical outcomes.
Candidate gene	Genes thought (hypothesised) to be responsible for causing a specific condition or characteristic (phenotype).
Cell lines	Usually refers to genetically identical cells that are perpetually cultured in vitro. Used for experimental purposes.
Co-ancestry	Shared (or common) ancestry. Populations with relatively few ancestors have higher levels of co-ancestry.
Darwinian selection	Natural selection, where individuals who have particular characteristics have an advantage relative to the rest of the population, thus contributing disproportionately to the next generation. An example could be individuals who are resistant to a particular deadly pathogen.
De novo mutations	Changes in DNA sequence that occur for the first time in either male or female gametes (i.e sperm or egg), and thus appear in the offspring but not previous generations.
DNA sequencing	Processes and technologies for ascertaining DNA sequence of organisms. Most widely used technology platform is Illumina-based, which generate large amounts of short read sequences.
Epigenetics	Changes arising from alterations in gene expression levels that are caused by reversible chemical modification of DNA, but not changes to the DNA sequence passed on from parents to offspring.

Gene	Various definitions: 1) a hereditary unit; 2) a region of DNA that codes for a specific form of a protein; 3) a region of DNA that contains a specific sequence that is transcribed into RNA and influences biology of the organism.
Genetic research	Investigations of the influence of inherited genetic variation on specific characteristics. Genetic research in a health context usually involves correlating either DNA sequence variants with health outcomes.
Genetic variance	Variation in inherited DNA sequence between individuals within or between populations. Some of this variation is referred to as the genetic variance (i.e. heritability) that explains some of the variance in phenotype between individuals within a specified population.
Genome	The entire DNA sequence of an individual, including its physical arrangement.
Genomics	Refers to the study (including technologies) of the entire genome of an organism, including the physical arrangement of the genome.
Genome Wide Association Study	An experimental procedure where millions of variations in DNA sequence spread across the entire genome of a population of individuals are correlated with variation in a physical characteristic or phenotype (e.g., disease) to identify genes responsible for variation in phenotype.
Genome-wide estimation	Estimation of genetic variation from a genome-wide set of genetic variants. Used to estimate heritability.
Genotype	Various meanings. As a verb, it refers to the process of determining DNA sequence at a loci or set of loci. As a noun, 'genotype' refers to the DNA sequence at a specified locus for an individual.
Genotyping	Process of determining the DNA sequence of a specific individual at predetermined sites (loci) in the genome.
Heritability	The proportion of observed variation in an observed characteristic that is attributable to inherited genetic variation. For example most (80%) of the variation in human height is due to inherited genetic variants, thus height is described as being 'highly heritable'.

Homozygosity	Refers to regions of DNA where an individual's sequence inherited from the father is the same as the region inherited from the mother. Higher rates of homozygosity in the genome of an individual are consistent with in-breeding.
Imputation	Refers to a mathematical process used to calculate missing genotypic information of individuals. Used to increase data, typically in genome-wide association studies.
Loci	Plural of the term 'locus', which refers to a specific regions of genome. Usually to a functional region, such as a a region encoding an expressed gene, or some other biological significance.
Mendelian	A characteristic or a gene that behaves according Mendel's laws of inheritance. In medical contexts, refers to diseases that are caused by a single genetic change (similar to monogenic) that can be traced from generation to generation within a family.
Metabolomics	Refers to the study of the entire set of metabolites within an organism or tissue.
Mono-genic	Where genetic variation in a characteristic is due to a single gene ('mono' = one). Often used in reference to Mendelian diseases that are caused by a single gene.
Multi-genic	Where genetic variation in a characteristic is the combined result of multiple genes. This is the case for common diseases such as diabetes, cancer, psychiatric diseases, and for human characteristics such as height and weight.
Next Generation sequencing (NGS)	DNA sequencing technologies that are typically high throughput but read only short fragments of DNA.
Polygenic	Same as multi-genic: 'Poly' meaning 'many'. Usually refers to heritable conditions and characteristics that involve many genes – ranging from tens to thousands.
Polymorphisms	Literally means 'many forms'. In a genetics context, refers to differences in DNA sequence.

Pharmacogenomics	Refers to the research and practice of targeting particular drug therapies to an individual based on their genotype at particular genes. For example, individuals who metabolise a drug faster may require a higher dose of that drug, or individuals could be genetically prone to an adverse event for a particular drug, which wouldn't be used for that individual.
Phenotype	Physical appearance or characteristics of an individual.
Proteomics	Refers to the study of the entire set of proteins within an organism or tissue. Proteins are translated from expressed genes.
SNP's	Single Nucleotide Polymorphisms – A single letter change in DNA code usually measured directly via DNA sequencing methods, or via 'chip' microarray technologies.
Tissue Bank	Physical location of a collection of tissues used for medical and other research. Can be termed a Biobank.
Transcriptomics	Refers to the study of the entire set of expressed genes within an organism or tissue. Usually involves indirectly sequencing RNA.
Variants	Usually refers to differences in DNA sequences.
Whole Genome Sequence	The entire DNA sequence of an individual. Usually determined for experimental or research purposes, or to develop information resources that can inform genetic analyses in biomedical research.

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Appendix A: Relevant Resources

Critique(s) of genetics-based research in Indigenous populations –
<http://www.conversations.canterbury.ac.nz/documents/FINAL%20NGAPAEPAPER.doc>

Māori protocols – <http://www.katoa.net.nz/kaupapa-Māori/Māori-protocols>

National Congress of American Indians Genetics Resource Centre –
<http://www.ncai.org/policy-research-center/initiatives/projects/genetics-resource-center>

Research consultation with Māori (Otago University policies) –
<http://www.otago.ac.nz/research/Māoriconsultation/>

Te Aroturuki – <http://www.dabhand.co.nz/tap/index.html> (draft)

Genetics Education Websites:

- <http://www.genetics.edu.au>
- <http://www.geneticseducation.nhs.uk>
- <http://learn.genetics.utah.edu/>
- <https://unlockinglifescode.org/>
- <https://www.theguardian.com/science/2013/jun/08/genome-sequenced>

Youtube videos:

- Genomics – <https://www.youtube.com/watch?v=mmglClg0Y1k>
- Genomics in healthcare – <https://www.youtube.com/watch?v=KiQgrK3tge8>





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