Understanding Survival and Suffering: An Individual-Level Joint-Burden Approach for Measuring Health Loss Among Māori and non-Māori

Illustrated Using a National Retrospective Cohort Study of Type 2 Diabetes in Aotearoa New Zealand

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Mihi

Ko Mōtatau te maunga

Ko Taumārere te awa

Ko Ngāti Hine tōku iwi

Ko Ngāti Te Tāwara me Ngāti Manu ōku hapū

Ka mihi au ki ngā tūpuna kua mene ki te pō, mō ngā taonga i waiho mai e rātou ki a mātou—te kaha, te mātauranga me te mana.

Ka mihi hoki au ki te hunga ora.

Ki tōku whānau, ki ōku hoa, ki ōku kaiārahi—tēnā koutou mō tō koutou aroha, tō koutou tautoko me tō koutou manawanui i tēnei haerenga roa.

Ko tēnei mahi he tohu whakaute ki te iwi, he ngana hoki kia mārama ake ai tātou ki ngā take e whakararu nei i te hauora, ā, kia mau tonu ai te tika me te pono mō ngā uri whakatipu.

Tēnā koutou, tēnā koutou, tēnā tātou katoa.

Abstract

Persistent inequities in health outcomes between Māori and non-Māori in Aotearoa New Zealand are well documented. However, most epidemiological analyses rely on population-level measures that obscure variation within populations and provide limited insight into whether some Māori experience comparatively favourable outcomes. This thesis addresses that gap by developing and applying an individual-level framework to examine both survival and suffering among Māori with type 2 diabetes mellitus (hereafter referred to as DI).

Using a national retrospective cohort design, this study examines Māori and non-Māori adults who died from DI across five study years (2013, 2014, 2016, 2018, and 2019) using linked administrative microdata from the Integrated Data Infrastructure (IDI). The research is grounded in a Kaupapa Māori Research framework and Mode 2 knowledge production, with the explicit aim of producing tools that support Māori Treaty Partners to scrutinise health system performance. A process-oriented model of health is developed to distinguish determinants, biological processes, and impacts, enabling transparent operationalisation of health loss using administrative data while remaining aligned with Kaupapa Māori Research principles.

The thesis introduces two linked methodological innovations. First, it develops a novel individual-level metric, Years of Life Lost to Disability (YLLD), to quantify cumulative non-fatal burden from DI and its complications alongside Years of Life Lost (YLL) to capture premature mortality. Second, it develops a joint-burden matrix that integrates fatal and non-fatal dimensions without collapsing them into a single composite measure. This approach preserves conceptual clarity and avoids the ethical and interpretive limitations associated with composite burden metrics such as Disability-Adjusted Life Years (DALYs).

Across the study period, total fatal and non-fatal burden from DI increased, particularly after 2016. Māori consistently bore a disproportionate share of both YLL and YLLD relative to their population size, contributing approximately one-third of total burden while comprising around one-sixth of the national population. Proportionate burden ratios were close to or exceeded two in every year, indicating that Māori experienced roughly twice the burden expected based on population share alone. This inequality was expressed through both higher mortality and younger age at death (elevated YLL), and through sustained non-fatal disability prior to death (elevated YLLD).

The joint-burden matrix identified meaningful within-Māori variation. A subgroup of Māori experienced outcomes among the most favourable observed nationally, demonstrating that Māori health outcomes are not uniformly poor. This enabled structured comparison between Māori with favourable and adverse joint outcomes. Determinant analyses employed a staged, hypothesis-driven approach combining non-parametric difference testing with SESOI-based equivalence testing and tipping-point sensitivity analyses.

Findings indicate that commonly cited structural and contextual determinants — including area-level deprivation, income, cultural identity, health literacy (educational attainment proxy), and geographic locale — did not consistently differentiate Māori with favourable versus adverse outcomes. Deprivation and cultural identity most often demonstrated practical similarity within pre-specified margins. Income showed heterogeneous patterns, including early-year differences and later-year convergence, with equivalence supported only in 2019. For health literacy and geographic locale, limited coverage and sensitivity to missingness constrained inference. Overall, the determinants examined did not uniformly explain the marked variation observed among Māori in joint burden.

This thesis makes three principal contributions. It provides the first national individual-level joint burden assessment of fatal and non-fatal DI burden among Māori. It introduces YLLD and a joint-burden matrix that make within-population variation visible without collapsing distinct dimensions of health loss. It also advances an epidemiological approach aligned with Kaupapa Māori Research that foregrounds accountability, distributional visibility, and learning from both strength and harm. Together, these contributions provide new tools for Māori health research and for Treaty-based scrutiny of health system performance.

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Finally, I'd like to dedicate this PhD to Gran and Gramps and my aunties Bella, Keti, Sarah, Pam, Heeni, and Maureen for always welcoming me home.

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Glossary of Māori Terms

Unless clarified, translations for Māori words and phrases are from Te Aka: Māori dictionary: https://Māoridictionary.co.nz

Aroha ki te tangata	An ethical orientation toward people that foregrounds respect, care, humility, and relational responsibility in Māori research
Hapū	Subtribe or section of a large kinship group and the primary political unit in traditional Māori society
Hauora	Health
Hinengaro	From Te Wheke: The mind
Iwi	Tribe or large group of people descended from a common ancestor and associated with a distinct territory
Kaupapa Māori	Māori approach or Māori ideology incorporating the knowledge, skills, attitudes and values of Māori society
Kaupapa Māori Research	Research that incorporates the knowledge, skills, attitudes and values of Māori society
Kia āta-kōrero	An ethic of deliberate, truthful, and culturally grounded communication that is contextually responsible, relationally accountable, and protective of Māori people, knowledge, and relationships
Kia tūpato	An ethic of caution, reflexivity, and restraint that requires researchers to anticipate risk, recognise power, and act carefully to avoid harm, misrepresentation, or unintended consequences for Indigenous peoples and communities
Mana	Authority or standing
Manaakitanga	An ethic of care, generosity, and responsibility that obliges researchers to uphold the mana of others through respectful conduct, reciprocity, and the provision of benefit, rather than extraction or exploitation
Mana ake	Framed as a distinct dimension tied to identity/authority/unique selfhood within the whole wellbeing system
Māori	Indigenous person of Aotearoa New Zealand
Marae	Wharenui or meeting house where formal gatherings take place. Also used to include the complex of buildings around the marae
Mātauranga	Māori knowledge or wisdom
Ngāti Hine	Iwi located in Northland, New Zealand

Oranga	Health or wellbeing
Rangatira	Chief
Rangatiratanga	Self-determination, sovereignty, autonomy, self-government
Rohe	Tribal area
Rūnanga	Tribal council
Taha hinengaro	From Te Whare Tapa Wha: Mental and emotional health
Taha tinana	From Te Whare Tapa Wha: Physical health
	From Te Wheke: Physical wellbeing
Taha whānau	From Te Whare Tapa Wha: Family health
Taha wairua	From Te Whare Tapa Wha: Spiritual health
Taonga	Treasure, anything prized
Te Kupenga	Statistics New Zealand's survey of Māori wellbeing
Te reo	Māori language
Te Rūnanga o Ngāti Hine	Ngāti Hine tribal council
Te Tiriti o Waitangi	The Māori language version of the Treaty of Waitangi
Te Whare Tapa Whā	A model for understanding Māori health that uses the wharenui (meeting house) as a symbol for the 4 cornerstones of Māori health: Taha hinengaro, Taha tinana, Taha whānau, Taha wairua
Te Wheke	Māori health model that uses the wheke (octopus) to describe the elements of waiora (total wellbeing)
Te Whatu Ora	Also called Health NZ, a Crown Entity that funds and delivers health services, including hospital and specialist services, and primary and community care
Tikanga	Correct procedure, custom
Tino rangatiratanga	Self-determination, sovereignty, autonomy, self-government
Tūrangawaewae	Place where one has rights of residence and belonging through kinship
Waiora	From Te Wheke: The total wellbeing of an individual and family
Wairuatanga	From Te Wheke: Framed as a spiritual dimension of wellbeing
Whakapapa	Lineage, descent
Whakapono	An ethic of integrity, truthfulness, and trustworthiness that requires researchers to act honestly, keep faith with communities, and align words, methods, and outcomes in ways that are reliable and morally coherent

Whakawhanaungatanga	The active process of establishing, nurturing, and sustaining relationships through shared connection, mutual obligation, and ongoing accountability, rather than through transactional or extractive engagement
Whānau	Extended family or the primary economic unit of traditional Māori society
Whanaungatanga	The active process of establishing, nurturing, and sustaining relationships through shared connection, mutual obligation, and ongoing accountability, rather than through transactional or extractive engagement

Glossary of Acronyms

ACC	Accident Compensation Commission
ASM	Age-standardised mortality
BASS	Better Administrative and Support Services Programme
BC	Breast cancer
CPD	Cardio-pulmonary disease
CS	Current state
FS	Future state
GBD	Global Burden of Disease
ICD	International Classification of Disease
ICD-09	International Classification of Disease 9th Revision
ICD-10	International Classification of Disease 10th Revision
IDI	Integrated Data Infrastructure
IMPB	Iwi-Māori Partnership Board
ISH	Ischaemic heart disease
LC	Lung cancer
MECE	Mutually exclusive and collectively exhaustive
MfO	Managing for Outcomes
MV	Motor Vehicles
NZDep	NZDep is an area-based measure of deprivation in New Zealand
NZHS	New Zealand Health Survey
OED	Oxford English Dictionary
OECD	Organisation for Economic Co-operation and Development
PYLL	Potential years of life lost
QALY	Quality-adjusted life year
SD	Suicide
SMART	Specific, Measurable, Assignable, Realistic, and Time-related
SPS	Structured problem solving
SQL	Structured Query Language
WHO	World Health Organisation
YLL	Years of Life Lost
YLD	Years Lost to Disability
YLLD	Years of Life Lost to Disability

Chapter 1. The Origin of This Study

Chapter 1 sets the stage for this thesis in three parts. Part 1 outlines two initiatives that prompted the research questions for this study. Part 2 reports the results of a targeted literature review that tests whether these questions have been addressed in existing research. Part 3 provides an overview of the chapters of this thesis.

Part 1. Initiatives Leading to the Research Questions of This Study

Over the past 25 years, I have led several public service initiatives, including the design and rollout of Managing for Outcomes (MfO) for the New Zealand Public Service; a reform of medical licensing for a Gulf State; and a turnaround at Te Puni Kōkiri (the New Zealand Ministry of Māori Development) for its Minister.

Although many of these initiatives shaped my thinking, two were pivotal in forming the research questions for this study. The first is the New Zealand Treasury's Better Administrative and Support Services (BASS) programme. The second is research I conducted at the Accident Compensation Corporation (ACC). Each is discussed below.

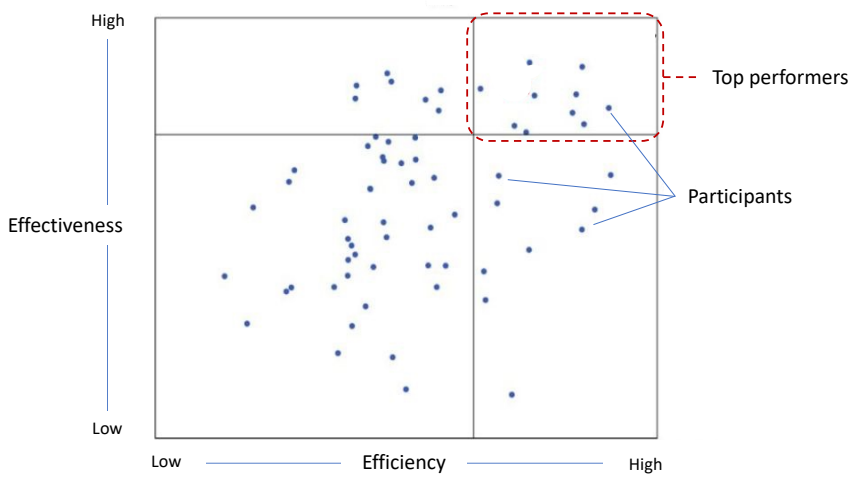
The Treasury BASS Programme

In 2012, the New Zealand Treasury published a comprehensive benchmark of the cost and performance of State services administrative and support (A&S) services, including Human Resources and Finance (The Treasury, 2012).

Benchmarking involved five steps. First, the services to be benchmarked were defined. Second, the aspects of performance to be measured were specified. Third, metrics for measuring performance were established. Fourth, data were collected from participating agencies. Finally, the performance of participating agencies was compared with that of similar organisations to identify opportunities for improvement.

In this final step, the Hackett Value Grid (see O'Connor, 2024) was used to illustrate performance on two dimensions: efficiency and effectiveness. The following figure (Figure 1) provides an illustration of the grid.

Figure 1: Hackett Value Grid



Once performance was plotted on the grid, organisations could assess their position against comparable entities and identify the practices employed by higher performers to improve their services.

I was contracted by the BASS team in 2013 to use the benchmark data to write a strategy to transform the performance of A&S services (The Treasury, 2014). At the time, I did not consider how benchmarking might be applied to Māori (indigenous person of Aotearoa New Zealand) health; it was only after my work at ACC that the relevance became clear.

ACC Research on Māori and Non-Māori Access to Care

The second initiative that contributed to the research questions was research I conducted at ACC in 2019. That research examined whether Māori accessed the care needed for rehabilitation after a major injury, such as a compound fracture or an open crush (Munn, 2019).

This research had two main findings. First, it found that only 34% of Māori and 43% of non-Māori individuals received the care necessary for rehabilitation. Second, it showed that, while access remained an issue for Māori, when they accessed needed care, they often received more timely services than non-Māori. For example, Māori clients who received treatment got to surgery on average 20 days faster and received significantly faster weekly compensation payments than non-Māori (Munn, 2019).

These findings contradicted the prevailing narrative that Māori consistently receive inferior care and prompted me to consider that, if some Māori could access better services than non-Māori in this context, then some Māori may achieve health outcomes comparable to the best observed nationally.

Combining Insights from BASS and my ACC research

Both initiatives highlighted the same core issue: important variation can be concealed when analysis uses only population-level summaries. In BASS, benchmarking revealed unanticipated performance differences across agencies operating within the same system. My ACC research showed unexpectedly that some Māori received substantially better services than non-Māori once they accessed needed care.

This limitation is well-recognised in epidemiology. Rates and standardised comparisons are central to quantifying inequality, but for chronic conditions they provide limited insight into how burden is distributed across individuals, including where burden is concentrated (Rose, 1985; Permanyer et al., 2023).

Together, these insights gave rise to two research questions:

1. The first question, which was shaped by my research at ACC, is: Do Māori with major chronic health conditions experience outcomes that rank among the best observed across Māori and non-Māori?
2. The second question, which was informed by the BASS programme and follows from the first, is: What distinguishes Māori with the most favourable outcomes from Māori with the most adverse outcomes?

Like BASS, these questions treat favourable outcomes not merely as exceptions but as cases that enable systematic comparison between Māori with contrasting outcomes requiring individual-level analysis.

Part 2. Literature Review of Research Questions

Conventional literature reviews aim to map a field, synthesise theory, and derive questions from existing scholarship. The literature review in this study begins with clearly specified research questions grounded in real-world problems and was deliberately scoped to determine whether the literature has:

1. Identified Māori with favourable outcomes for major chronic health conditions or developed analytic frameworks capable of doing so
2. Examined what distinguishes Māori with favourable outcomes from Māori with adverse outcomes using explicit and reproducible analytic approaches.

This approach is consistent with Mode 2 knowledge production, which prioritises context-embedded, application-oriented inquiry and accountability beyond the academy (Gibbons et al., 1994; Nowotny et al., 2001). As Kaupapa Māori Research (research that incorporates the

knowledge, skills, attitudes and values of Māori society), this study is accountable to Māori Treaty Partners. The methodological and philosophical foundations of this approach, including their alignment with Mode 2 and Kaupapa Māori Research, are explained in Chapter 2. They are noted here to explain the scope and logic of the literature review.

The Whakapapa of Māori Health Research and Its Bearing on This Study

The questions this thesis asks grew out of more than my involvement in BASS and my research at ACC. They also descend from a longer tradition of Māori health scholarship. This sub-section traces that tradition and the scholars and communities who made this study possible. My account of this whakapapa is not neutral. It reflects my experience and commitment as a kaupapa Māori researcher, which in turn shapes who I foreground and what I see as important for Māori health. I explain those commitments in detail in Chapter 3.

Over the past four decades, the Hauora Māori Standards of Health series has shaped the empirical study of Māori health. Its four volumes, published between 1980 and 2007, form a spine against which the field can be understood. Each volume documented the state of Māori health and advanced a view of what caused health disparities. Alongside the series, a parallel literature on Māori models of health and Kaupapa Māori research theory extended and sharpened the claims the series made. Together, the four volumes and the wider literature on Māori health, Māori models of wellbeing, and Kaupapa Māori research give rise to a whakapapa of four interconnected and overlapping waves. In the first three, the field established and sharpened its account of Māori health disparities. In the fourth, the objective of the field began to shift.

First wave: Establishing the Disparity (1980–1988)

Eru Pōmare's work in the early 1980s marked the beginning of the systematic study of Māori health. His first Hauora volume, *Māori Standards of Health: 1955–1975* (Pōmare, 1980), reported a higher Māori incidence and mortality across major causes of death and attributed much of the disparity to adverse lifestyle factors. The second volume, *Hauora: Māori Standards of Health II. A Study of the Years 1970–1984* (Pōmare & de Boer, 1988), confirmed that disease incidence and mortality remained higher for Māori than for non-Māori. It also looked beyond individual behaviour, pointing to socio-economic conditions, cultural factors, and the effects of monoculturalism as possible contributors to Māori ill-health. Across both volumes, the comparison with non-Māori was treated as the obvious standard for judging

Māori health. Neither offered a reason for choosing that comparator. It was simply taken as the natural way to show that a gap existed.

Alongside Pōmare's epidemiological work, fundamental questions were being raised about what health meant. In *A Māori Perspective of Health* (1985), Durie argued that health is not a universal concept and outlined a Māori model built around four dimensions — wairua, hinengaro, tinana, and whānau — later known as Te Whare Tapa Whā. Rose Pere's Te Wheke offered a similar framework depicting wellbeing as an interconnected set of eight dimensions symbolised by the tentacles of an octopus, with wairua at its centre (Pere, 1991). While the *Hauora* volumes measured Māori outcomes against non-Māori benchmarks, Pere and Durie articulated a definition of Māori health grounded in Māori knowledge and collective wellbeing. Walker's *Ka Whawhai Tonu Mātou* (1990) widened this perspective by setting Māori health within the long history of colonial dispossession, which he argued any serious account must acknowledge.

Second wave: Relocating the cause and asserting a Māori analysis (1995)

By the mid-1990s, Māori health research had begun to shift its explanation of disadvantage and its claim to interpretive authority. The third *Hauora* volume, *Māori Standards of Health III* (Pōmare et al., 1995), marked this turn. Where the first volume had emphasised lifestyle, the third argued that Māori ill-health stemmed from socio-economic and cultural conditions created by colonisation and Māori urbanisation. It also argued that Māori health would not improve until Treaty grievances were addressed. In fifteen years, the series had moved from locating the cause of Māori health gaps from Māori behaviour to the actions of the colonising state.

The volume also made an explicit methodological claim: that *Hauora* represented a Māori analysis of health data, not simply another review of Māori health by Crown agencies. It included a section presenting its findings in te reo Māori and contested the definition of the Māori population, a matter later taken up in debates over ethnicity measurement.

During the same period, Kaupapa Māori research was being formalised. Graham Hingangaroa Smith's doctoral work (1997) framed Kaupapa Māori as theory and transformative praxis arising from the struggle between dominant Pākehā state interests and subordinated Māori interests. Linda Tuhiwai Smith's *Decolonizing Methodologies* (1999) extended this to research practice, arguing that Western research was inseparable from colonisation and that Māori research must be conducted by, and accountable to, Māori. Eketone (2008) later described its

theoretical foundations, showing how Kaupapa Māori combines critical and constructivist commitments in pursuit of Māori-defined change.

Third wave: Racism, rights, and the quality of the data (2007 onwards)

In the 2000s, Māori health research sharpened its causal argument, linked it to a claim of right, and began examining the reliability of the data Māori health status relied on. The fourth *Hauora* volume, *Māori Standards of Health IV* (Robson & Harris, 2007), and the opening chapter by Reid and Robson, strengthened the framing introduced in *Hauora III*.

Reid and Robson argued that Māori health inequities stem from the unequal distribution of health determinants and that racism is a major determinant of health and a core driver of ethnic inequalities. Empirical work outside the series supported this claim with analyses of the 2002/03 and 2006/07 New Zealand Health Surveys showing that Māori reported the highest levels of racial discrimination and that these experiences were consistently associated with poorer health across multiple domains (Harris et al., 2006, 2012). Reid and Robson also asserted that Māori, as tangata whenua, have the right to monitor the Crown, a right grounded in Indigenous rights and the Treaty of Waitangi. In this wave, the *Hauora* series was reframed as the exercise of a Tiriti-derived right rather than an academic project.

During the same period, researchers turned to the quality of ethnicity data. Building on *Hauora III*'s contention that the definition of the Māori population was shaped by political choices rather than neutral criteria, Cormack and Robson (2010) argued that ethnicity in health data reflects social position and treatment rather than biology. Harris et al. (2022) extended these concerns arguing that Māori are systematically undercounted in administrative health data, and that this undercounting breaches Te Tiriti o Waitangi. While these critiques did not undermine Māori-led epidemiology, they highlighted the need for methods that can specify data limitations precisely rather than treating them as reasons to abandon administrative analysis.

Fourth wave: From equality to equity (2008 onwards)

The founding volumes of *Hauora* focused on closing the gap between unequal Māori and non-Māori health outcomes. Equity, in that framing, was the means — the differential resourcing required to reach equal outcomes — rather than the goal. Over the last 15 years, the objective for Māori health has shifted from achieving equal outcomes to achieving equitable outcomes.

A significant driver of this shift was international. The World Health Organization's Commission on Social Determinants of Health, chaired by Michael Marmot, published *Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health* (CSDH, 2008).

The Commission framed its object explicitly as the promotion of health *equity*, to be achieved by acting on the social conditions in which people are born, live, and age, and called on governments worldwide to join a global movement towards that end. Its frame was general and multinational, concerned with inequities between and within countries and across social groups defined by income, gender, and social exclusion.

Equitable outcomes, defined by the World Health Organization, was the absence of unfair and avoidable differences in health (CSDH, 2008). This framing was adopted by the Ministry of Health, which went on to define inequitable outcomes as differences in health that are not only avoidable but unfair and unjust (Ministry of Health, 2019a). This framing was subsequently entrenched by the Waitangi Tribunal in *Hauora: Report on Stage One of the Health Services and Outcomes Kaupapa Inquiry* (Waitangi Tribunal, 2019) when the Tribunal found that the Crown had breached Te Tiriti o Waitangi by failing to address persistent Māori health inequities. In doing so, the Tribunal defined the principle of equity as requiring the Crown to commit to achieving *equitable* health outcomes for Māori, and the principle of active protection as requiring the Crown to act, to the fullest extent practicable, to achieve *equitable* health outcomes. Equity rather than equality became the standard against which the Crown's Treaty compliance in health is now judged.

Despite the Tribunal rulings, equality of outcomes as the goal, equity as the means, and equity as a goal are frequently left unreconciled, sometimes within a single body of work. Sheridan et al. (2024), for example, argue for a right to equal outcomes while framing the problem, and their analysis, in terms of equity (Sheridan et al., 2024). What is lost in that conflation is a difference that matters for measurement. Equality of outcomes describes a measurable state that can be demonstrated objectively when Māori and non-Māori experience the same distribution of health outcomes. The answer does not depend on who is asking. Equity is different: it can hold when differences are judged fair.

The consequence is that a gap can persist and the equity standard still be met. Three examples show how. First, rheumatic heart disease is associated with household crowding (Baker et al., 2022; Oliver et al., 2017). A difference between Māori and non-Māori can therefore be attributed to housing rather than to health services. The health system can maintain that it resourced prevention and treatment in proportion to need, and that what remains lies beyond its control. Second, where a difference can be traced to patient behaviour, such as smoking, it can be presented as a matter of choice rather than of unfair treatment. Third, where a difference has a documented biological correlate, as with variation in the urate transporter gene SLC2A9 and gout in Māori (Hollis-Moffatt et al., 2009, 2011), a higher prevalence of gout

among Māori (Klemp et al., 1997; Winnard et al., 2012) can be presented as biological and therefore unavoidable.

In each case the same observed gap can be declared acceptable or unacceptable depending on the value judgement made about its cause, and the party making that judgement is generally the party being held to account. Equality of outcomes requires no such judgement.

The fourth wave — in which the health outcome for Māori has shifted from equality to equity — is the one this thesis engages most directly. The whakapapa traced above showed that Māori experience poorer outcomes and that Māori health researchers have, over the past 60 years, relocated the cause of those outcomes, asserted Māori authority to interpret their own data, and interrogated the quality of that data. This thesis now returns to the question of the standard itself: what it would mean to hold Māori and non-Māori outcomes to a defined and testable measure of statistical equality, and how such a measure might operate at the level of the individual.

Against that whakapapa, the literature review asks whether this tradition, or the wider epidemiological literature, has:

1. Identified Māori with favourable outcomes for major chronic conditions or developed methods capable of doing so
2. Examined what distinguishes Māori with favourable outcomes from those with adverse ones.

Literature Review Methodology

Five steps were taken to conduct the literature review:

1. Establish keywords for the review
2. Identify databases and search period
3. Develop search strings
4. Conduct searches
5. Report results.

Each step is discussed below.

Step 1. Establish Keywords for Review

The first step involved identifying keywords from each research question and selecting synonyms likely to appear in the academic literature, including standard epidemiological terms for burden and commonly used descriptors for favourable and adverse outcomes. The key words and synonyms are shown in Table 1 below.

Table 1: Key Search Words and Synonyms

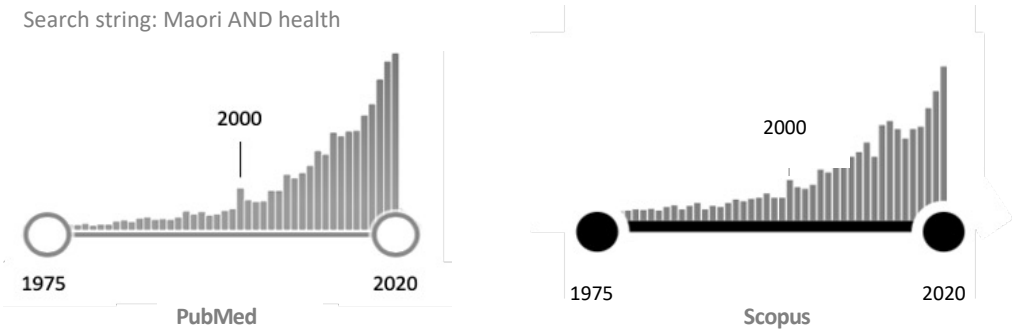
No	Key word	With synonym
Question 1: Do Māori with major chronic health conditions experience outcomes that are among the most favourable observed across both Māori and non-Māori?		
1	Māori	Māori
2	Favourable / "among the best"	"best outcome" OR "best outcomes" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor" OR "protective factors" OR protective OR resilience OR "positive deviance" OR outlier OR outliers OR "high performing" OR "high-performing"
3	Health	hauora OR wellbeing OR well-being
4	Outcomes/ burden	mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications OR hospitali?ation OR hospitali?ations OR hospitalization OR hospitalizations
5	Major health conditions	diabetes OR "type 2 diabetes" OR cardiovascular OR "heart disease" OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions"
Question 2: What distinguishes Māori with the most favourable outcomes from Māori with the most adverse outcomes?		
1	Differences / comparison	diff* OR similar* OR compare* OR contrast*
2	Favourable / "among the best"	favourable OR best OR excellent OR optimal OR low burden OR resilience OR "positive deviance"
3	Adverse / "among the worst"	adverse OR poor OR worst OR low OR lag* OR high burden
4	Explanatory characteristics	determin* OR factor* OR predictor* OR associated OR correlat* OR "risk factor*" OR protective
5	Outcomes / burden	outcome* OR result* OR mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali* OR YLL OR YLD OR DALY

Step 2. Identify Databases and Search Period

Step 2 involved selecting the databases to be searched and defining the period for the review. Three databases were selected for the search: Scopus, PubMed, and CINAHL Complete. Scopus and PubMed were chosen because they provide comprehensive coverage of international peer-reviewed health and epidemiology literature. CINAHL Complete was added to strengthen the capture of New Zealand research that may be less consistently indexed in Scopus or PubMed and to broaden the retrieval of applied and practice-oriented studies relevant to Māori health outcomes.

The review period began in 2000, reflecting a point at which Māori health literature began to increase (Figure 2). It ended in 2020, the year immediately preceding commencement of the literature review in January 2021.

Figure 2: Growth of Literature on Māori Health



Source: PubMed and Scopus search results, 27 Jan 2023

Step 3. Develop Search Strings

The next step involved developing a master search strategy for each research question. Each of these was then translated into database-specific syntax to accommodate differences in field tags, phrase searching, and wildcard conventions across the searched databases.

Table 2 summarises the master strategies and provides exemplar strings. Database-specific search strings are provided in Appendix 5.

Table 2: Master Search Strategies

No	Focus	String
Question 1		
1.1	Narrow, condition-specific	(Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR cardiovascular OR "heart disease" OR cancer OR "chronic disease" OR "chronic condition*") AND (health OR hauora OR wellbeing OR well-being) AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation*) AND ("best outcome*" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor*" OR protective OR resilience OR "positive deviance" OR outlier* OR "high performing" OR "high-performing")
1.2	Broader, drops condition list	(Māori OR Maori) AND (health OR hauora OR wellbeing OR well-being) AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation*)

		AND ("best outcome*" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor*" OR protective OR resilience OR "positive deviance" OR outlier* OR "high performing" OR "high-performing")
Question 2		
2.1	Within-Māori favourable vs adverse; distinguishing characteristics	(Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation* OR admission*) AND (("within Māori" OR "within-Māori" OR subgroup* OR strata OR stratified OR heterogeneity OR variation OR "risk stratification")) AND (determin* OR factor* OR predictor* OR associated OR correlat* OR "risk factor*" OR protective OR resilience) AND (favourable OR favorable OR "best outcome*" OR "better outcome*" OR optimal OR "low burden" OR "better survival" OR "lower mortality" OR adverse OR poor OR worst OR "high burden" OR "worse outcome*" OR "higher mortality")
2.2	Māori vs non-Māori; favourable outcomes, comparative	(Māori OR Maori) AND (non-Māori OR non-Maori OR "non Māori" OR "non Maori" OR European OR "non-Indigenous") AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication*) AND (favourable OR favorable OR "best outcome*" OR optimal OR "low burden" OR "better survival" OR "lower mortality")
2.3	Māori vs non-Māori; adverse outcomes, comparative	(Māori OR Maori) AND (non-Māori OR non-Maori OR "non Māori" OR "non Maori" OR European OR "non-Indigenous") AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication*) AND (adverse OR poor OR worst OR "high burden" OR "worse outcome*" OR "higher mortality")

Step 4. Conduct Searches

Database searches were conducted using database-specific translated search strings (Appendix 5). The search results for each question are set out below.

Question 1: Do Māori with major chronic health conditions experience outcomes that are among the most favourable observed across both Māori and non-Māori?

Across all search strings and databases, 389 records were identified for question 1. After removing duplicate records using Zotero reference management software, 209 unique articles remained. These records were then carried forward for title and abstract screening using predefined inclusion criteria designed to identify studies capable of informing the first research question. Screening was conducted at the title and abstract level using four criteria.

First, the study population or data source needed to clearly relate to Māori adults in Aotearoa New Zealand. This ensured that the evidence considered was directly relevant to the population of interest and reflected the social, health system, and epidemiological context in which Māori health outcomes occur. Studies focusing on other populations or international contexts were excluded unless Māori-specific results were clearly reported.

Second, the study needed to focus on a major chronic condition, including diabetes, cardiovascular disease, cancer, or chronic kidney disease. These conditions represent a substantial proportion of morbidity and mortality among Māori and are central to understanding long-term health trajectories. Studies focused on COVID-19 or accident and injury-related outcomes were excluded as these reflect different epidemiological dynamics and were outside the scope of the research question.

Third, the study needed to report a measurable health outcome, such as incidence, mortality, survival, disease burden, complications, or hospitalisation. This requirement ensured that the literature identified provided empirical evidence on health outcomes rather than focusing solely on service delivery, policy commentary, descriptive health system issues, or subjective accounts of health loss — including spiritual, relational, or experiential dimensions that, while meaningful within a Kaupapa Māori understanding of hauora, are not directly operationalisable as measures of health loss using administrative data.

Fourth, the abstract needed to signal the potential to identify favourable Māori health outcomes or provide an analytic framing capable of supporting the identification of best-performing individuals or groups. These included studies reporting comparatively favourable outcomes such as lower incidence, lower mortality, improved survival, or parity with non-Māori populations as well as analyses examining variation in outcomes within populations.

Studies investigating determinants, risk factors, treatment adherence, or protective factors associated with improved outcomes were also retained where these could plausibly contribute to understanding why some Māori experience more favourable health trajectories than others.

Following title and abstract screening, seven articles were selected for full-text review. These articles were identified as most likely to inform the research question by either reporting health outcomes for Māori in Aotearoa New Zealand, examining ethnic differences in chronic disease outcomes, or analysing determinants that could plausibly contribute to favourable Māori health trajectories:

1. **Agban et al. (2008)** examined trends in the management of diabetes complication risk across ethnic groups in New Zealand primary care, providing evidence on treatment and monitoring patterns relevant to diabetes outcomes
2. **Elley et al. (2008)** analysed cardiovascular risk management among patients with type 2 diabetes in New Zealand primary care, comparing the management of cardiovascular risk factors across ethnic groups including Māori
3. **Krishnan et al. (2018)** identified a genetic variant associated with increased body mass index but reduced risk of type 2 diabetes among Māori and Pacific populations, highlighting a potential protective biological factor
4. **Parkin et al. (2021)** explored barriers and facilitators to metformin adherence and persistence among people with type 2 diabetes in New Zealand, including Māori participants, providing insight into behavioural factors influencing medication use
5. **Rush et al. (2009)** analysed metabolic risk and dysglycaemia within a Māori cohort, identifying anthropometric thresholds associated with diabetes risk
6. **Teng et al. (2019)** investigated factors associated with progression from pre-diabetes to diabetes using linked administrative data, identifying protective factors that may contribute to more favourable disease trajectories
7. **Williams et al. (2017)** compared face-to-face and telephone delivery of the Green Prescription programme among Māori and New Zealand Europeans with type 2 diabetes, examining differences in participation and health-related outcomes.

Three additional articles were retained for full-text review because they provided contextual evidence on determinants, treatment patterns, or disease distribution relevant to chronic disease outcomes among Māori in Aotearoa New Zealand. Although these studies did not directly examine favourable outcomes, they provided supporting evidence on factors that may influence variation in health trajectories and were therefore considered relevant to interpreting the research question.

The additional studies were as follows:

1. **Aminisani et al. (2020)** analysed sociodemographic and lifestyle factors associated with multimorbidity in New Zealand adults, offering broader contextual insight into determinants of chronic disease outcomes
2. **Chepulis et al. (2020)** examined the association between metformin adherence and glycated haemoglobin (HbA1c) levels in patients with type 2 diabetes in New Zealand, providing evidence on treatment adherence and variation in glycaemic outcomes
3. **Wong et al. (2016)** assessed ethnic variation in diabetes prevalence among patients presenting with acute stroke and transient ischaemic attack in Northland, providing information on diabetes distribution across ethnic groups.

Question 2: What distinguishes Māori with the most favourable outcomes from Māori with the most adverse outcomes?

Across all search strings and databases, 389 records were identified for Question 2. After duplicate removal, 208 unique records retained. Although this total was similar to that obtained for Question 1, the underlying records were not identical, reflecting differences in the search strings used. Some articles appeared in both search sets, while others were unique to each question.

The remaining records were then screened using predefined criteria designed to identify studies capable of informing Question 2, which examines factors associated with favourable and adverse health outcomes among Māori. Screening was conducted at the title and abstract level using four criteria.

The same first three screening criteria used for Question 1 were applied to the Question 2 searches. These criteria required the following:

1. The study population related to Māori in Aotearoa New Zealand
2. The study focused on major chronic conditions including diabetes, cardiovascular disease, cancer, or chronic kidney disease
3. The study reported measurable health outcomes such as incidence, mortality, survival, complications, disease burden, or hospitalisation.

Fourth, the study needed to examine factors associated with variation in outcomes, including sociodemographic characteristics, health behaviours, clinical management, access to care, or other determinants capable of influencing health trajectories. Studies that compared Māori with non-Māori populations or analysed determinants of favourable or adverse outcomes were prioritised.

Following title and abstract screening, fifteen articles were selected for full-text review. These articles were identified as most likely to inform the second research question by examining factors associated with favourable or adverse health outcomes among Māori in Aotearoa New Zealand, including differences in disease management, treatment access, adherence, and survival outcomes across major chronic conditions.

The 15 retained articles were as follows:

1. **Agban et al. (2008)** examined trends in the management of diabetes complication risk across ethnic groups in New Zealand primary care, providing evidence on treatment patterns associated with later outcome variation
2. **Chepulis et al. (2020)** examined the association between metformin adherence and glycated haemoglobin (HbA1c) levels in patients with type 2 diabetes in New Zealand, providing evidence on treatment adherence and variation in glycaemic outcomes
3. **Elley et al. (2008)** analysed cardiovascular risk management among patients with type 2 diabetes in New Zealand primary care, providing evidence on ethnic differences in preventive care and clinical management
4. **Horsburgh et al. (2019)** examined adherence to metformin monotherapy among people with type 2 diabetes in New Zealand, providing evidence on medication-taking behaviour as a determinant of diabetes outcomes
5. **Huria et al. (2018)** analysed dialysis-related practices and outcomes in Aotearoa New Zealand using a Kaupapa Māori framework, providing evidence on inequities in treatment and survival between Māori and non-Māori
6. **Joshy et al. (2009)** examined the prevalence of diabetes in New Zealand general practice, providing evidence on the influence of ethnicity and social deprivation on diabetes burden
7. **Lao et al. (2016)** examined differences in survival between Māori and New Zealand Europeans with prostate cancer, providing evidence on ethnic variation in cancer outcomes
8. **McAuley et al. (2003)** described the implementation of a lifestyle intervention programme for New Zealand Māori to reduce the risk of type 2 diabetes and cardiovascular disease, providing evidence on modifiable factors linked to favourable health trajectories

9. **McKenzie et al. (2011)** investigated reasons for ethnic inequalities in breast cancer survival in New Zealand, providing evidence on factors that may explain adverse outcomes among Māori
10. **Murphy et al. (2003)** described the design and implementation of a lifestyle intervention programme to prevent type 2 diabetes in New Zealand Māori, providing evidence on culturally tailored approaches to improving chronic disease risk
11. **Priest et al. (2010)** examined determinants of inequalities in cervical cancer stage at diagnosis and survival in New Zealand, providing evidence on factors associated with adverse outcomes across ethnic groups
12. **Robinson et al. (2006)** examined ethnic differences in type 2 diabetes care and outcomes in a multiethnic Auckland community, providing direct evidence on disparities in diabetes management and health outcomes
13. **Seneviratne et al. (2015)** examined ethnic differences in breast cancer survival in New Zealand, providing evidence on the contribution of screening, treatment, tumour biology, demographics, and comorbidities to outcome variation
14. **Wang et al. (2013)** examined outcomes after coronary artery bypass grafting in New Zealand, providing evidence that Māori experienced poorer post-surgical outcomes than Europeans
15. **Williams et al. (2017)** compared face-to-face and telephone delivery of the Green Prescription programme among Māori and New Zealand Europeans with type 2 diabetes, examining differences in participation and health-related outcomes.

Six additional articles were retained for full-text review because they examined determinants or treatment patterns associated with chronic disease outcomes among Māori in Aotearoa New Zealand and therefore had the potential to inform analysis of factors associated with favourable or adverse health trajectories.

The six additional articles were as follows:

1. **Collins (2010)** examined kidney disease among Māori and Pacific peoples in New Zealand, providing evidence on the burden and clinical characteristics of chronic kidney disease in Indigenous populations

2. **Haeusler et al. (2014)** examined the prevalence of low vitamin B12 status among people with type 2 diabetes receiving metformin therapy in New Zealand, providing evidence on treatment-related metabolic effects associated with long-term metformin use
3. **McLeod et al. (2010)** examined disparities in cervical cancer survival between Māori and non-Māori women in New Zealand, providing evidence on factors influencing ethnic differences in cancer outcomes
4. **Obertová et al. (2015)** examined prostate-specific antigen (PSA) screening and follow-up investigations among Māori and non-Māori men in New Zealand, providing evidence on ethnic differences in prostate cancer screening pathways and diagnostic follow-up
5. **Rush et al. (2009)** examined optimal waist circumference thresholds for identifying dysglycaemia and metabolic risk in a Māori cohort, providing evidence on metabolic risk factors associated with the development and progression of type 2 diabetes
6. **Seneviratne et al. (2015)** examined ethnic differences in breast cancer survival in New Zealand, analysing the contributions of screening, treatment, tumour biology, demographics, and comorbidities to outcome variation.

Step 5. Report Results

The findings from the full-text review of the retained articles are presented below. The retained studies were examined to determine whether the existing literature provides evidence relevant to the research questions guiding this study.

Question 1

Across the retrieved records, the literature relating to Māori and major chronic health conditions focuses primarily on ethnicity-group comparisons, risk factor management, or determinants of disease progression, rather than analyses capable of identifying Māori with outcomes at the favourable end of the distribution across both Māori and non-Māori.

Several studies examined clinical management or behavioural determinants associated with diabetes outcomes. For example, research conducted in New Zealand primary care settings examined the management of diabetes complication risk factors and cardiovascular risk among patients with type 2 diabetes across different ethnic groups, demonstrating variation in monitoring and treatment patterns relevant to future health outcomes (Agban et al., 2008; Elley et al., 2008). Similarly, qualitative research examining metformin adherence among people with type 2 diabetes identified barriers and facilitators influencing medication persistence, highlighting behavioural and health-system factors that may shape disease

management trajectories (Parkin et al., 2021). Evidence from observational studies also examined adherence to lifestyle or exercise-based interventions among Māori and non-Māori participants with type 2 diabetes, showing differences in programme participation and health-related outcomes across intervention delivery models (Williams et al., 2017).

Other studies examined biological or metabolic determinants associated with diabetes risk and progression. For example, research investigating waist circumference thresholds in a Māori cohort identified anthropometric indicators associated with dysglycaemia and metabolic risk (Rush et al., 2009). In addition, analysis of linked health and social administrative data explored factors associated with progression from pre-diabetes to diabetes, identifying protective characteristics associated with lower progression risk (Teng et al., 2019). Genetic research also identified a CREBRF variant associated with increased body mass index but reduced risk of type 2 diabetes among Māori and Pacific peoples, suggesting the presence of biological mechanisms that may influence diabetes risk profiles (Krishnan et al., 2018).

The contextual studies similarly emphasised determinants or risk distribution rather than favourable outcome identification. For example, research examining multimorbidity among New Zealand adults identified associations between sociodemographic characteristics, lifestyle factors, and the presence of multiple chronic conditions (Aminisani et al., 2020). Other studies examined treatment adherence and glycaemic control among people with type 2 diabetes (Chepulis et al., 2020) and the prevalence of diabetes among patients presenting with stroke or transient ischaemic attack in Northland, including variation across ethnic groups (Wong et al., 2016).

Taken together, these studies demonstrate that the existing literature can document risk factors, determinants of disease progression, and differences in clinical management across ethnic groups. However, none directly address Question 1 as posed and none included analyses designed to identify Māori individuals whose outcomes are among the most favourable observed across a population distribution.

Question 2

Across the retrieved records for Question 2, the literature is largely characterised by ethnicity-group comparisons and multivariable predictor epidemiology, rather than study designs that deliberately separate Māori with favourable and adverse outcomes and then examine what distinguishes them. In most studies, Māori are treated as an exposure category or analytic covariate within condition-specific cohorts, and interpretation focuses primarily on measuring or explaining inequalities between Māori and non-Māori populations.

Within the retrieved set, several studies examined clinical management or treatment-related factors associated with outcomes. For example, research conducted in New Zealand primary care examined the management of diabetes complication risk factors and cardiovascular risk among patients with type 2 diabetes across ethnic groups, demonstrating variation in monitoring, treatment practices, and preventive care relevant to future outcomes (Agban et al., 2008; Elley et al., 2008). Studies examining medication use and adherence similarly identified behavioural and health-system factors that may influence disease trajectories. Research analysing adherence to metformin therapy demonstrated associations between medication adherence and glycaemic outcomes among patients with type 2 diabetes (Chepulis et al., 2020), while additional work examining adherence to metformin monotherapy provided further evidence on medication-taking behaviour as a determinant of diabetes outcomes (Horsburgh et al., 2019).

Other studies examined health-system processes and care pathways associated with chronic disease outcomes. For example, analyses of diabetes care in a multiethnic Auckland community documented differences in monitoring, treatment, and risk factor control across ethnic groups (Robinson et al., 2006). Research examining diabetes prevalence in New Zealand general practice similarly identified variation in disease burden associated with ethnicity and socioeconomic deprivation (Joshy et al., 2009). Studies examining intervention-based approaches also identified modifiable determinants of disease risk, including lifestyle interventions designed to reduce diabetes and cardiovascular risk among Māori communities (McAuley et al., 2003; Murphy et al., 2003) as well as differences in participation and health-related outcomes across alternative delivery modes of the Green Prescription programme for people with type 2 diabetes (Williams et al., 2017).

Several studies also examined clinical outcomes for other major chronic conditions, particularly cancer and cardiovascular disease. For example, analyses of prostate cancer survival documented differences in outcomes between Māori and New Zealand Europeans (Lao et al., 2016), while research examining breast cancer outcomes identified multiple contributing factors to ethnic differences in survival, including screening participation, treatment patterns, tumour characteristics, and comorbidities (McKenzie et al., 2011; Seneviratne et al., 2015). Similarly, studies examining cardiovascular disease outcomes reported poorer outcomes following coronary artery bypass grafting among Māori compared with Europeans in New Zealand (Wang et al., 2013). Research examining cervical cancer outcomes also identified determinants of disparities in stage at diagnosis and survival between Māori and non-Māori women (Priest et al., 2010).

The contextual studies similarly emphasised risk factors, service pathways, or disease burden rather than outcome-based subgroup identification. For example, research examining kidney disease among Māori and Pacific peoples documented the epidemiology and clinical burden of chronic kidney disease in these populations (Collins, 2010). Other studies examined treatment-related metabolic effects associated with long-term metformin therapy (Haeusler et al., 2014), disparities in cervical cancer survival between Māori and non-Māori women (McLeod et al., 2010), and ethnic differences in prostate cancer screening pathways (Obertová et al., 2015). Research examining metabolic risk in a Māori cohort also identified anthropometric thresholds associated with dysglycaemia and diabetes risk (Rush et al., 2009).

Taken together, the Question 2 returns show that while the literature identifies several plausible determinants associated with chronic disease outcomes—including treatment adherence, preventive care, clinical management, screening participation, and service pathways—it does not address the research question as posed. Specifically, none of the reviewed studies adopts a design that deliberately separates Māori with the most favourable outcomes from those with the most adverse outcomes and then examines the factors that distinguish these groups.

More specifically, none of the identified studies provides a method for the following:

1. Reproducibly identifying a subgroup of Māori with favourable outcomes for a given chronic condition
2. Defining a comparable group of Māori with adverse outcomes
3. Estimating differences between these groups using a clearly specified analytic framework, such as positive deviance, extreme-outcome design, quantile or threshold benchmarking, or joint mortality–morbidity classification.

Where studies do individualise outcomes, they typically do so indirectly—for example through genetic or pharmacogenetic explanations—rather than through empirical analyses designed to compare Māori with the best and worst outcomes within the same population. As a result, the existing literature provides important insight into determinants of health inequalities but does not provide a reproducible framework for identifying Māori with favourable outcomes or for systematically analysing the factors associated with those outcomes.

Consolidated Findings from the Literature Review

The literature review shows that while the Māori health literature is methodologically strong in documenting health inequalities, it remains primarily oriented toward ethnicity-level comparisons rather than individual-level outcome analysis. Most studies estimate differences

between Māori and non-Māori in disease incidence, clinical management, care pathways, and survival outcomes across major chronic conditions. This approach has been central to a large body of Māori health research and has played an important role in documenting structural inequities within the health system.

Across the studies identified in this review, research most commonly focuses on risk factors, determinants of disease progression, treatment adherence, and differences in service access or clinical management across ethnic groups. For example, studies examining diabetes management and cardiovascular risk among patients with type 2 diabetes document variation in monitoring, treatment practices, and preventive care across ethnic groups (Agban et al., 2008; Elley et al., 2008). Other studies examine behavioural determinants such as medication adherence (Chepulis et al., 2020; Horsburgh et al., 2019) or participation in lifestyle interventions designed to reduce diabetes and cardiovascular risk (McAuley et al., 2003; Murphy et al., 2003; Williams et al., 2017). Research examining cancer and cardiovascular outcomes similarly documents ethnic differences in survival, screening participation, stage at diagnosis, and treatment pathways (Lao et al., 2016; McKenzie et al., 2011; Seneviratne et al., 2015; Wang et al., 2013; Priest et al., 2010).

While these studies provide important insight into determinants of health inequalities and the functioning of health systems, they do not examine variation in outcomes within Māori populations. Instead, Māori are typically analysed as a single exposure group or analytic category within broader population comparisons. As a result, the literature provides limited insight into whether some Māori experience outcomes that are comparable to, or better than, those observed elsewhere in the population distribution.

Across the reviewed studies, favourable outcomes for Māori are rarely the primary analytical focus. When favourable outcomes are observed, they are typically reported incidentally within broader analyses of ethnic differences. More importantly, none of the reviewed studies provides a reproducible methodological framework for identifying Māori individuals or subgroups with favourable outcomes and comparing them with Māori experiencing adverse outcomes for the same condition.

This absence reflects an important methodological gap. While the literature identifies several plausible determinants of health outcomes—including treatment adherence, clinical management, screening access, lifestyle factors, and service-level variation—it does not apply study designs capable of systematically identifying Māori with the most favourable outcomes and examining the factors that distinguish them from those experiencing poorer outcomes.

Consequently, the existing literature provides strong evidence on population-level inequalities and determinants of disease progression, but it does not address the central analytical problem posed in this study: how to identify Māori individuals with the most favourable outcomes for a given chronic condition and compare them with Māori experiencing the most adverse outcomes using a transparent and reproducible framework.

Part 3. Chapter Overview

This part provides a concise chapter-by-chapter overview of the thesis.

Chapter 1. The Origin of this Study

Chapter 1 introduces the problem addressed in this thesis and establishes the rationale for its research questions and methodological approach. Part 1 draws on two formative professional initiatives to demonstrate how population-average approaches can obscure important variation in individual outcomes, including the presence of Māori with comparatively favourable outcomes within systems characterised by inequality. These insights motivate core research questions focused on identifying Māori with favourable and adverse outcomes for major chronic conditions and understanding what distinguishes them. Part 2 reports the findings of a literature review, which concludes that existing research has not addressed the research questions. The review shows that while Māori health scholarship documents inequalities using ethnicity-level comparisons, it does not provide reproducible methods for identifying Māori with among the most favourable outcomes or for systematically comparing Māori with favourable and adverse outcomes for the same condition. Part 3 concludes the chapter by outlining the overall structure of the thesis.

Chapter 2. The Methodological Foundations of This Study

Chapter 2 establishes the philosophical, methodological, and ethical foundations that underpin the research. It sets out the research philosophy guiding the study by articulating a constructivist ontology; a pragmatic epistemology; and a Kaupapa Māori (Māori approach or Māori ideology incorporating the knowledge, skills, attitudes and values of Māori society) axiology and by explaining how these positions shape the use of quantitative, IDI-based methods. It also situates the study within Mode 2 knowledge production, framing the research as problem-driven, transdisciplinary, contextually grounded, and accountable, and it demonstrates how this orientation aligns with Kaupapa Māori Research commitments to equality, transformation, and Treaty-based responsibility. This chapter then translates these foundations into practice by detailing how Māori expectations of credibility, reliability, intimacy, and low self-orientation are enacted throughout the thesis to ensure that

methodological rigour is matched by ethical integrity and accountability to iwi (tribe or large group of people descended from a common ancestor and associated with a distinct territory) and hapū (subtribe or section of a large kinship group and the primary political unit in traditional Māori society).

Chapter 3. The Methodological Approach of This Study

Chapter 3 sets out the guiding methodological approach and research design for the thesis. It introduces Structured Problem Solving (SPS) as the overarching, hypothesis-driven framework used to define outcome gaps, structure questions, and generate evidence-based responses. The chapter then presents a process-oriented model of health developed for this study, which links determinants, biological processes, and layered impacts in a way that can be operationalised using administrative data while remaining aligned with Kaupapa Māori Research. Finally, it details the quantitative research design, including condition selection, population definition, comparator groups, outcome measures, and analytic sequencing, establishing the foundation for the empirical analyses that follow.

Chapter 4. Measuring Fatal and Non-Fatal Burden

Chapter 4 explains how the impact of DI is measured using individual-level fatal and non-fatal burden measures and metrics. It defines the target population and justifies the selection of DI as the in-scope medical condition through a structured, outcome-focused process grounded in epidemiological and Kaupapa Māori Research. It finalises the research questions and then details the measurement of mortality and morbidity, introducing Years of Life Lost (YLL); Years of Life Lost to Disability (YLLD); and a joint-burden matrix used to preserve and integrate these dimensions without reliance on composite summary measures. Finally, it documents the process of gaining access to the Integrated Data Infrastructure (IDI) and describes the datasets used to operationalise these measures at a national scale.

Chapter 5. Calculating YLL, YLLD, and Joint Burden

Chapter 5 documents the steps taken to calculate individual-level YLL, YLLD, and joint-burden for Māori and non-Māori adults who died of DI. It sets out the procedures used to establish YLL from mortality data and national life tables, applying a single benchmark across all individuals. The chapter then details the calculation of YLLD from DI without complications and from DI with one or more complications, drawing on linked administrative health data, structured diagnostic inclusion criteria, and disability weights to quantify cumulative non-fatal burden over time. Finally, it describes how individual-level YLL and YLLD are combined into a joint-burden matrix using population-wide quartile rankings to classify favourable and adverse

outcome profiles, thereby producing the framework used consistently across all study years and in subsequent analyses.

Chapter 6. Findings on YLL, YLLD, and Joint Burden

Chapter 6 presents the empirical findings on fatal and non-fatal burden from DI for Māori and non-Māori and answers the first research question. The chapter describes the cohort composition and demonstrates that Māori experience consistently higher population-based burden ratios (PBRs) for DI-attributable mortality across all study years. It then reports total YLL and YLLD, showing that Māori contribute a disproportionate share of both premature mortality and lived disability relative to population size. Building on these totals, the chapter examines quartile distributions of YLL and YLLD to reveal how burden is structured across individuals. It then integrates fatal and non-fatal burden using a joint-burden matrix, which identifies Māori with favourable and adverse outcome profiles and establishes the empirical basis for subsequent within-Māori comparative analyses.

Chapter 7. Methodology for Comparing Similarities and Differences Among Māori

Chapter 7 sets out the methodological approach used to answer the second research question regarding whether, and in what ways, Māori with favourable outcomes differ from Māori with adverse outcomes. The chapter first describes a structured, hypothesis-driven process for identifying plausible determinants of outcome variation, beginning with a comprehensive issues tree adapted from an international determinants framework and refined to foreground upstream, Treaty-based, and Kaupapa Māori Research priorities. This process combines systematic hypothesis generation, a targeted literature review, and explicit assessment of IDI data availability to produce a final set of empirically testable hypotheses relating to deprivation, income, cultural identity, health literacy, and geographic locale. The chapter then details the statistical methods used to test these hypotheses in the IDI, including non-parametric difference testing, equivalence testing using pre-specified smallest effect sizes of interest, a coverage threshold to preserve generalisability, and tipping-point analyses to assess robustness. Together, these methods provide a transparent framework for distinguishing meaningful differences, meaningful similarities, and genuinely inconclusive findings, establishing the analytic foundation for the results and interpretation presented in Chapter 8.

Chapter 8. Results of Determinant Analyses Across Māori

Chapter 8 reports the empirical results of the determinant analyses comparing Māori with favourable outcomes and Māori with adverse outcomes. The chapter presents non-parametric

Mann–Whitney U test results assessing whether distributions of deprivation, income, cultural identity, health literacy, and geographic locale differed between the two groups across the five study years. It then reports the results of determinant-specific equivalence testing and tipping-point analyses for those contrasts that met pre-specified coverage criteria and did not show statistically significant differences in the initial tests. Finally, the chapter integrates evidence from both difference and equivalence analyses to identify where the data support meaningful differences, practical similarity, or genuinely inconclusive findings. Together, the results show that commonly cited contextual determinants do not display large, consistent gradients between Māori with favourable and adverse joint outcomes, providing the empirical basis for discussion in Chapter 9.

Chapter 9. Study Limitations, Implications, and Final Reflections

Chapter 9 concludes the thesis by outlining study limitations and by drawing out the implications of the findings and reflecting on the significance of this work. It sets out the key limitations of the study, including constraints associated with YLLD calculation, generalisability, quantitative design choices, and persistent Māori data gaps. The chapter then interprets the implications of the results by focusing on the thesis's epidemiological contributions (particularly individual-level burden measurement and joint-outcome classification) and the relevance of these tools for Māori health accountability and burden-of-disease measurement. Finally, it considers what follows if the empirical findings are treated as consequential, outlining implications for Māori Treaty Partners and whānau (extended family or the primary economic unit of traditional Māori society); future research; public policy; and health services.

Conclusion

Chapter 1 shows that while Māori health inequalities are well evidenced, existing research is not designed to identify Māori individuals with favourable outcomes or to compare them systematically with Māori experiencing adverse outcomes for the same condition. This gap is not one of data availability, but of analytical orientation. Addressing this gap requires a methodological approach capable of identifying, classifying, and comparing outcomes at the individual level in ways that are transparent, reproducible, and accountable to Māori priorities.

Chapter 2. The Methodological Foundations of This Study

This chapter sets out the methodological foundations of the study and is organised into three parts. Part 1 describes the research philosophy underpinning the study. Part 2 introduces Mode 2 knowledge production as a framing for problem-driven research. Part 3 defines the behaviours of a Kaupapa Māori Researcher and describes how these behaviours are enacted in practice.

Part 1. The Research Philosophy of This Study

A research philosophy encompasses a scholar's ontological, epistemological, and axiological beliefs about research and knowledge. Ontology concerns the nature of reality and asks how we know that something exists. Epistemology concerns knowledge and knowing and asks how we know what we know. Axiology concerns the role of values in research and asks how values shape the research we undertake.

Major Research Philosophies

As a framework for clarifying my research philosophy, four widely recognised philosophies are summarised briefly below. These summaries are not intended as exhaustive accounts but as context for the research approach adopted in this thesis.

Positivism

Positivists hold the ontological position that there is a single reality that exists independently of people's experiences (Guba & Lincoln, 1994). If three positivist researchers observed the same event under the same circumstances, they would expect to see the same thing. Epistemologically, positivists argue there is no need to interact with participants, and axiologically they emphasise objectivity and replicability. Methodologically, they tend to use deduction and quantitative data to test a priori hypotheses about relationships between variables (Guba & Lincoln, 1994).

Constructivism

Constructivists argue that multiple realities exist, and these are shaped by individuals' unique life experiences (Guba & Lincoln, 1994). If five people observed the same event, a constructivist would expect each to perceive it differently, reflecting their diverse backgrounds and contexts. Epistemologically, constructivism holds that researchers must engage closely with participants to understand these varied perspectives. Axiologically, it emphasises that

values are inseparable from observation and that research value lies in the breadth and depth of knowledge co-constructed through interaction with participants (Guba & Lincoln, 1994). Methodologically, constructivists favour inductive, predominantly qualitative designs that build theory grounded in individual and group experiences (Creswell & Creswell, 2018).

Transformativism

Transformativists share the constructivist view that multiple socially constructed realities exist, but they emphasise differences between groups with and without power (Mertens, 2007). For example, they believe that a factory owner and a worker would interpret the same event differently. Epistemologically and axiologically, transformativists believe researchers should be actively involved in their work, co-creating knowledge with participants in ways that empower marginalised groups (Mertens, 2007). They also believe that value lies in redressing inequalities and fostering change (Creswell & Creswell, 2018). Methodologically, they favour participatory action research and mixed methods to both understand and alter lived realities (Denscombe, 2007; Mertens, 2007).

Pragmatism

Pragmatists adopt whichever ontology, epistemology, axiology, or method they believe best addresses real-world problems (Creswell & Plano Clark, 2017). They may use a positivist ontology alongside a transformativist axiology if this maximises their impact on an important issue (Morgan, 2007). Methodologically, pragmatists often use mixed methods, arguing that both quantitative and qualitative data are needed to address pressing social problems (Creswell & Creswell, 2018).

My Research Philosophy

My research approach draws selectively from different philosophical paradigms as set out below.

Ontology

I have a constructivist ontology. I believe that perceptions, which are shaped by life experience, are not static. For example, my views about why senior executives avoid articulating their Treaty obligations have changed over two decades of public service experience. I also believe that individuals with similar life experiences may focus on different issues when observing the same event.

Epistemology

I have a pragmatic epistemology. For me, research has value if it can help resolve pressing problems and improve people's lives. Moreover, as a pragmatist, I do not believe my constructivist ontology requires a constructivist epistemology or axiology, particularly if such alignment would limit the real-world impact of research.

Axiology

I identify as both a pragmatist and a Kaupapa Māori Researcher. Alongside using structured problem-solving (SPS) in my work, I am guided by the values and responsibilities of being a Kaupapa Māori Researcher. These values shape how I define problems, approach evidence, and interpret findings.

Linking Philosophy to Method

My philosophy is operationalised through a problem-driven, pragmatic approach that is situated explicitly within a Mode 2 knowledge production framework. This framework is discussed next.

Part 2. Mode 2 Knowledge Production and Alignment to Kaupapa Māori Research

This thesis adopts a methodological stance consistent with Mode 2 knowledge production. Mode 2 research is problem-driven, transdisciplinary, socially accountable, and reflexive (Gibbons et al., 1994). In Mode 2 research, value is assessed in terms of methodological rigour, relevance, practical utility, and legitimacy in the real-world (Gibbons et al., 1994; Nowotny et al., 2001). This stands in contrast to Mode 1 knowledge production, which is discipline-based, investigator-led, and evaluated primarily through academic peer review and internally defined scholarly standards (Gibbons et al., 1994; Nowotny et al., 2001).

Alignment With Kaupapa Māori Research

While originating outside Indigenous contexts, Mode 2 offers an approach that is aligned with the aspirations of Māori scholars, including that research should be oriented toward practical benefit, collective wellbeing, and systemic change (Smith, 1997; Smith, 2012).

Co-Production of Knowledge

A central tenet of Mode 2 is the co-production of knowledge. Expertise is distributed, and valuable knowledge emerges from collaboration between researchers, practitioners, policymakers, and communities (Gibbons et al., 1994; Nowotny et al., 2001).

Kaupapa Māori Research similarly rejects Māori as passive research subjects and instead positions Māori as agenda-setters who define research priorities and judge research value in terms of benefit and accountability to Māori communities (Smith, 2012).

While this thesis does not claim to fully realise co-production given its reliance on IDI data and a university-led design, it adopts co-production as a guiding ideal. The study is framed as a tool to help iwi and hapū scrutinise Crown performance. Its measures, metrics, and analyses were also deliberately selected to be usable by Māori Treaty Partners rather than academic audiences.

Transdisciplinarity

Mode 2 is transdisciplinary because it integrates and flexibly draws on multiple disciplines to address complex problems in the context of application (Nowotny et al., 2001; Hessels & van Lente, 2008). This thesis is transdisciplinary because it combines:

1. Epidemiological metrics
2. Kaupapa Māori Research principles
3. Structured problem-solving methods.

The development of a process-oriented model of health (discussed in Chapter 3) and the adaptation of IDI administrative data for Kaupapa Māori Research ends exemplify how transdisciplinary methods can generate insights that are both technically robust and culturally grounded.

Contextualisation

Another hallmark of Mode 2 is contextualisation. Knowledge must be evaluated in relation to the setting in which it is produced (Nowotny et al., 2001).

The context for this study is the persistent inequality in health outcomes between Māori and non-Māori in Aotearoa New Zealand and the accountability of the Crown under Te Tiriti o Waitangi (the Māori language version of the Treaty of Waitangi) to pursue equal health outcomes and to take equitable action when outcomes are unequal.

In this thesis, an equal health outcome occurs when a Māori health outcome is statistically indistinguishable from the corresponding non-Māori outcome. An equal action means delivering the same response to all groups, whereas an equitable action refers to a differentiated response that is proportionate to need and aimed at achieving equal outcomes. These distinctions matter because a uniform response can be inadequate, and potentially inconsistent with Treaty obligations, if it leaves outcome inequalities unchanged.

Reflexivity and Accountability

Mode 2 also emphasises reflexivity. Researchers must interrogate their own assumptions and the implications of their work (Nowotny et al., 2001; Hessels & van Lente, 2008). This emphasis aligns closely with Kaupapa Māori Research, where reciprocity, accountability, and responsibility to Māori communities are foundational principles (Smith, 1997; Moewaka Barnes et al., 2008).

In this study, reflexivity required an explicit acknowledgement of the risks associated with using Crown administrative data, including the Integrated Data Infrastructure (IDI). These data were not collected for Kaupapa Māori research purposes; Māori individuals and communities did not directly consent to their use in this project; and data governance and stewardship remain primarily with the Crown. As a result, IDI-based research carries well-documented risks, including the potential to obscure the historical and structural determinants of inequality if data are treated as neutral or purely technical artefacts (Walter & Andersen, 2013; Kukutai & Taylor, 2016; Kukutai & Cormack, 2020).

Despite these risks, the IDI remains Aotearoa New Zealand's largest cross-sector linked microdata resource available for approved research (Milne et al., 2019). While this study does not resolve the limitations of the IDI, it is designed to minimise extractive harm and maximise benefit by applying Kaupapa Māori Research principles to the framing, analysis, and reporting of IDI data (Smith, 2012; Hudson et al., 2010). This is discussed further in Part 3 of this Chapter.

Critiques of Mode 2 and Study Safeguards

Mode 2's emphasis on application, relevance, and contextual accountability has attracted critique, including that without explicit ethical grounding, Mode 2 approaches can be co-opted to serve institutional, managerial, or commercial priorities rather than the interests of affected communities (Ziman, 2000). In health research, this risk includes prioritising efficiency, innovation, or system performance over health outcomes, equality, and equity.

This critique underscores that methodological rigour alone is insufficient to confer ethical legitimacy or achieve meaningful change, particularly in Indigenous contexts shaped by Treaty obligations. This study responds to these critiques through the following safeguards:

1. Rejecting a Mode 1 production of knowledge in which Māori health inequalities can be treated as detached academic phenomena
2. Using SPS to define and analyse real-world problems in ways that are explicitly oriented toward Māori priorities

3. Developing new quantitative metrics to operationalise Māori health need in transparent and reproducible ways
4. Embedding Kaupapa Māori Research behaviours that foreground accountability to Māori communities and Māori Treaty Partners and that require methodological choices to be assessed not only for technical strength but also for impact.

The Kaupapa Māori Research behaviours underpinning this study are outlined in the following section. SPS is presented in Chapter 3, and the development of new metrics is detailed in Chapter 4.

Part 3. Kaupapa Māori Health Research Behaviours

Kaupapa Māori Research is not defined by a single method. Instead, it is grounded in values, relationships, and obligations that underpin the production of knowledge (Pihama, 2010; Smith, 1997; Smith, 2012). This includes an explicit commitment to avoid a deficit-only framing of Māori health. Accordingly, the thesis is designed to identify and learn from both adverse outcomes and favourable outcomes among Māori while still supporting Treaty-based accountability. The sections that follow describe how these behaviours are enacted.

The Trust Equation

The Trust Equation defines trust as the sum of an individual's credibility, reliability, and intimacy divided by their self-orientation (Maister et al., 2000) (Figure 3).

Figure 3: Trust Equation

$$\text{Trust} = \frac{\text{Credibility} + \text{Reliability} + \text{Intimacy}}{\text{Self-orientation}}$$

Used as a heuristic, the Trust Equation provides a structured way to organise how Kaupapa Māori Research commitments are enacted in practice without displacing the relational frameworks that are central to Kaupapa Māori Research inquiry.

Credibility

In the Trust Equation, credibility refers to the perception of competence, knowledge, and sound judgment. It is established when a researcher communicates clearly and demonstrates expertise grounded in evidence and reasoned argument (Maister et al., 2000).

In Kaupapa Māori Research, credibility is not limited to technical competence; it is relational, political, and cultural, and it depends on whether Māori communities can see their values, aspirations, and authority reflected in research.

Kaupapa Māori Research must uphold mātauranga (Māori knowledge or wisdom), te reo (Māori language), and tikanga (correct procedure, custom) as foundational rather than peripheral. As Pihama (2010) and Smith (1997, 2012) detail, this is enacted through four relational commitments: demonstrating aroha ki te tangata (an ethical orientation toward people that foregrounds respect, care, humility, and relational responsibility); enacting manaakitanga (an ethic of care, generosity, and responsibility that obliges researchers to uphold the mana of others through reciprocity and the provision of benefit, rather than extraction or exploitation); exercising kia tūpato (an ethic of caution, reflexivity, and restraint that requires researchers to anticipate risk, recognise power, and act carefully to avoid harm or misrepresentation); and prioritising whakawhanaungatanga (the active process of establishing, nurturing, and sustaining relationships through shared connection and mutual obligation, rather than transactional or extractive engagement).

In this framing, credibility is earned through legitimate relationships, ethical conduct, and responsiveness to iwi and hapū priorities. It is not enough to be technically or methodologically proficient. Research must also contribute to tino rangatiratanga; demonstrate integrity to Māori partners; and produce findings that strengthen collective wellbeing (Smith, 1997; Hudson et al., 2010).

Reliability

In the Trust Equation, reliability refers to consistency both in delivering on tasks (rational reliability) and in how people are treated (emotional reliability) (Maister et al., 2000).

In Kaupapa Māori Research, reliability goes further. It means not only being dependable in procedures, but also in upholding relational and ethical commitments to Māori communities. This includes acting transparently; following through on commitments; and ensuring Māori participants and partners are safe, informed, and respected throughout the research process (Smith, 1997; Moewaka Barnes et al., 2008). It also involves demonstrating that Māori knowledge and interests are treated with care and protection and are guided by values such as manaakitanga; whakapono (an ethic of integrity, truthfulness, and trustworthiness that requires researchers to act honestly, keep faith with communities, and align words, methods, and outcomes in ways that are reliable and morally coherent); and kia-āta-kōrero (an ethic of deliberate, truthful, and culturally grounded communication that is contextually responsible,

relationally accountable, and protective of Māori people, knowledge, and relationships (National Ethics Advisory Committee, 2012; Hudson et al., 2010).

In Māori settings, reliability also has a structural dimension, including being consistent in holding Crown agencies to account for their Treaty obligations. Reid & Robson (2007) argue that Māori have a right to monitor Crown performance, and that research which fails to challenge Crown accountability risks becoming complicit in maintaining inequality. A reliable researcher, in this context, is one who provides iwi and hapū with tools to demand accountability and change. Being a reliable researcher, in this context, also means reporting Māori outcome distributions in full, including the presence of Māori with favourable outcomes as well as those experiencing severe health loss so that explanations and accountability are grounded in observed variation rather than assumed deficit.

In this way, Kaupapa Māori Research reframes reliability: it is not only about consistency or reproducibility, but also about being steadfast in upholding relationships, values, and Treaty responsibilities. Predictability matters, but only when it is aligned with Māori priorities and supports transformative outcomes.

The Treaty of Waitangi and Treaty Partners

In 1840, Rangatira (chiefs) signed Te Tiriti o Waitangi (te reo Māori version of the Treaty) and the Crown signed the Treaty of Waitangi (English version of the Treaty). While both texts formalised relationships between Māori and the Crown, they conveyed different expectations of authority. Te Tiriti affirmed Māori tino rangatiratanga (self-determination, sovereignty, autonomy, self-government) over people; lands; and other taonga (treasure, anything prized), whereas the Crown interpreted the Treaty as granting it full sovereignty over Aotearoa New Zealand. This enduring tension continues to shape health policy, service design, and research accountability today.

This study recognises two distinct Treaty partners:

1. Māori Treaty partners: iwi and hapū, represented through rūnanga (tribal council) and other mandated bodies
2. Crown Treaty partners: Ministers, officials, and institutions that act on behalf of the Crown.

This framing is not simply historical context. It is central to how this study defines accountability. The research in this thesis is not conducted on behalf of the Crown, and it does not treat Crown interests as neutral. Instead, the thesis positions iwi and hapū as the intended beneficiaries of its methods, tools, and findings.

Intimacy

In the Trust Equation, intimacy refers to the sense of emotional closeness and safety that builds rapport and allows others to share personal or sensitive information (Maister et al., 2000). It reflects the degree of trust that people place in a researcher's ability to hold and protect their information.

In Kaupapa Māori Research, intimacy is not based on rapport and disclosure alone. It is rooted in whakapapa (lineage, descent) and whakawhanaungatanga. Māori researchers are often already known within the communities they work with, or they are knowable through shared kinship ties and iwi affiliations (Irwin, 1994; Moewaka Barnes et al., 2008). These connections ground research relationships in mutual respect and accountability, not anonymity, and they carry with them responsibilities. As Reid & Robson (2007) note, research that does not contribute to transformation is complicit in colonisation.

Kaupapa Māori Researchers enact intimacy by upholding values such as aroha ki te tangata ; manaakitanga; and kia tūpato (Smith, 1999; Cram, 2001). These values protect against extractive practices and ensure that closeness is never exploitative but always oriented toward mana (authority or standing) and collective wellbeing. As Cram (2001) reminds us, research participants and communities must see benefit returned, relationships maintained, and their aspirations genuinely reflected in outcomes (Cram, 2001).

In this way, Kaupapa Māori Research reframes intimacy not only as emotional closeness, but also as a commitment to ethically grounded, whakapapa-informed, and future-oriented relationships. It is measured by whether research protects dignity, strengthens relationships, and delivers outcomes that matter to Māori communities.

Self-Orientation

In the Trust Equation, self-orientation refers to the extent to which individuals are perceived to prioritise their own interests over those of others. High self-orientation arises when personal recognition, institutional status, or career advancement are prioritised above the needs of others, including research participants (Maister et al., 2000).

In Kaupapa Māori research, high self-orientation is inconsistent with tikanga-based expectations of researcher conduct because it privileges individual gain over collective wellbeing and positions the researcher rather than whānau, hapū, or iwi, as the primary beneficiary of the work. Such an orientation undermines relational obligations central to kaupapa Māori practice, including aroha ki te tangata and manaakitanga, and it sits in tension

with commitments to tino rangatiratanga in knowledge production and use (Pihama, 2010; National Ethics Advisory Committee, 2012; Smith, 2012; Hudson et al., 2010).

In contrast, low self-orientation reflects humility, reciprocity, and a commitment to collective uplift where research becomes a means of serving Māori-defined aspirations, not of extracting value for institutional or academic gain. Durie emphasises that Māori health advancement requires Māori authority and Māori-defined priorities to sit at the centre of health development, including decision-making and the distribution of benefits for whānau, hapū, and iwi, even when this challenges mainstream or academic norms (Durie, 1998; Durie, 2001). Moewaka Barnes et al., (2008) add that Māori research legitimacy rests on enduring relationships and collective responsibilities, not individual ownership or prestige.

Self-orientation, then, is a test of who benefits, whose authority is upheld, and whose goals the research ultimately serves. Kaupapa Māori Research reframes this concept as a collective ethical obligation. Anything less signals a breach of trust.

Bringing the Threads Together

In Kaupapa Māori Research, trust cannot be reduced to a formula. While frameworks such as the Trust Equation offer a useful organising structure, they only partially reflect the relational, ethical, and transformative foundations of Kaupapa Māori Research practice.

By interpreting the components of the Trust Equation through Kaupapa Māori Research values, rather than interpreting Kaupapa Māori Research through the Trust Equation, this part has shown how researcher conduct in this study is oriented toward Māori expectations where:

1. Credibility is grounded not only in expertise but in legitimacy, whakapapa, and alignment with Māori values and aspirations
2. Reliability goes beyond consistency to mean enduring accountability to whānau, hapū, iwi, and the Treaty
3. Intimacy is expressed through whakapapa, whanaungatanga, and commitment to ongoing benefit, rather than rapport alone
4. Low self-orientation is tested not by appearance but by the extent to which research strengthens tino rangatiratanga and resists extractive practices.

Consistent with these commitments, the thesis is oriented toward identifying both favourable and adverse outcomes among Māori and explaining within-Māori variation rather than treating Māori health outcomes as uniformly poor or defined only by comparison to non-Māori.

Together, these behaviours shape how this research was conceived, conducted, and communicated. They also provide a practical framework for assessing whether Kaupapa Māori Research principles have been upheld throughout.

The following table summarises how these behaviours have been embedded across key components of the thesis (Table 3). It demonstrates how Kaupapa Māori values informed every stage of its development.

Table 3: Embedding Kaupapa Māori Research Behaviours Across this Thesis

Thesis Component	**How it Gives Effect to Kaupapa Māori Research**
Structured problem solving (SPS) (Ch.3; applied in Ch.7)	SPS offers a robust scaffold for integrating Kaupapa Māori values with scientific analysis. Its use in this study ensures that research is grounded in a clear articulation of Māori priorities and that findings contribute to transformative change for whānau, hapū, and iwi.
Process-oriented model of health (Ch.3, Part 2)	Credibility requires methods that can operationalise Māori health outcomes in ways that respect tino rangatiratanga and equality. This section develops a process-oriented model of health that links determinants, biological processes, and impacts, enabling layered measurement that supports transformative intent.
Research design (Ch.3, Part 3; Ch.4)	In Kaupapa Māori Research, low self-orientation is demonstrated when researchers privilege iwi and hapū needs over personal or institutional agendas. These sections justify the focus on DI, the use of IDI data, and the comparator groups through a Kaupapa Māori lens, centring Māori health need, acknowledging limits of Crown data sovereignty, and mitigating risks of extractive practice. The design explicitly supports identification of Māori with favourable outcomes as well as adverse outcomes, enabling within-Māori learning alongside between-group accountability.
Measuring YLL and YLLD (Ch.4-5)	Reliability requires steadfastness in holding the Crown accountable to its Treaty obligations. These chapters introduce and operationalise new metrics (YLLD and the joint-burden matrix) to quantify Māori health need and to measure Crown responsiveness with transparent methods and safeguards against misrepresentation.
Results (Ch.6 and Ch.8)	Intimacy in Kaupapa Māori Research arises through whakapapa; whakawhanaungatanga; and accountability to whānau, hapū, and iwi. These chapters present disparities between Māori and non-Māori and within Māori, framed not as epidemiological abstractions but as measures of Māori health accountability and collective wellbeing. These chapters present outcome distributions between Māori and non-Māori and within Māori, explicitly identifying Māori with both favourable and adverse outcomes. Findings are framed as tools for Māori health accountability and collective wellbeing—supporting learning from strength as well as scrutiny of harm and inequity.

Thesis Component	How it Gives Effect to Kaupapa Māori Research
Methodology for Comparative Analysis (Ch. 7)	Credibility and reliability in Kaupapa Māori Research require that analytic choices are transparent, reproducible, and oriented toward Māori-defined accountability rather than opportunistic inference from Crown data. Chapter 7 operationalises this by specifying a structured process to develop and refine hypotheses about within-Māori outcome variation, and by setting out pre-defined testing rules in the IDI, including coverage thresholds, non-parametric difference testing, and equivalence testing anchored to smallest effect sizes of interest, to distinguish evidence of difference, evidence of practical similarity, and genuine inconclusiveness in a way that is interpretable for iwi and hapū purposes.
Interpretation, implications, and reflections (Ch.9)	In Kaupapa Māori research, keeping self-orientation low and maintaining reliability require that findings are interpreted in ways that uphold tino rangatiratanga, prioritise collective benefit, and support Treaty-based accountability. Chapter 9 interprets the results through kaupapa Māori values, critiques Crown performance where relevant, and translates the research outputs into practical implications for iwi and hapū, public policy, and health service design, positioning the methods as tools for accountability and systemic change rather than extractive gain.

Conclusion

This chapter establishes the methodological foundations of the study. It articulates the research philosophy underpinning the thesis and situates the work within a constructivist ontology, pragmatic epistemology, and Kaupapa Māori Research axiology. It then positions the study within Mode 2 knowledge production and shows how a problem-driven, transdisciplinary and contextually accountable approach aligns with Kaupapa Māori Research commitments to equal outcomes, transformation, and accountability under Te Tiriti o Waitangi. Finally, the chapter translates these foundations into practice by defining the behaviours of a Kaupapa Māori Researcher and showing how Māori expectations of credibility, reliability, intimacy, and low self-orientation are enacted as practical commitments rather than abstract principles. Together, these foundations provide the ethical, philosophical, and methodological basis for the chapters that follow.

Chapter 3. The Methodological Approach of This Study

This chapter describes the overall research approach and study design. It is organised into three parts. Part 1 introduces SPS as the guiding methodological approach for this research. Part 2 presents a process-oriented model of health developed for this study. Part 3 outlines the quantitative research design.

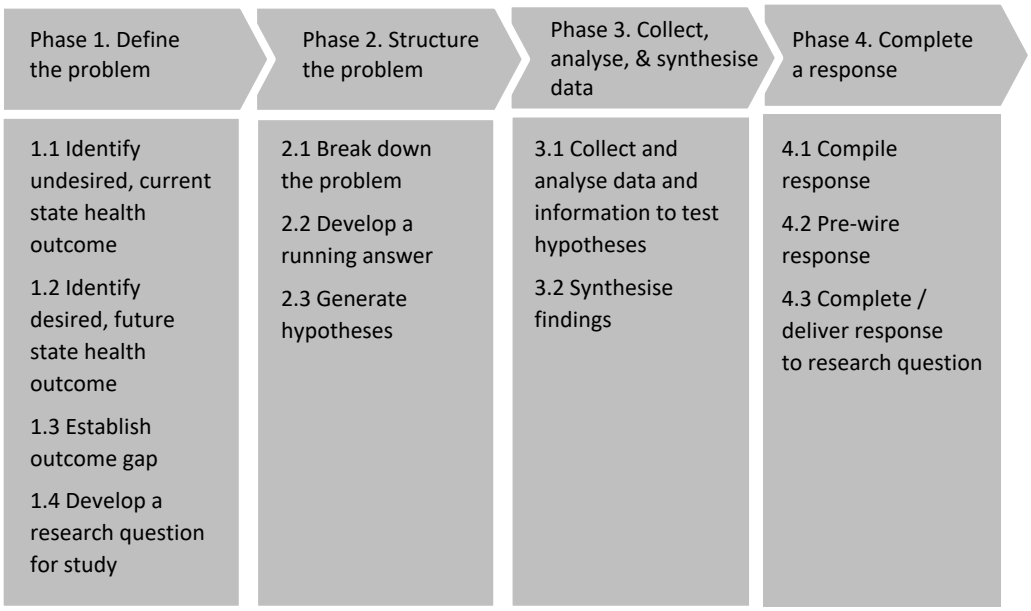
Part 1. Structured Problem Solving

SPS is a hypothesis-driven, iterative method grounded in the hypothetico–deductive tradition of scientific inquiry, and it provides a disciplined way to define problems, structure questions, generate and test hypotheses, and synthesise findings into actionable conclusions.

SPS Phases and Steps: A Generic Overview

In its generic form, SPS is organised into four phases: define the problem; structure the problem; collect, analyse and synthesise data; and complete a response (Figure 4).

Figure 4: Structured Problem Solving Phases

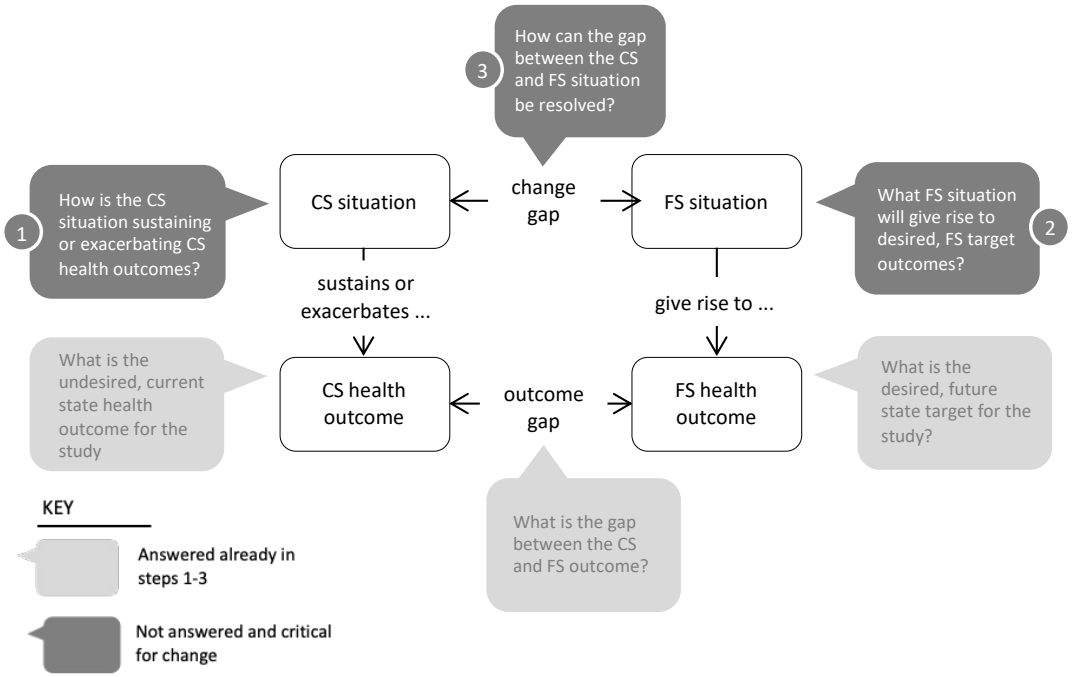


While these phases are depicted as linear, SPS is iterative. Early analyses may reveal that hypotheses are poorly specified, that important variables are missing, or that the problem structure requires revision. In such cases, a researcher returns to earlier phases to refine the framing of the problem or the hypotheses being tested. Together, these phases provide a systematic approach to moving from an ill-defined problem to a coherent, evidence-based solution. Each phase is defined below.

Phase 1. Define the Problem

The first phase is about defining a problem in detail before work begins on a solution. It involves specifying an undesired current state and a desired future state and then defining the gap between them. Figure 5 presents a job aid developed for this study to support problem definition. It does this by directing attention to the key questions that distinguish current and future outcomes; situations (which give rise to outcomes); and the gaps between them.

Figure 5: Question Framework



The purpose of this phase is to anchor analysis to outcomes that matter rather than to available data, existing interventions, or institutional convenience. A well-defined problem provides the foundation for all subsequent analysis.

Phase 2. Structure the Problem

Once the problem has been defined, it is broken down into manageable components. This phase involves structuring the problem into mutually exclusive and collectively exhaustive (MECE) parts and developing an initial “running answer” that identifies the most plausible explanations for an outcome gap. Explicit, refutable hypotheses are then generated to test these explanations. This step ensures that data collection and analysis are comprehensive, transparent, and logically coherent.

Phase 3. Collect, Analyse, and Synthesise Data

The third phase involves assembling relevant data and testing the hypotheses generated in Phase 2. Data quality is assessed, appropriate analytic methods are applied, and findings are synthesised to determine whether hypotheses are supported or refuted.

Phase 4. Complete a Response

The final phase integrates the results of analysis into a coherent response to the original problem. Findings are interpreted, limitations are assessed, and implications are drawn for decision-making, accountability, or further inquiry. In applied research contexts, this phase focuses on producing conclusions that are actionable, transparent, and proportionate to the strength of the evidence and urgency of the problem.

Part 2. The Model of Health Used in This Research

Existing models of health offer important perspectives and inform thinking about health and wellbeing. However, no single model can be operationalised using large-scale IDI microdata in a way that directly supports Māori Treaty partners to hold the health system to account.

This part therefore presents a process-oriented model of health developed for this study. It builds on elements from the WHO, biomedical, and Māori health models and is designed to:

1. Support quantitative analysis of outcome disparities across the DI pathway
2. Represent health in a layered and relational way that reflects Māori perspectives on whānau, independence, and participation
3. Enable the operationalisation of Māori health need in a way that strengthens tino rangatiratanga and system accountability.

To contextualise this new model, three health models are described below.

The World Health Organization's Model of Health

The WHO defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 1946). This definition is widely cited for its positive framing of health and its inclusion of social wellbeing, which broadens the scope of what health systems are expected to address (Larsen, 2022).

The WHO model has been criticised for being difficult to operationalise in empirical research and for offering limited guidance for measuring and comparing health outcomes across individuals or populations (Jadad & O'Grady, 2008). Its emphasis on complete wellbeing also raises concerns about attainability and the expansion of medical intervention thresholds (Huber et al., 2011).

These limitations reduce its utility for individual-level, administrative-data driven analyses where transparent measurement of outcome disparities and system accountability is required.

The Biomedical Model of Health

The biomedical model conceptualises health as the absence of disease, with illness arising from identifiable biological abnormalities that can be diagnosed and treated (Engel, 1977). Its strengths lie in measurability, diagnostic clarity, and its long-standing success in treating acute and chronic disease (Bunker et al., 1994).

Critics argue that the biomedical model insufficiently accounts for social, environmental, and structural determinants of health and that its narrow focus can contribute to overdiagnosis and fragmented care (Wade & Halligan, 2004; Moynihan et al., 2012). While well suited to clinical intervention, the biomedical model is limited in its capacity to represent layered impacts of illness or to support system-level accountability for outcomes (Engel, 1977; Wade & Halligan, 2004).

Māori Models of Health

Māori health models extend the WHO model by incorporating spiritual, relational, and cultural dimensions of wellbeing in their design.

Two of the most well-known models are Te Whare Tapa Whā and Te Wheke. Te Whare Tapa Whā presents health as a four-sided house, where each side represents a dimension of health: taha tinana (physical); taha wairua (spiritual); taha whānau (relational); and taha hinengaro (mental/emotional) (Durie, 1998). Te Wheke uses more dimensions than Te Whare Tapa Whā, including but not limited to mana ake (framed as a distinct dimension tied to identity/authority/unique selfhood within the whole wellbeing system) (Pere, 1991).

Proponents argue that these models validate culturally grounded care, guide the funding of traditional Māori health services, and strengthen provider–patient relationships through whakawhanaungatanga (Wilson et al., 2021; Ministry of Health, 2023).

While no direct criticisms of Māori models are evident, some of the practical challenges raised in relation to the WHO model apply when using administrative data i.e., several dimensions of Māori health models are difficult to quantify and expanding definitions of health without appropriate measures risks stretching administrative data beyond what they can support.

These challenges do not reflect limitations of Māori models themselves, which are deliberately holistic and values-driven, but rather the constraints of Crown administrative data systems that were not designed to represent Māori concepts of health.

Health Model Developed for This Study

Each model described above contributes important insight into what it means to be healthy or unhealthy, but each has limited practical utility for this study because none can be translated directly into a transparent, individual-level measurement framework using large-scale administrative data. The WHO model is aspirational and normatively powerful in defining health as more than the absence of disease, but its breadth makes it difficult to operationalise within the IDI in a way that is consistent and reproducible. The biomedical model is comparatively straightforward to implement because it aligns with diagnoses, procedures, and service-use records, but it is conceptually narrow and risks treating health as synonymous with clinical disease states. Māori health models provide holistic and culturally grounded accounts of wellbeing that reflect Māori realities and aspirations, but they are not able to be operationalised with explicit definitions and decision rules that can be implemented at scale using linked administrative data.

Process-Oriented Model of Health

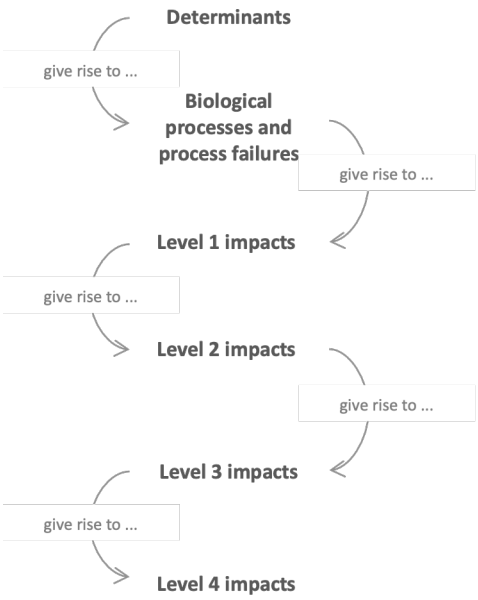
Kaupapa Māori Research using the IDI requires a model that supports (1) operationalisation using linked administrative data; (2) separation of determinants, biological processes, and impacts so that different forms of health loss can be measured without being collapsed into a single proxy; and (3) outputs that are interpretable and usable by iwi and hapū to scrutinise health system performance and the Crown's responsiveness where outcomes are unequal.

The absence of such a model motivated the development of a process-oriented model of health for this study. This model three parts:

1. Determinants
2. Biological processes and process failures
3. Impacts (Figure 6).

Each of these parts is discussed below.

Figure 6: Interrelationships Between Components



Determinants

Determinants are upstream influences that initiate, aggravate, prevent, or mitigate biological process failures. They include not only individual or environmental factors but also the structural conditions shaping health across the life course.

These conditions include environmental exposures, behaviours, service access, and social conditions such as poverty or racism. In the Māori context, determinants also include the structural impacts of colonisation; breaches of the Treaty; and systemic racism (i.e., forces that shape outcomes in ways distinct from generic social determinants frameworks).

Biological Processes and Failures

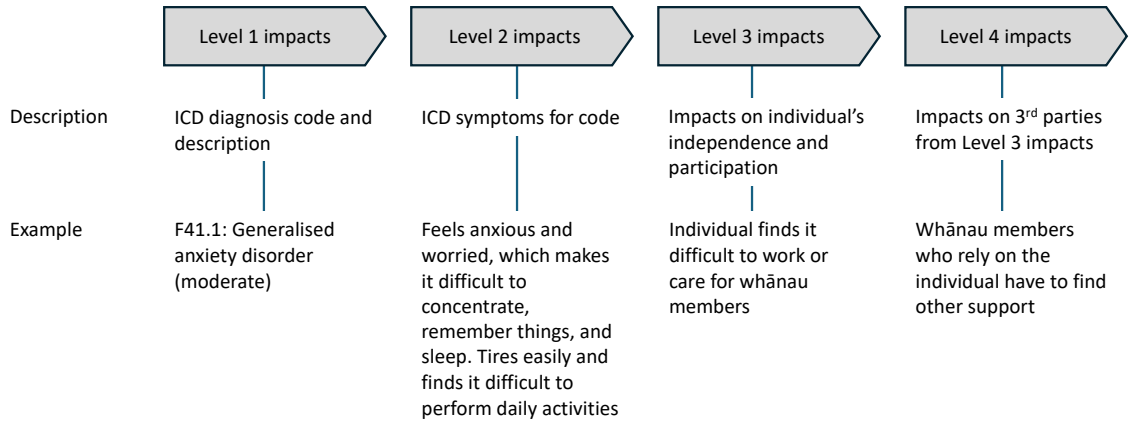
Biological processes underpin bodily functions. Process failures such as insulin resistance result in diagnosable diseases (e.g., diabetes). This model treats the emergence of disease as a failure of underlying processes, which are shaped by determinants.

Layered Impacts

The impacts of disease are conceptualised across four levels:

1. Level 1: Diagnosed disease (ICD-coded condition)
2. Level 2: Physical symptoms
3. Level 3: Effects on individual independence and participation
4. Level 4: Spillover impacts on whānau, marae (where formal greetings and discussions take place. Often also used to include the complex of buildings around the marae) or hapū (Figure 7).

Figure 7: Health Model Impacts



This layered structure supports measurement and interpretation by distinguishing impacts that can be operationalised in administrative data from impacts that cannot. In this study, quantification focuses primarily on individual-level impacts that can be measured transparently in the IDI (Levels 1–3), while Level 4 is retained as a kaupapa Māori–aligned conceptual anchor to ensure interpretation remains attentive to collective burden, relational wellbeing, and accountability beyond the individual.

Application and Contribution of the Model

This model contributes to the thesis by providing a practical bridge between kaupapa Māori intent and implementable epidemiological measurement using large-scale administrative data. It clarifies what "health loss" means in this study by specifying a process in which upstream determinants shape biological processes, which in turn generate layered impacts. This structure matters in practice because it identifies which aspects of health can be measured directly in the IDI and which cannot, and it prevents the analysis from defaulting either to narrow biomedical endpoints or to holistic concepts that cannot be operationalised transparently. In doing so, the model supports individual-level measurement that is reproducible and comparable across people and over time, while keeping interpretation anchored to context and health system performance rather than individualised and deficit-based explanations.

The model also contributes by underpinning the operationalisation and interpretation of one of the study's key outcome metrics. This study distinguishes mortality-related impact from morbidity-related impact, and it provides a clear rationale for retaining two separate individual-level measures rather than collapsing multiple dimensions into a single summary indicator.

In this study, Years of Life Lost (YLL) operationalises fatal impact as premature mortality relative to a common life-table benchmark, while Years of Life Lost to Disability (YLLD) operationalises non-fatal impact as time lived with diabetes-related disability accumulated across an individual's observed disease course using explicit diagnostic inclusion rules and disability weights. Locating YLL and YLLD within distinct impact levels strengthens scientific rigour by making the measurement logic transparent and defensible, and it strengthens kaupapa Māori alignment by producing outputs that can be interpreted and used by iwi and hapū to scrutinise where health loss is occurring (through premature death, prolonged disability, or both) and to ask more precise accountability questions of the health system than population averages or single endpoints allow.

A further contribution of the model is that it provides a design scaffold for the thesis by separating outcome definition from determinant explanation. Outcomes are operationalised first using individual-level YLL and YLLD (and their joint classification), and only then are hypotheses tested about the determinants that may distinguish Māori with favourable and adverse joint outcomes. This sequencing supports reproducible case definition and avoids circularity in which determinants implicitly define outcomes.

Part 3. Research Design

This final part of the chapter translates the methodological foundations into a concrete quantitative research design with three defining features. First, it focuses on clearly specified outcome gaps rather than on available data or conventional epidemiological indicators. Second, it uses individual-level analysis to reveal variation within populations, including the presence of Māori with both favourable and adverse outcomes. Third, it is structured not only to describe patterns of health outcomes but also to produce transparent, interpretable, and reproducible measures of health need that support Treaty-based scrutiny of Crown performance.

Study Design and Setting

This thesis is structured as a national retrospective cohort study using linked administrative data from the IDI. The IDI is a large, de-identified research database maintained by Statistics New Zealand that links individual-level data across health, social, and administrative domains.

The study is situated in Aotearoa New Zealand and examines deaths occurring across five selected study years: 2013, 2014, 2016, 2018, and 2019. The upper bound of 2019 reflects the most recent year of complete mortality data available at the time of analysis.

The study cohort for each year comprised all individuals whose underlying cause of death was recorded as type 2 diabetes (DI) (ICD-10 E11) in the New Zealand Mortality Collection and who were linked within the IDI, as described in Chapter 4. Across the five study years, 3,915 individuals were identified, with annual deaths ranging from 711 in 2013 to 891 in 2019 (Table 17).

Outcomes were analysed across five non-consecutive study years. These years were selected deliberately to:

1. Align with the two most recent Census years (2013 and 2018), enabling linkage to individual-level characteristics such as deprivation, average income, and educational attainment
2. Capture mid-point variation in outcomes (2016)
3. Provide a longitudinal perspective on diabetes-related mortality
4. Incorporate the most recent available mortality data (2019) to support up-to-date findings.

A retrospective cohort design was appropriate for the research questions because it enables longitudinal assessment of outcomes at the individual level, allows examination of cumulative health loss over time, and supports comparison of outcome distributions within and between populations. Study size was determined by the number of eligible individuals meeting inclusion criteria within the national IDI datasets.

The IDI was selected because it provides near-universal population coverage and enables longitudinal, individual-level linkage across mortality, morbidity, and service-use data. This depth and scope are necessary for estimating individual-level YLL and YLLD and for examining variation in outcomes that population averages conceal.

While the IDI is a Crown-held administrative dataset and was not designed for Kaupapa Māori Research, there is no alternative national dataset capable of supporting the analytic requirements of the research questions. Safeguards applied in this study, including outcome-focused framing, transparent and reproducible methods, and explicit acknowledgement of measurement limits, help ensure that the dataset is used critically rather than in an extractive way.

Selection of the Medical Condition

DI was selected as the chronic condition for this study through an explicit problem-structuring process aligned with SPS. This condition was chosen because it:

1. Disproportionately affects Māori across incidence, morbidity, and mortality
2. Produces substantial premature mortality and prolonged non-fatal burden

3. Has well-established clinical coding within administrative data
4. Enables joint examination of survival and suffering over time.

From an epidemiological perspective, DI is particularly well suited to individual-level burden analysis because its impacts accumulate over the life course and manifest across multiple domains of health. From a Kaupapa Māori Research perspective, this focus aligns with Māori conceptions of oranga (health or wellbeing) by foregrounding the importance of longevity and quality of life rather than mortality alone.

Target Population and Eligibility Criteria

The target population for this study is based on the following inclusion criteria: (1) aged 15 years and older; and (2) identified as Māori using the administrative ethnicity classifications available in the IDI.

Exclusion criteria were defined as follows: (1) individuals with evidence consistent with type 1 diabetes or gestational diabetes only; and (2) individuals with insufficient information to establish cohort entry, DI status, or outcome measurement.

Ethnicity was operationalised using the standardised ethnicity tables held in the IDI, which derive ethnicity across multiple linked administrative collections rather than from a value recorded in any single source. This reduces dependence on the accuracy of any one collection, since a record missed or mis-recorded in one can be recovered from another. However, it does not eliminate misclassification. A person never recorded as Māori in any contributing collection remains uncounted, and the direction of that residual error is known, in that it understates rather than overstates Māori burden. While this operationalisation does not capture the full whakapapa-based and relational dimensions of Māori identity, it enables transparent and reproducible analysis at a national scale. The limitations of this approach are acknowledged explicitly and addressed through analytic framing rather than treated as neutral or exhaustive.

Comparator Group

A non-Māori comparator group with DI was included to enable assessment of equality. Comparisons between Māori and non-Māori are used to assess whether Māori outcomes are comparable to the best observed nationally and to identify outcome gaps that warrant explanation and accountability.

Importantly, the comparator group is not treated as a normative benchmark for Māori health. Rather, it functions as a reference group for evaluating whether the health system is delivering outcomes consistent with its obligations to achieve Treaty-based equality.

In addition to between-group comparisons, the design explicitly supports within-Māori comparisons, enabling identification of Māori with favourable and adverse outcome profiles.

Outcome Measures

The primary outcome measures for this study are YLL and YLLD. YLL quantifies premature mortality by estimating the difference between age at death and expected remaining life years based on national life tables. YLLD captures cumulative non-fatal health loss by quantifying the years lived with disability arising from DI and its complications.

Both measures are calculated at the individual level, allowing burden to be aggregated, stratified, and compared without obscuring within-population variation. This individual-level approach is essential for identifying Māori with favourable outcomes and for examining the distribution, rather than only the average, of health loss.

A joint-burden framework is used to examine the combined distribution of fatal and non-fatal burden. This framework enables classification of individuals according to their joint YLL and YLLD profiles and supports analysis of diverse outcomes.

Detailed specification of outcome construction and calculation is provided in Chapters 4 and 5.

Analytic Strategy and Sequencing

Analyses were sequenced deliberately to support both epidemiological clarity and accountability:

1. Cohort description to establish population characteristics and absolute burden
2. Between-group comparisons to quantify inequality between Māori and non-Māori
3. Within-Māori analyses to identify variation in outcomes among Māori
4. Joint-burden classification to identify individuals with favourable and adverse outcome profiles
5. Determinant analyses to examine factors associated with outcome variation.

This sequencing ensured that favourable outcomes are identified explicitly rather than inferred indirectly and that within-group learning did not obscure structural inequalities.

Bias, Confounding, and Validity Considerations

Several sources of bias and limitation are recognised at the design stage. Selection bias may arise from differential diagnosis, healthcare access, or survival, although the use of multiple

linked administrative sources mitigates this risk. Misclassification of DI status, complications, and ethnicity is possible due to reliance on administrative coding practices. Residual confounding is likely, particularly for social, cultural, and structural determinants that are imperfectly captured in administrative data. Surveillance bias may also influence observed morbidity patterns, as healthcare contact varies across populations.

In addition, a quantitative-only design limits the ability to directly examine how outcomes are experienced, interpreted, or navigated by Māori. While a mixed-methods approach could have addressed this limitation, it was beyond the scope of this study. To mitigate this constraint, findings are interpreted in light of existing qualitative Māori health research, and analytic emphasis is placed on outcome distributions and accountability rather than causal attribution.

Rather than attempting to eliminate these limitations, the research design addresses them through transparency, cautious interpretation, and avoidance of causal over-claiming. These constraints are revisited in Chapter 9.

Missing Data

Patterns of missing data were examined descriptively. Where appropriate, analyses used complete-case approaches or explicit missing categories. Detailed handling of missing data is described in the relevant analytic chapters.

Kaupapa Māori Research Considerations

In Kaupapa Māori Research, research design is not value-neutral. Decisions about populations, comparators, outcomes, and analytic strategies carry ethical and political implications, particularly in Indigenous health contexts that are shaped by colonisation and Treaty obligations. Accordingly, this study's design is explicitly constrained by Kaupapa Māori Research commitments to tino rangatiratanga, reciprocity, and collective benefit.

This means that Māori are not treated as a residual subgroup or as a population defined primarily by deficit. Instead, Māori health outcomes are the primary analytic concern, and non-Māori are included as a comparator group. The design is oriented toward identifying both adverse outcomes and favourable outcomes among Māori, reflecting a Kaupapa Māori Research emphasis on learning from strength as well as from harm.

As discussed earlier, while this study does not resolve the structural governance limitations of Crown-held administrative data, the research design incorporates safeguards to minimise harm and maximise Māori benefit, which is consistent with the Kaupapa Māori Research commitments outlined in Chapter 2.

Conclusion

This chapter sets out the guiding methodological approach and research design used in this study. It introduces SPS as a hypothesis-driven, iterative framework for defining problems, structuring questions, and generating evidence-based responses to clearly specified outcome gaps. It then presents a process-oriented model of health developed to operationalise Māori health need and system accountability using administrative data, while remaining aligned with a Māori conception of health as layered, relational, and collective.

Building on these foundations, the chapter translates the SPS framework and health model into a concrete quantitative research design that is outcome-driven, individual-level, and explicitly oriented toward equality and Treaty-based accountability. It specifies the condition of focus, target populations, comparator groups, outcome measures, and analytic sequencing required to examine both between-group inequalities and within-Māori variation in health outcomes. Together, the methodological approach, health model, and research design provide the foundation for the empirical chapters that follow.

Chapter 4. Measuring Fatal and Non-Fatal Burden

This chapter details how the impact of DI (as the chronic condition for this study) is measured using individual-level fatal and non-fatal burden metrics. It is organised into three parts. Part 1 sets out the target population and why DI was selected as the chronic condition for this study. It also provides the final research questions. Part 2 details the approach used to measure the fatal and non-fatal impacts of DI. Part 3 summarises the steps taken to obtain access to the IDI.

Part 1. The Target Population and In-Scope Medical Condition of This Study

Target Population

This study focuses on adults rather than children or mixed-age populations.

This decision is in part based on the epidemiology of chronic conditions. Chronic conditions are characterised by prolonged duration, cumulative exposure, and sustained interaction with health systems over time (World Health Organization, 2005; Bernell & Howard, 2016). While some chronic conditions have childhood onset, the overwhelming burden of chronic disease occurs in adulthood, where cumulative exposures and long-term disease trajectories can be meaningfully observed and measured (GBD 2019 Diseases and Injuries Collaborators, 2020). From an epidemiological perspective, focusing on adults enables robust assessment of cumulative health loss across the life course. This is consistent with established life-course models of chronic disease that emphasise the accumulation of risk, exposure, and impact over time (Ben-Shlomo & Kuh, 2002).

A focus on adults is also necessary to achieve the aim of this research to estimate fatal and non-fatal burden, including YLL and disability-weighted measures, which are designed to capture long-term consequences of disease rather than early-life onset alone (GBD 2019 Diseases and Injuries Collaborators, 2020).

From a Kaupapa Māori Research perspective, the focus on adults aligns with concerns about sustained wellbeing and the capacity of Māori to live well, fulfil roles and responsibilities, and participate fully in whānau, hapū, and iwi life over time (Durie, 2006). Chronic conditions that constrain adult independence and participation have consequences that extend beyond the individual, affecting whānau stability, caregiving responsibilities, economic participation, and intergenerational wellbeing (Adelman et al., 2014).

Restricting the study population to adults therefore strengthens conceptual coherence, epidemiological validity, and cultural relevance. It ensures that analyses are focused on the segment of the population where chronic disease burden is greatest and where individual-level outcome measures can be meaningfully interpreted.

The Chronic Condition

The study focuses on a single medical condition. This enabled the development and application of new individual-level outcome measures (YLLD and the joint burden matrix) that would not have been feasible across multiple conditions. This depth of focus aligns with Kaupapa Māori Research principles by targeting a condition of major significance to Māori communities and producing findings that can be meaningfully applied to improve outcomes.

The selection of the condition followed a structured process that answered four questions:

1. What are the leading causes of death and premature death for adult Māori men and women over a sustained period?
2. Which of the leading causes affect both Māori men and women?
3. Which of the remaining causes are chronic conditions?
4. Which of the remaining conditions have the highest survival rates following onset?

Each question is discussed below.

Question 1. What Are the Leading Causes of Death and Premature Death for Adult Māori Men and Women Over a Sustained Period?

In 2019, the Ministry of Health published the Wai 2575: Māori Health Trends Report to support the Waitangi Tribunal inquiry into primary health care in Aotearoa New Zealand (Ministry of Health, 2019b). This report identifies the leading causes of death and premature death for Māori men and women over the period 1996–2014.

Focusing on the leading causes of death ensured that the study targeted conditions with the greatest potential to improve Māori health at scale rather than conditions selected for data convenience or academic interest.

Leading Causes of Death and Premature Death for Māori Men

Table 4, reproduced from the Wai 2575 Māori Health Trends Report, presents the top five leading causes of death and premature death for adult Māori men between 1996 and 2014, ranked by age-standardised mortality (ASM) and YLL (Ministry of Health, 2019b).

Table 4: Leading Causes of Death for Māori Men, 1996 - 2014

Rank		96-98	97-99	98-00	99-01	00-02	01-03	02-04	03-05	04-06	05-07	06-08	07-09	08-10	09-11	10-12	11-13	12-14
1.	ASM	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD
	YYL	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD
2.	ASM	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC
	YYL	MV	MV	MV	MV	MV	MV	MV	MV	MV	MV	MV	MV	MV	LC	SU	SU	LC
3.	ASM	HD	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	SU	SU	HD
	YYL	SU	SU	SU	SU	SU	SU	SU	SU	SU	SU	SU	LC	LC	SU	LC	LC	SU
4.	ASM	MV	HD	HD	HD	HD	HD	MV	MV	MV	MV	MV	MV	MV	SU	DI	DI	SU
	YYL	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	DI	SU	SU	MV	MV	DI	HD
5.	ASM	DI	MV	MV	MV	MV	MV	SU	SU	SU	SU	SU	CPD	CPD	MV	MV	HD	DI
	YYL	HD	DI	DI	DI	DI	DI	DI	DI	DI	DI	HD	DI	DI	DI	DI	HD	DI

When ranked by ASM, the leading causes of death for Māori men were ischaemic heart disease (ISH); lung cancer (LC); diabetes (DI); motor vehicle accidents (MV); and suicide (SU). When ranked by YLL, the leading causes were ISH, MV, SU, LC, and DI. Together, the leading causes of death and premature death for Māori men over this sustained period were ISH, MV, LC, SU, and DI.

Leading Causes of Death and Premature Death for Māori Women

Table 5 from the Report presents the corresponding rankings for Māori women over the same period (1996–2014), again using both ASM and YLL (Ministry of Health, 2019b).

Table 5: Leading Causes of Death for Māori Women, 1996-2014

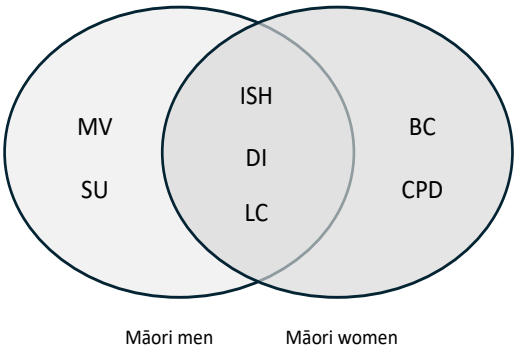
Rank		96-98	97-99	98-00	99-01	00-02	01-03	02-04	03-05	04-06	05-07	06-08	07-09	08-10	09-11	10-12	11-13	12-14
1.	ASM	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	LC	LC	LC
	YYL	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	IHD	LC	LC	LC	LC	LC	LC
2.	ASM	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	IHD	IHD	IHD	IHD	IHD	IHD
	YYL	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LLC	IHD	IHD	IHD	IHD	IHD	IHD
3.	ASM	DI	DI	DI	CD	DI	DI	DI	CPD	CPD	CPD	CPD	CPD	CPD	CPD	CPD	CPD	CPD
	YYL	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
4.	ASM	CD	CD	CD	DI	DI	CD	CPD	CPD	CD	DI	BC	CD	CD	CD	CD	BC	BC
	YYL	MV	MV	DI	DI	CD	DI	DI	DI	DI	DI	CPD	CPD	CPD	CD	CPD	CPD	CPD
5.	ASM	BC	BC	BC	BC	CPD	CPD	CD	CD	DI	CD	DI	DI	BC	BC	DI	CD	CD
	YYL	DI	DI	MV	CD	DI	CD	CD	CPD	CPD	CPD	DI	DI	CD	CPD	DI	CD	CD

Ranked by ASM, the leading causes of death for Māori women were ISH; LC; cardiopulmonary disease (CPD); and cerebrovascular disease (CD). Ranked by YLL, the leading causes were ISH; LC; breast cancer (BC); DI; and CPD. Together, the leading causes of death and premature death for adult Māori women over the period were ISH, LC, BC, DI, and CPD.

Question 2. Which of the Leading Causes Affect Both Māori Men and Women?

The second step was to identify the leading causes of death that affect both Māori men and Māori women. To do this, the leading causes identified in Question 1 were examined to identify areas of overlap (Figure 8).

Figure 8: Areas of Overlap for Leading Causes



The figure shows that three leading causes of death affect both Māori men and women: ISH, LC, and DI.

Restricting the candidate conditions to those affecting both men and women strengthened the analytical robustness of the study and ensured that subsequent analyses would reflect Māori health outcomes at a population level rather than reflecting gender-specific disease patterns. From a Kaupapa Māori Research perspective, this step aligns with whānaungatanga by prioritising conditions with impacts that cut across whānau, hapū, and iwi and where mitigation would deliver collective benefit.

Question 3. Which of the Remaining Causes of Death Are Chronic Conditions?

The third step refined the list of causes identified in Question 2 to include only conditions that are understood as chronic: that is, conditions characterised by persistence over time, cumulative impact on health, and a requirement for ongoing management rather than discrete, time-limited interventions. This definition aligns with standard public health and epidemiological use, which treats chronic conditions as long-lasting diseases or disorders that typically require sustained interaction with health systems (Centers for Disease Control and Prevention, 2022; World Health Organization, 2005).

On this basis, lung cancer was removed from the list. While advances in treatment have improved survival for some cancers, lung cancer is typically managed as a malignant disease rather than a stable, long-term condition requiring ongoing chronic management. Lung cancer outcomes are often dominated by relatively short survival horizons with low five-year survival

reported across many countries (Allemani et al., 2018). Even where survivorship is extended, illness trajectories for incurable cancers can be highly heterogeneous and episodic (Geijteman et al., 2024), making them less suitable for an analytical framework designed to identify sustained favourable versus adverse outcomes over long periods as DI and cancer are fundamentally different disease dynamics.

Taken together, these refinements ensure that the final set of medical conditions examined in this thesis is conceptually aligned with a chronic disease framework, analytically coherent for individual-level burden measurement, and appropriate for the study's objectives of identifying sustained favourable and adverse outcomes among Māori.

After filtering, two conditions remained: ISH and DI.

Question 4. Which of the Remaining Medical Causes Have the Highest Survival Rates?

The final step was to determine which of these conditions was most suitable for analysing both fatal and non-fatal burden at the individual level.

This required consideration of post-diagnosis survival. Conditions characterised by short survival windows constrain the ability to examine long-term morbidity, variation in lived experience, and health system responsiveness over time. In contrast, conditions with extended survival trajectories enable analysis of both the quantity and quality of life following diagnosis, which are central aims of this study.

Following acute myocardial infarction, while ISH has five-year survival estimates of approximately 70%–80% among discharged patients, mortality risk remains concentrated in the period immediately following acute events (Bata et al., 2006). This survival pattern limits the opportunity to examine extended non-fatal burden or long-term variation in outcomes.

DI differs fundamentally from ISH. DI is typically associated with prolonged disease duration and gradual accumulation of complications (World Health Organization, n.d.). Survival is therefore not commonly expressed as a fixed-term survival rate. Instead, its impact is more appropriately measured through reductions in life expectancy. International evidence indicates that each decade of earlier diagnosis of DI is associated with approximately three to four years of reduced life expectancy (Emerging Risk Factors Collaboration, 2023). Importantly, individuals live for many years following diagnosis, experiencing highly variable trajectories of morbidity and functional impact.

This extended survival profile makes DI best suited to the aims of this study by enabling:

1. Estimation of individual-level YLL from premature mortality
2. Measurement of YLLD arising from prolonged morbidity
3. Assessment of health system responsiveness over time rather than at a single acute episode.

From a Kaupapa Māori Research perspective, DI is also a consequential condition because it undermines health through both shortened lives and prolonged constraint on independence and participation. Its impacts reverberate through whānau via caregiving demands, reduced economic participation, and disrupted intergenerational roles and responsibilities. This makes it well suited to an analytic approach that treats outcomes as consequential for Māori collective wellbeing and for Treaty-based accountability, rather than as isolated clinical endpoints.

On these bases, DI was selected as the medical condition in scope for this study.

Finalisation of Research Questions

Having established the target population as Māori adults and DI as the medical condition, the research questions for this study were finalised.

The initial research questions were intentionally broad, reflecting an early interest in whether Māori with major chronic conditions experience outcomes comparable to the best observed and, if so, how such outcomes might be identified.

As the methodological foundations of the study were refined, particularly through the decision to focus on a single high-burden condition and to develop individual-level measures of fatal and non-fatal impact, the questions were narrowed to ensure analytical precision and coherence with the study design. This process resulted in the following final research questions:

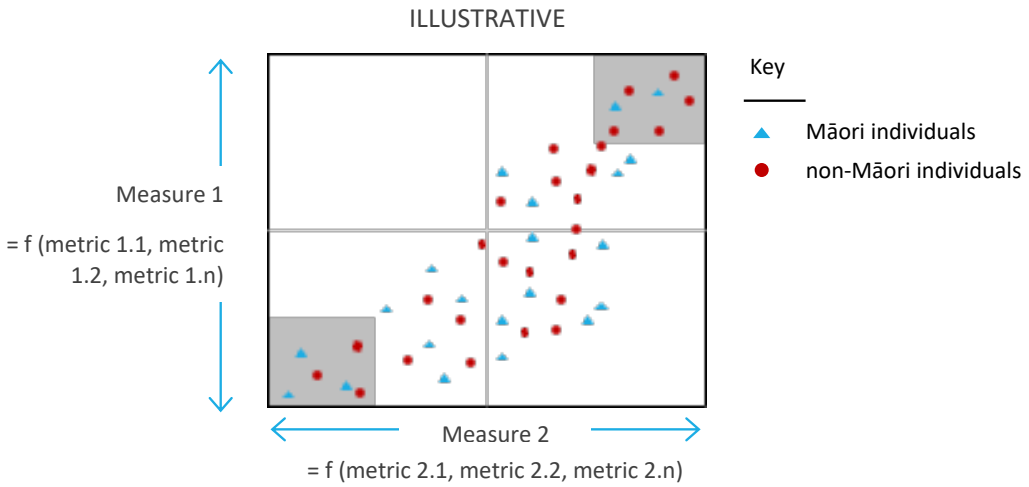
1. Do Māori with DI experience outcomes that rank among the best observed across Māori and non-Māori?
2. What distinguishes Māori with the most favourable outcomes from Māori with the most adverse outcomes?

Part 2. Measuring the Impacts of DI

In the Hackett Group methodology used in the BASS programme, performance was summarised using two top-line measures: efficiency (the ratio of outputs to inputs) and effectiveness (the extent to which services achieve their intended outcomes). Each top-line

measure was supported by a set of underpinning metrics. To emulate this logic for DI outcomes, this study required two top-line measures that capture the most consequential health impacts of the condition (Figure 9).

Figure 9: Adapting the Hackett Group Methodology to Map DI Health Outcomes



Study Measures

Mortality and morbidity were selected as the two topline measures for the study. Together, these dimensions reflect the most consequential impacts of chronic disease and form the core components of health loss in epidemiology. Mortality captures premature death and the ultimate failure of prevention, treatment, and system responsiveness, while morbidity captures the lived impact of illness, impairment, and disability over time (Murray & Lopez, 1996; Salomon et al., 2012).

These measures are also central to Māori health priorities in Aotearoa New Zealand, where inequalities in premature mortality and lived health loss are considered indicators of health system performance (Waitangi Tribunal, 2019).

The selection of mortality and morbidity was also driven by two methodological requirements. First, mortality-related and morbidity-related health loss are analytically distinct yet comprehensively exhaustive dimensions of burden, ensuring that major components of disease impact are not omitted or double-counted. Second, both mortality and morbidity can be operationalised at the individual level within longitudinal linked data environments, which enables individual-level analysis rather than reliance on population averages (Milne et al., 2019).

Measuring the Mortality Impact of DI with YLL

YLL quantifies the number of years of life lost due to premature death by comparing an individual's age at death with their expected remaining life expectancy at that age. Unlike rate-based measures, YLL captures when death occurs, making it particularly well suited to individual-level analysis.

Alternative measures of mortality burden, such as life expectancy and crude or age-standardised mortality rates, are widely used in population health research. However, these measures were not suitable for the aims of this study. Life expectancy is a population-level summary and does not support comparisons among individuals who have already developed a condition. Crude and age-standardised mortality rates quantify the frequency of death but do not distinguish between deaths occurring early in life and those occurring closer to their expected life expectancy. As a result, they obscure variation in lived experience and limit learning about outcome distributions.

YLL was selected because it meets three critical requirements of this research.

First, it strengthens comparability and interpretability across individuals and groups. By applying the same decision rules to all individuals, YLL enables direct comparison of outcomes between Māori and non-Māori and among Māori, without requiring additional standardisation steps that can obscure meaning. This matters because the analytic objective is explicitly distributional and individual-level: identifying favourable and adverse outcomes depends on being able to rank and compare individuals on a common scale. Using YLL also supports interpretability over time. When the reference frame is held constant, differences in measured health loss can be read as differences in outcomes (or trajectories) rather than shifts in the measurement scale itself.

Second, using YLL strengthens accountability by keeping the measurement standard external to the populations being compared. A core purpose of this thesis is to support Treaty-based scrutiny of whether the health system is delivering equal outcomes and responding equitably where outcomes are unequal. That accountability requires a metric that does not take the observed outcome distribution within any group as the standard for what is "expected" or "acceptable." In this way, YLL provides a stable reference point against which outcomes can be assessed and keeps the analytic focus on health system performance and population-level fairness.

Third, it avoids embedding existing structural inequalities into the metric at the point of measurement. If it varies by group (e.g., through ethnicity- or sex-specific standards), the metric can inadvertently normalise historically produced inequalities by treating poorer outcomes as expected for that group.

In this study, YLL was calculated using the 2017–2019 New Zealand Life Tables. For each individual, YLL was defined as the expected remaining life expectancy at age of death, derived from the combined-gender, all-ethnicities life table. For example, if an individual died at age 69 and the life tables indicated an expected remaining lifespan of nine years at that age, their YLL was nine years.

A single national reference was applied to all individuals rather than using sex- or ethnicity-specific life tables. This decision was deliberate: using group-specific life tables would have lowered the expected lifespan against which Māori (and males) are measured, introducing a biased reference standard that obscures rather than measures health inequity. By applying a single national standard, this study ensures that each premature death is assessed against the same expectation of life, consistent with Treaty-based commitments to equality in outcomes.

Measuring the Non-Fatal Burden of DI with YLLD

In addition to premature mortality, DI produces substantial non-fatal health loss through prolonged symptoms and complications, including neuropathy, renal disease, visual impairment, and other disabling sequelae that constrain daily functioning and participation. For this thesis, non-fatal burden needed to be visible at the individual level because the analytic objective is to identify and compare Māori individuals with favourable and adverse outcome profiles.

Conventional measures used in surveillance (such as incidence, prevalence, and population-level YLD) are valuable for monitoring trends, but they rely on aggregate summaries and modelled estimates that obscure individual trajectories and within-group variation (GBD 2019 Diseases and Injuries Collaborators, 2020). This limits their usefulness for Kaupapa Māori Research where health need must be interpretable in relation to individuals, whānau, and system performance.

This study therefore required a non-fatal individual-level metric burden that could be calculated directly from longitudinal administrative records and interpreted alongside YLL using consistent units. To meet these requirements, a novel metric was developed for this study: YLLD.

Conceptual basis of YLLD

YLLD builds on the Global Burden of Disease formulation of YLD, which estimates non-fatal health loss by combining disability weights with prevalence (GBD 2019 Diseases and Injuries Collaborators, 2020). However, YLD is typically constructed at the population level using modelled prevalence and does not permit individual-level estimation of lived burden.

YLLD adapts this approach by using observed diagnosis histories and durations within linked administrative data to estimate cumulative disability burden over each person's observed disease course.

Conceptually, YLL measures life years lost due to premature death. YLLD extends this logic by estimating the number of years lost to DI and its complications, expressed in the same unit (years). This symmetry supports joint interpretation of fatal and non-fatal burden.

Alternative metrics such as Quality-Adjusted Life Years (QALYs) were not appropriate for this thesis. QALYs are oriented toward "healthy years gained" and embed value judgements that imply that years lived with disability are valued less than years lived in full health (Nord, 1999). From a Kaupapa Māori Research perspective, the QALY framing risks conflict with commitments to mana, dignity, and the inherent worth of people regardless of health status (Hudson et al., 2010).

Why YLLD was selected

YLLD was selected because it meets three requirements of this research.

First, it enables individual-level, distributional analysis of non-fatal burden using the IDI. This is essential for identifying Māori with comparatively favourable outcomes and comparing them with Māori experiencing adverse outcomes rather than relying on population-level averages.

Second, it is conceptually aligned with YLL. Using a compatible "years-lost" measure strengthens interpretability when the two dimensions are examined jointly and supports a coherent mortality–morbidity outcome framework.

Third, it supports accountability-oriented interpretation by making lived burden visible as an empirical outcome that can be interrogated in relation to service pathways and system responsiveness.

Methodology for calculating YLLD

YLLD was calculated using longitudinal IDI data by applying Global Burden of Disease disability weights to observed individual health trajectories (Salomon et al., 2012). The calculation proceeded in three steps.

First, the duration of DI and diabetes-related complications was estimated for each individual. Duration was measured from the first recorded diagnosis date in the linked administrative record to the date of death. Because administrative records do not capture true biological onset, these durations represent an operational approximation of the recorded disease course and are interpreted accordingly.

Second, condition-specific disability weights sourced from the GBD Study were assigned to each diagnosed disease state. Disability weights reflect average severity of health loss associated with specific conditions. Each disability weight was multiplied by the observed duration of that condition for the individual, producing a disability-weighted time component.

Third, total YLLD was calculated as the sum of disability-weighted durations across DI and observed complications. Where multiple complications overlapped in time, each contributed to total YLLD using an additive approach. No multiplicative comorbidity adjustment was applied. This decision reflects a trade-off: comorbidity adjustment can be desirable when estimating instantaneous health loss, but it requires stronger assumptions about interaction between states than the administrative data can support transparently. Given the analytic purpose of this thesis (i.e., distributional visibility and outcome classification), an additive approach was preferred because it preserves interpretability, is reproducible, and is applied consistently across all individuals.

Assigning zero non-fatal burden to individuals without recorded complications would risk underestimation due to underdiagnosis, incomplete coding, or gaps in service contact. To avoid this, a base disability weight for uncomplicated DI was applied for the duration of each individual's observed DI history, recognising that DI itself contributes non-fatal burden even where complications are not captured.

All YLLD calculations were conducted within the secure IDI environment using linked administrative health records. This approach avoided reliance on modelled prevalence estimates and enabled direct individual-level estimation based on observed diagnosis and service histories.

Interpretation and limitations

The GBD disability weights are derived from international valuation exercises and have not been validated against Māori conceptions of health, wellbeing, or disability (GBD 2019 Diseases and Injuries Collaborators, 2020). Their use in this thesis reflects pragmatic constraints of available data rather than an assertion of cultural completeness. Consistent with Kaupapa Māori Research practice, this limitation is made explicit so that YLLD is understood as

an operational approximation that can be scrutinised and improved. Additional limitations arise from reliance on administrative data: conditions that are not diagnosed, not coded, or not captured in available datasets will not contribute to YLLD, leading to underestimation for some individuals. These are constraints of the data environment rather than the conceptual intent of the measure and are treated as interpretive limits.

Despite these limitations, YLLD enables individual-level measurement of non-fatal burden, preserves visibility of within-Māori variation, and aligns conceptually with YLL. Together, these features allow Māori health need to be quantified in ways that support scrutiny and accountability rather than abstraction.

Measuring the Joint Burden of DI

Conceptual Basis of the Joint Burden Matrix

To preserve the distinctiveness of fatal and non-fatal burden while enabling integrated analysis, this study developed a joint-burden matrix. In this matrix, the horizontal axis represents non-fatal burden (YLLD), and the vertical axis represents fatal burden (YLL). Each individual is positioned according to their calculated YLL and YLLD values.

Maintaining fatal and non-fatal burden as separate analytic dimensions aligns with equity-focused epidemiology, which emphasises that measurement choices carry normative consequences and should make distributional differences visible rather than compressing them into a single summary metric (Harper et al., 2010). Separating mortality and morbidity preserves interpretability; enables clearer identification of within-group and between-group disparities; and avoids masking offsetting patterns (for example, lower mortality but higher lived disability, or vice versa) that matter for accountability and prioritisation (Asada, 2007).

From a Kaupapa Māori Research perspective, preserving distinct dimensions of fatal and non-fatal burden respects the dignity of individuals whose lives may be shaped by disability without implying lesser worth. The matrix also supports tino rangatiratanga by producing evidence that iwi and hapū can use to identify who is thriving, who is struggling, and where outcomes diverge most sharply.

Limitations of Existing Composite Burden Measures

Composite measures such as Disability-Adjusted Life Years (DALYs); Health-Adjusted Life Expectancy (HALE); and Quality-Adjusted Life Years (QALYs) were considered but not used in this study for three interrelated reasons.

First, composite measures are constructed at the population level and rely heavily on modelled averages. In the case of DALYs, this involves combining YLL and YLD using prevalence-based estimates that obscure individual trajectories. For the specific purposes of this study (i.e., identifying Māori with among the most favourable and most adverse outcomes and supporting within-Māori learning), this loss of distributional detail was a critical limitation. Population-level composites cannot reveal individual-level variation in survival and lived burden.

Second, by collapsing fatal and non-fatal burden into a single summary value, these three composite metrics treat qualitatively different experiences as analytically equivalent. Individuals who die early with little disability may receive similar scores to those who live many years with substantial morbidity. From an analytical perspective, this erases important information about how survival and suffering intersect. From a Kaupapa Māori Research perspective, it risks diminishing mana (prestige, authority) by implying that distinct life experiences are substitutable rather than meaningful in their own right.

Third, measures such as DALYs and QALYs embed normative assumptions about health states and the value of life years. These assumptions are rarely transparent and have not been grounded in Māori epistemologies of health, wellbeing, or dignity. In particular, QALY-based approaches risk framing disabled life as inherently less valuable, which conflicts with Kaupapa Māori commitments to dignity, equality, and collective wellbeing. For this study, it was therefore preferable to retain explicit, interpretable dimensions rather than adopt a composite metric with implicit value judgements.

These concerns are well established in the literature. DALYs have been criticised for embedding contestable assumptions about the commensurability of death and disability and for relying on summary aggregation that can conceal important differences within populations (Anand & Hanson, 1997), and QALYs have been challenged for privileging biomedical conceptions of health and implicitly devaluing disabled lives (Nord, 1999).

Construction of the Joint Burden Matrix

Construction began with independently ranking YLL and YLLD into quartiles, which were calculated within each study year using the full cohort distribution of YLL and YLLD and then applied to classify individuals in that year. This enabled classification of individuals into one of four joint outcome categories:

1. Area 1 (lowest burden): YLL in Q1 and YLLD in Q1
2. Area 2 (low burden): YLL and YLLD both in Q1–Q2, but not both in Q1 (i.e., at least one measure is in Q2 and neither exceeds Q2)
3. Area 3 (moderate burden): YLL and YLLD both in Q1–Q3, with at least one measure in Q3, and neither measure in Q4
4. Area 4 (high burden): YLL in Q4 or YLLD in Q4 (or both), regardless of the other measure's quartile (e.g., Q4 YLL with Q1 YLLD, or Q4 YLLD with Q2 YLL).

This stratification allows outcomes to be examined both continuously and categorically, supporting descriptive, comparative, and hypothesis-driven analysis.

Interpretive Value and Contribution of the Matrix

This structure supports explicit identification of individuals, enabling learning from within-Māori variation rather than positioning Māori health solely in terms of deficit relative to non-Māori. The application of the joint-burden matrix to the study cohort is presented in Chapter 5 where it is used to examine the distribution of survival and suffering among Māori with DI and to explore factors associated with divergent outcome profiles.

Part 3. Applying for Access to the IDI

Once the approach to measuring the mortality and morbidity impacts of DI at the individual level had been determined, access to the IDI was sought to obtain the data required.

Because of its breadth and depth, the IDI provides unique capacity to examine health outcomes across the entire population. For this study, access to the IDI was essential: no other dataset in Aotearoa New Zealand offers sufficient coverage to calculate individual-level YLL and YLLD across the Māori population or to support robust within and between-group comparisons. Alternative sources, such as sample surveys, do not provide the scale required to assess outcome variation among Māori adults. The IDI was therefore the only viable platform for this research.

The application process was lengthy. Two pre-application meetings were held with Statistics NZ advisors to scope the feasibility of the project. A 30-page application was then prepared that set out the research aims, detailed the datasets required, and described how each dataset would be used to calculate YLL and YLLD and to compare outcomes for Māori and non-Māori. Because metadata on variables is limited, a broad set of datasets was requested to ensure adequate coverage of health outcomes and relevant determinants. Following a review and a

series of follow-up meetings, the application was approved. Statistics NZ confidentiality training was subsequently completed, and a legally binding secrecy declaration was signed. In total, the application and approval process took approximately three months.

Dataset Selection

The datasets requested were selected to support complete coverage of both health outcomes (mortality, morbidity, hospitalisation, pharmaceutical and laboratory claims, mental health services) and relevant determinants (socioeconomic status, education, employment, benefit receipt, and cultural engagement). Together, these sources provided the multidimensional view of health needed for a Kaupapa Māori Research analysis of outcomes and inequalities. The full set of datasets accessed is shown in Table 6, which also records the two additional datasets (Te Kupenga and the New Zealand Health Survey) added after approval.

Table 6: Application Datasets

No	Dataset name	Description
Access granted as part of initial application		
1	Mortality	Data classifying the underlying cause of death for all deaths registered in New Zealand, including all registered foetal deaths (stillbirths), using the World Health Organization Rules and Guidelines for Mortality Coding.
2	Chronic conditions	Healthcare users in the population cohort diagnosed with one or more of eight chronic conditions/significant health events identified using a variety of sources.
3	Programme for integration of mental health data	Subset of fields from PRIMHD. Specifically, contains data about the referral, what services (activities) were provided, and demographic information. Excludes outcomes, diagnosis, and legal status data.
4	Pharmaceuticals	Subset of fields from the Pharmaceutical Claims Collection. Specifically, contains information about subsidised dispensing processed by the General Transaction Processing System (GTPS), including demographic information about healthcare users to whom these prescriptions were dispensed.
5	Laboratory claims	Subset of fields from the Laboratory Claims Collection. Specifically, contains claim and payment information for laboratory tests processed by the General Transaction Processing System (GTPS). Also contains laboratory test information from Pegasus IPA and Medlab South.

No	Dataset name	Description
6	Publicly funded hospital discharges	Subset of fields from the National Minimum Dataset (NMDS). Includes discharge and event data about hospital events and demographic data reported for the population cohort.
7	Privately funded hospital discharges	Subset of fields from the National Minimum Dataset (NMDS). Includes discharge and event data about hospital events and demographic data reported for the population cohort.
8	General medical services claims	Subset of fields from GMS. Specifically, information from fee-for-service claims made by general practitioners.
9	National non-admitted patient collection	Subset of fields from NNPAC. Specifically, contains information about all non-admitted (e.g., outpatient) events reported for the population cohort.
10	National needs assessment and service coordination Information system	Used by Ministry-funded Needs Assessment and Service Coordination (NASC) agencies to record information about clients who are eligible for Disability Support Services (DSS).
11	2013, 2018 Census	People and dwellings in New Zealand on census night. Provides a snapshot of our society at a point in time.
12	Household labour force survey	Sample data about employment, unemployment, and people not in the labour force in New Zealand.
13	New Zealand income survey	Sample data about sources of incomes, including wages and salaries, self-employment, government transfers, other private transfers, and investments.
14	Benefits dynamics data	People who have received a working-age social welfare benefit. Provides basic information on demographic characteristics, and traces their changing benefit status and other circumstances. Also traces the benefit histories of partners and dependent children included in benefits.
15	General social survey	Data about the well-being of New Zealanders aged 15 years and over, including a wide range of social and economic outcomes and how people are faring.
16	Tertiary education data	Students enrolled or who have completed qualifications in formal/non-formal tertiary qualifications at government-funded tertiary education organisations.
Access granted following a subsequent request for additional data		
1	Te Kupenga	Data on the social, cultural, and economic wellbeing of Māori in New Zealand, including information about the health of the Māori language and culture.

No	Dataset name	Description
2	New Zealand Health Survey	Provides information about the health and wellbeing of adults and children in New Zealand. The NZHS became a continuous survey in 2011, enabling the publication of annual updates on the health of New Zealanders.

Limitations of IDI Use for Ethnicity

Ethnicity in the IDI is derived from multiple administrative sources, creating potential for misclassification, particularly for Māori. Cultural and relational variables are limited in scope and availability. For example, Te Kupenga provides valuable insight into cultural connection and te reo Māori (Māori language) use but it is cross-sectional, infrequent, and not fully linkage-ready. Similarly, the New Zealand Health Survey includes self-reported wellbeing measures but lacks the scale and structure required for individual-level burden estimation. As with all administrative data, the vast bulk of datasets within the IDI were designed for service delivery rather than research, meaning gaps and biases in coverage remain.

Other limitations associated with the use of administrative data, including incomplete capture of lived experience and constraints on cultural variables, are discussed in Chapter 9.

Conclusion

This chapter establishes the target population and medical condition in scope, finalises research questions, and justifies a deliberate emphasis on individual-level measurement of both fatal and non-fatal health loss among Māori adults.

This chapter also introduces and justifies the use of YLL to capture premature mortality, YLLD to capture cumulative non-fatal burden, and a joint-burden matrix to preserve and integrate these distinct dimensions without collapsing them into a single composite metric. Together, these measures were designed to support individual-level analysis, distributional visibility, and accountability-oriented interpretation, consistent with both epidemiological rigour and Kaupapa Māori Research principles.

Finally, this chapter documents the process of securing access to the IDI and describes the datasets used to operationalise these measures at a national scale. While recognising the limitations of Crown-held administrative data, the chapter situates IDI use within an explicit Kaupapa Māori Research framework and demonstrates why it was the only viable platform for addressing the study's research questions.

Chapter 5. Calculating YLL, YLLD, and Joint Burden

This chapter outlines the steps taken in the IDI to calculate YLL, YLLD, and the joint burden from DI in a transparent and reproducible way. It has four parts. Part 1 details the steps taken to establish YLL. Part 2 outlines the steps taken to calculate YLLD without complications. Part 3 describes the steps taken to calculate YLLD with one or more complications. Part 4 describes the method used to combine individual-level YLL and YLLD into a joint-burden matrix for individual health outcomes.

Although this study analyses outcomes across five study years (2013, 2014, 2016, 2018, and 2019), the methodological steps for calculating YLL, YLLD, and the joint-burden classification are described using the 2019 study year only. This year was used as an exemplar because the analytic procedures, data sources, variable constructions, and associated code and decision rules were applied consistently across all study years. Describing the full process for a single year avoids unnecessary repetition. Complete set of IDI code for 2019 is attached as Appendix 2.

Part 1. Calculating YLL from DI

Three steps were taken to estimate YLL among Māori and non-Māori adults whose underlying cause of death was DI (ICD-10 E11) in 2019:

1. Identify the unique identifier and age of death for those who died of DI in 2019
2. Prepare and save the New Zealand Life Table in the Sandpit. The Sandpit is the designated secure workspace within the IDI where researchers store code, outputs, and reference datasets
3. Identify YLL to DI by those who died of DI in 2019.

Step 1. Identify the Unique Identifier and Age of Death for Those Who Died of DI in 2019

Mortality data in the IDI are drawn from the New Zealand Mortality Collection maintained by the Ministry of Health. This dataset records all registered deaths in New Zealand, including the date of death, underlying cause of death, and contributing causes, coded to the International Statistical Classification of Diseases and Related Health Problems – 10th Revision (ICD-10) (World Health Organization, 2016). The Mortality Collection is the authoritative national source for cause-of-death data and is updated annually within the IDI.

In this step, the Mortality Collection was used to:

1. Identify all individuals whose underlying cause of death in 2019 was DI (ICD-10 code E11) and classify them as Māori or non-Māori using ethnicity data from the IDI's standardised ethnicity tables
2. Extract each individual's date of birth and calculate their age at death.

The Statistics New Zealand unique identifier (snz_uid) and calculated age at death (age_death) are the variables that form the base cohort for subsequent YLL calculations. An example of the output is presented in Table 7 below.

Table 7: YLL to DI – Step 1 Output

Row[a]	snz_uid[b]	m_nm[c]	year_birth	year_death	age_death[d]
1	877382	1	1959	2019	60
2	1029937	0	1942	2019	77
3	5643210	1	1971	2019	48

a: The column is included for illustrative purposes only it was not part of the output
b: snz_uid: Unique identifier for individuals in the IDI
c: m_nm: Identifies whether the individual was Māori (1) or non-Māori (0)
d: age_death: Calculated as year_death from year_birth (year based age approximation).

Step 2. Prepare and Save the New Zealand Life Table in the IDI Sandpit

The New Zealand Life Tables 2017–2019 provide age-specific life expectancy estimates separately for Māori and non-Māori and for males and females. As discussed in Chapter 3, this study used the average life expectancy at each age across all four groups (Māori males, Māori females, non-Māori males, non-Māori females).

As researchers cannot import external files into the IDI Lab, Step 2 involved transferring the revised table into the IDI Sandpit (a designated storage area for reference datasets and other material). This enabled programmatic linkage to the Step 1 mortality cohort to calculate expected remaining life years for each individual.

Step 3: Identify YLL for Individuals Who Died of DI in 2019

In this step, the mortality cohort identified in Step 1 was linked to the revised New Zealand Life Table prepared in Step 2. For each individual, age at death was matched to the corresponding life expectancy value from the Life Table, producing an estimate of the YLL due to DI. An illustration of the output from this step is presented in Table 8 below.

Table 8: YLL - Step 3 Output

Row	snz_uid	m_nm	year_birth	year_death	age_death	YLL[a]
1	877382	1	1959	2019	60	24.7
2	1029937	0	1942	2019	77	11.2
3	5643210	1	1971	2019	48	35.5

a: YLL to DI for individuals = Expected years remaining from the Life Table

The result of this step was an individual-level dataset of YLL values for all people who died of DI in 2019.

Part 2. Calculating YLLD Without Complications

YLLD from DI without complications was calculated separately from YLLD with complications (covered in Part 3 of this Chapter). This separation helps mitigate the risk that differences in access to hospital services could bias estimates. This is because Māori are more likely than non-Māori to experience barriers to timely and appropriate health care, including structural discrimination, geographic access challenges, and lower trust in the health system (Came et al., 2020).

In all YLLD calculations presented in this thesis, no multiplicative adjustment for coexisting conditions was applied. YLLD was calculated as the cumulative product of condition-specific duration and disability weight over time, with each included condition contributing independently to an individual's total YLLD in proportion to observed duration and severity. This approach reflects the longitudinal accumulation of burden rather than an instantaneous comorbidity load. While the Global Burden of Disease study incorporates comorbidity adjustment when producing population-level estimates (Vos et al., 2012), an additive individual-level approach was preferred in this research because it is transparent, reproducible in the IDI, and applies a consistent decision rule across individuals.

Steps Taken to Quantify YLLD

Two steps were taken to calculate individuals' YLLD from DI without a complication:

1. Identify the first year of diagnosis with DI as a chronic condition
2. Calculate the YLLD for DI for each individual.

Each of these steps is detailed below.

Step 1. Identify the Year of First Diagnosis with DI as a Chronic Condition

The first step in calculating YLLD from DI without complications was to determine the year in which each individual in the 2019 mortality cohort was first diagnosed with DI as a chronic condition. This was achieved using the Chronic Conditions Table in the IDI, which consolidates diagnostic information from multiple administrative health datasets (including hospital discharges, outpatient events, and other health service records) into a consistent format for longitudinal analysis.

The Chronic Conditions Table was selected because it provides a national, systematically coded record of chronic disease onset dates, enabling consistent identification of the first known diagnosis of DI for each individual. This approach mitigates bias arising from differential contact with hospital and primary care. Māori are less likely to appear in hospitalisation datasets due to barriers to access and differences in engagement with services, so relying on hospital discharges alone would systematically underestimate Māori DI prevalence and burden. By drawing on the Chronic Conditions Table, which integrates multiple linked health datasets, this study more completely captures Māori living with DI and strengthens the validity of within-group and between-group comparisons.

By establishing the year of first diagnosis, this step provided the starting point for calculating the total duration of time each individual lived with DI before death, which is a core input for the YLLD calculation in Step 2.

Step 2. Calculate the YLLD for DI for Each Individual

In this step, the duration of DI for each individual identified in Step 1 was combined with the Global Burden of Disease (GBD) Study 2019 disability weight for DI without a complication (0.049) to estimate YLLD. Duration was calculated as the time between the year of first diagnosis (from the Chronic Conditions Table) and the year of death.

To reduce underestimation when using year-level duration (rather than exact dates), duration was calculated using an endpoint convention of (year of death + 1). This convention approximates near-complete exposure in the final calendar year without changing the recorded year of death in the mortality data; it is used only for duration calculation where within-year timing cannot be represented precisely.

The decision to use GBD Study disability weights was based on three factors: (1) they are developed and refined through an internationally recognised and systematic methodology; (2) they provide coverage across a broad range of conditions, enabling consistent comparisons;

and (3) no equivalent set of nationally developed disability weights exists for Aotearoa New Zealand.

While robust and comparable, GBD Study weights do not capture Māori-specific third-tier and fourth-tier impacts of illness (e.g., effects on whānau, cultural participation, and collective wellbeing), which is a limitation discussed further in Chapter 8.

From a Kaupapa Māori Research perspective, the use of a consistent, globally recognised set of weights across all individuals ensures that Māori outcomes are not measured against lower or differential baselines. Instead, disparities in YLLD reflect real differences in disease duration and experience, not methodological inconsistencies or systemic bias. In this way, the method both meets epidemiological standards and supports Māori equality by making the lived time lost to DI fully visible.

The output of this process was an individual-level dataset of YLLD values for DI without a complication. An illustration of the output is shown in Table 9 below.

Table 9: YLLD Without a Complication – Step 2 output

snz_uid	m_nm	year_birth	year_death	age_death	year_diag	years_w_DI[a]	YLLD_nc[b]
877382	1	1959	2019	60	1980	39	1.91
1029937	0	1942	2019	77	1993	26	1.27
5643210	1	1971	2019	48	2000	19	0.93

a: years_w_DI or years lived with DI: Equals 2020 – year_diag
b: YLLD with no complication

Part 3. Calculating YLLD with Complications

This part sets out the calculation of YLLD from DI with one or more complications. Complications are a key driver of the overall burden of DI, often accelerating disease progression, increasing morbidity, and reducing quality of life. They can involve multiple organ systems and, when occurring in combination, substantially magnify the disability experienced. Quantifying this burden is therefore critical for understanding the full impact of the condition.

Steps Taken to Calculate the YLLD with Complications

The process to quantify YLLD from DI with complications followed eleven steps for both the Public and Private Hospital Discharge Tables:

1. Assess available health datasets and join event and diagnosis tables
2. Join event and diagnosis tables and identify year of events
3. Identify diagnoses of events

4. Remove duplicate records
5. Identify earliest year of diagnosis
6. Remove events before DI diagnosis
7. Identify years lived with diagnosed conditions
8. Develop disability weights tables
9. Calculate and aggregate YLLD from complications.

The steps as described below are for public hospital discharges only. The same process was applied to private hospital discharges but it is not described separately to avoid duplication.

Step 1. Assess Available Health Datasets and join Event and Diagnosis Tables

The first step in identifying complications from DI was to assess which health datasets in the IDI could be reliably linked at the individual level. Using the unique snz_uid spine variable, all major diagnosis-bearing health datasets were reviewed to determine whether they met linkage requirements.

This process confirmed that, at the time of this research, only the Public and Private Hospital Discharge Tables contained diagnosis data that could be fully linked to individuals in the study cohort. Other sources, including the Programme for the Integration of Mental Health Data (PRIMHD); the National Non-Admitted Patient Collection; and general practice datasets were not linkable to the cohort via available identifiers or lacked consistent diagnosis coding across the study years. For example, PRIMHD could not be used because the encrypted identifiers it contained could not be linked to snz_uid or any other IDI identifier.

Step 2. Join Event and Diagnosis Tables and Identify Year of Events

Events (hospital admissions or discharges where a diagnosis was recorded) are stored in separate event and diagnosis tables in the IDI. These were joined using encrypted event identifiers to bring together the event details and associated diagnosis codes along with the year in which each event occurred for Māori and non-Māori individuals.

This linkage ensured that each hospital contact was paired with its corresponding diagnostic codes, enabling accurate identification of the year in which each condition was recorded. The resulting dataset formed the basis for subsequent steps in which specific diabetes-related complications were identified and durations of illness were calculated.

Step 3. Identify Diagnoses for Events

After linking event and diagnosis tables, all diagnosis codes associated with each hospital event and the corresponding diagnosis dates for each individual were extracted. This step produced a complete list of all recorded diagnoses for individuals, retaining the original ICD-9 and ICD-10 coding as recorded in the discharge datasets. These diagnoses formed the starting point for identifying those specifically related to DI complications in later steps.

Step 4. Remove Duplicate Records

Joining event and diagnosis tables can create duplicate entries when the same diagnosis is recorded multiple times for the same event. In this step, duplicates were identified and removed to ensure that each diagnosis–event combination was counted only once.

Step 5. Identify Earliest Year of Diagnoses

After removing duplicates, the earliest year in which each individual received a diagnosis for a given condition was identified. This date served as the start date for calculating the number of years the individual lived with that condition.

Step 6: Remove Events Before DI diagnosis

After establishing each individual's earliest diagnosis year for each condition, diagnoses recorded before the individual's first recorded DI diagnosis year (from the Chronic Conditions Table) were removed. This ensured that only conditions plausibly occurring during the observed DI disease course contributed to complication-related YLLD and prevented pre-existing conditions from being misclassified as diabetes-related sequelae.

Step 7. Identify Years Lived with Diagnosed Conditions

Using the earliest diagnosis year from Step 5 and the individual's year of death, the total number of years lived with each condition was calculated. This included partial final years when applicable as described in Chapter 3. At this point, a complete set of ICD-9 and ICD-10 diagnoses from public hospital discharges was available for all conditions recorded after a DI diagnosis. The same process was repeated for private hospital discharges.

Step 8. Develop Disability Weights Tables

Three separate disability weights tables were developed for use in calculating YLLD from complications:

1. Diabetes-specific conditions: ICD codes directly attributable to DI
2. Diabetes-related mental health conditions: Mental health diagnoses with robust evidence of higher prevalence among people with diabetes

3. Other diabetes-related conditions: Associated conditions not captured in the first two categories but meeting inclusion criteria based on literature review and frequency thresholds.

For all three categories, disability weights were sourced from the 2019 GBD Study. Where a diagnosis had a corresponding disability weight in the GBD Study, that weight was used directly. Where no direct GBD Study weight existed, the condition was matched to the closest GBD Study health state lay description. Where no suitable match could be identified, the diagnosis was excluded to avoid introducing arbitrary or unsupported weights.

Three disability weights tables were then developed as described below.

Diabetes-Specific Disability Weights Table

Three steps were taken to compile the Diabetes-specific disability weights table:

1. Identify diabetes-specific diagnoses: Using the output from Step 6 (Listing 10), all diagnoses directly linked to DI pathophysiology or recognised complications were extracted
2. Assign disability weights: GBD Study 2019 disability weights were applied directly where available
3. Handle unmatched diagnoses: Where a direct GBD Study weight was unavailable, the diagnosis was matched to the closest GBD Study health state lay description. Diagnoses without a suitable match were excluded.

Mental Health-Related Disability Weights Table

Three steps were taken to compile the mental health-related disability weights table:

1. Identify mental health diagnoses: From the Step 6 output, all recorded mental health diagnoses were identified
2. Exclude unrelated conditions: The following were removed as clearly unrelated to diabetes: mental and behavioural disorders due to psychoactive substance use; Intellectual disabilities; pervasive and specific developmental disorders; and behavioural and emotional disorders with onset usually occurring in childhood and adolescence
3. Apply inclusion criteria: Remaining conditions were included if at least two systematic reviews and/or meta-analyses published within the past 20 years demonstrated a clear association between the condition and DI or significantly higher prevalence among people with DI than those without

4. Assign disability weights: Disability weights were assigned using the same approach as in Step 7.1, matching to the closest GBD Study health state lay description where no direct weight was available. Diagnoses without a suitable match were excluded.

Other' Disability Weights Table

Seven steps were taken to compile the 'Other' disability weights table:

1. Identify candidate diagnoses: All diagnoses not categorised as diabetes-specific or diabetes-related mental health were extracted
2. Standardise codes: ICD-9 and ICD-10 diagnostic codes were shortened to three characters to facilitate grouping
3. Prune unrelated disease types: Drawing on the Australian Institute of Health and Welfare methodology (Australian Institute of Health and Welfare, 2024), disease types unrelated to DI were excluded. Table 10 lists disease types removed (e.g., infectious diseases, pregnancy-related conditions, injuries) and those retained (e.g., neoplasms, circulatory system diseases, amputations)
4. Remove excluded codes: All pruned codes were removed from the list of potential 'other' diagnoses
5. Apply inclusion criteria: Remaining groups were assessed using the same evidence-based inclusion criteria as in the second disability weights table above. Literature supporting inclusion is provided in Appendix 4
6. Set minimum frequency threshold: Only conditions with more than 10 recorded diagnoses were retained. This threshold was selected after testing the hypothesis that ~20% of codes account for ~80% of diagnoses. The analysis showed that 16% of codes accounted for over 80% of diagnoses, supporting exclusion of rare conditions
7. Assign disability weights: GBD Study 2019 disability weights were applied directly where available or matched to the closest GBD Study health state lay description. Diagnoses without a suitable match were excluded.

Table 10: YLLD In-scope Disease Types After Pruning

Disease type	ICD-9 codes	ICD-10 codes
Pruned		
Infectious and parasitic disease	001 – 139	A00 – B99
Ear and mastoid process diseases	380 – 389	H60 – H95
Diseases of the musculoskeletal system and connective tissue	710 – 739	M00 – M99

Disease type	ICD-9 codes	ICD-10 codes
Pregnancy, childbirth and the puerperium disease	630 – 679	O00 – O9A
Conditions originating in the perinatal period	760 – 779	P00 – P96
Congenital malformations, deformations and chromosomal abnormalities	740 – 759	Q00 – Q99
Injury, poisoning and certain other consequences of external causes	800 – 999	S00 – T88
Codes for special purposes	n/a	U00 – U85
External causes of morbidity	E800 – E999	V00 – Y99
Factors influencing health status and contact with health services other than amputations	V01 – V82	Z00 – Z99 other than amputations (Z89) and Z99
Retained		
Neoplasms	140-239	C00-D49
Diseases of the blood and blood-forming organs and disorders involving the immune mechanism	280-289	D50 – D89
Diseases of the nervous system	320 – 359	G00 – G99
Diseases of the eye	360 – 379	H00 – H59
Diseases of the circulatory system	390 – 459	I00 – I99
Diseases of the respiratory system	460 – 519	J00 – J99
Diseases of the digestive system	520 – 579	K00 – K95
Diseases of the skin and subcutaneous tissue	680 – 709	L00 – L99
Diseases of the genitourinary system	580 – 629	N00 – N99
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	780 – 799	R00 – R99
Factors influencing health status and contact with health services other than amputations	n/a	Amputations (Z89) Dependence on renal dialysis (Z99.2)

Step 9. Calculate and Aggregate YLLD from Complications

For each category in Step 8, the duration of illness was multiplied by the relevant disability weight to estimate YLLD. These values were then summed at the individual level. Duplicates were removed, and Māori/non-Māori identifiers were reattached to outputs.

The resulting tables captured YLLD contributions from:

1. Diabetes-specific conditions
2. Diabetes-related mental health conditions
3. Other diabetes-related conditions.

These components were aggregated and added to YLLD from DI without complications (Part 2) to produce a total YLLD value for each individual.

Part 4. Joint-Burden Matrix for Individual Health Outcomes

Having established YLL and YLLD for each individual, these measures were then combined to construct a joint burden profile that captures both fatal and non-fatal impacts of DI at the Individual-level.

Methodological Steps

Construction of the joint burden matrix involved four steps:

1. Ranking and quartile assignment
2. Joint classification
3. Defining favourable and adverse outcome groups
4. Comparative analysis.

Each step is described below.

Step 1. Ranking and Quartile Assignment

Step 1 involved independently ranking YLL and YLLD values across the entire population (Māori and non-Māori combined). This ensured Māori outcomes were assessed against the best observed nationally, not only against other Māori.

Quartile cut-points at the 25th, 50th, and 75th percentiles were then used to assign each individual's position within the YLL and YLLD distributions, enabling consistent comparison within each study year and across groups. An illustration of the output of this step is set out below (Table 11).

Table 11: Joint-Burden Classification Output – Step 1

snz_uid	m_nm[a]	YLL[b]	YLLq	YLLD[d]	YLLDq	Area result
877382	1	4.3	1	5.2	1	1
1029937	0	9.8	2	14.4	3	3
5643210	1	19.3	4	21.0	4	4

It would have been possible to group YLL and YLLD into other groupings, including deciles rather than quartiles. Quartiles were chosen because they provide the best balance of statistical stability and interpretability. Quartiles are a standard summary approach within applied epidemiology and are widely used when presenting distributional patterns in a form that can be readily interpreted and compared across groups (Altman & Bland, 1994; Bennette & Vickers, 2012).

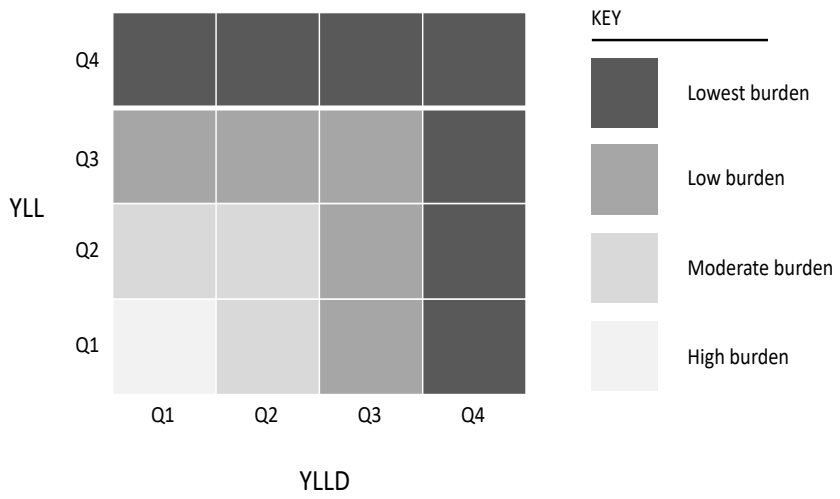
From a Kaupapa Māori perspective, quartiles also support accessibility and transparency. They allow results to be interpreted in a way that is meaningful not only to technical experts, but also to iwi, hapū, and whānau.

Step 2. Joint Classification

Each individual's YLL and YLLD quartile positions were combined to determine their placement in one of four joint-burden outcome areas (Figure 10):

1. Area 1 (lowest burden): YLL in Q1 and YLLD in Q1
2. Area 2 (low burden): YLL and YLLD both in Q1–Q2, but not both in Q1 (i.e., at least one measure is in Q2 and neither exceeds Q2)
3. Area 3 (moderate burden): YLL and YLLD both in Q1–Q3, with at least one measure in Q3, and neither measure in Q4
4. Area 4 (high burden): YLL in Q4 or YLLD in Q4 (or both), regardless of the other measure's quartile (e.g., Q4 YLL with Q1 YLLD, or Q4 YLLD with Q2 YLL).

Figure 10: Matrix for Sorting Individuals into Area Results



This structure allows clear differentiation between low and high burden, a distinction often obscured in composite measures such as the DALY. Importantly, it also enables the direct identification of Māori individuals who experienced among the best outcomes (Area 1) as well as those who experienced among the poorest (Area 4).

From a Kaupapa Māori Research perspective, this comparative approach supports accountability and transformation. By making visible both those Māori who face the lowest burden and those who face the heaviest burdens, the analysis creates an evidence base that iwi and hapū can use to demand change, advocate for resources, and design their own solutions. It also affirms the principle that Māori health outcomes should not only be measured in terms of disparity but also in terms of resilience, agency, and the conditions that enable success. In this way, comparative analysis strengthens tino rangatiratanga by turning variation within the Māori population into a tool for equality and equality-focused system scrutiny and whānau-led action.

Step 3. Defining Favourable and Adverse Outcome Groups

Step 3 involved consolidating joint-burden categories to define analytically meaningful groups for comparative analysis.

Although the joint-burden matrix classifies individuals into four outcome areas (Areas 1–4), preliminary inspection of the distribution showed that the number of individuals in Area 1 (lowest burden) alone was insufficient to support stable comparative analysis, particularly when stratified by year and by Māori ethnicity. To ensure adequate statistical power while retaining conceptual coherence, Areas 1 and 2 were combined and defined as the favourable outcome group. This grouping reflects a substantive rather than purely statistical distinction. Individuals in Areas 1 and 2 experience relatively low combined fatal and non-fatal burden, differing primarily in degree rather than kind. From an epidemiological perspective, combining these areas reduces small-cell instability while preserving the study's capacity to identify Māori whose outcomes are among the most favourable observed nationally.

Conversely, Area 4 was defined as the adverse outcome group, representing individuals with the highest levels of fatal and/or non-fatal burden. Area 3 was deliberately excluded from the adverse category. Individuals in Area 3 occupy an intermediate position and may reflect transitional or mixed outcome profiles. Including Area 3 in the adverse group would introduce a boundary problem by collapsing analytically distinct experiences into a single category and would risk diluting contrasts between those with clearly adverse outcomes and those with more moderate burden.

This classification strategy ensured that comparative analyses focused on clear outcome contrasts rather than arbitrary cut-points. It also aligns with the study's outcome-focused logic by enabling comparison between those with consistently favourable outcomes and those with clearly adverse outcomes, while avoiding misclassification at distributional boundaries.

From a Kaupapa Māori Research perspective, this approach supports interpretability and accountability. Grouping outcomes in this way allows Māori with comparatively strong outcomes to be identified, while ensuring that those experiencing the heaviest burdens are not obscured by intermediate cases. The resulting favourable–adverse contrast provides a transparent basis for examining variation within the Māori population and for identifying factors associated with both resilience and harm.

The definitions of favourable and adverse outcome groups established in this step were applied consistently across study years and form the basis for the comparative analyses presented in subsequent chapters.

Step 4. Comparative Analysis

The final step involved comparing the sociodemographic and cultural characteristics of Māori with favourable outcomes (Areas 1 and 2) and adverse outcomes (Area 4). These comparisons were conducted separately for each study year to examine patterns over time and to identify potential protective and risk factors.

The statistical methods used to undertake these comparative analyses, including variable construction, model specification, and handling of confounding and missing data, are described in detail in the analytic chapters that follow.

Conclusion

This chapter documents the procedures used in the IDI to calculate individual-level YLL, YLLD, and a joint-burden classification for Māori and non-Māori adults whose underlying cause of death was DI (ICD-10 E11) in each study year. Using the national Mortality Collection to define the analytic cohort and the New Zealand Life Tables 2017–2019 to assign expected remaining years of life at each age of death, the chapter establishes a transparent and reproducible approach to estimating YLL that applies a single benchmark to all individuals and therefore supports valid within- and between-group comparisons.

The chapter then sets out the methods used to quantify non-fatal burden. YLLD from DI without complications was calculated using the Chronic Conditions Table to identify each individual's first recorded DI diagnosis year, reducing bias that would arise from relying on

hospital discharge data alone. Because YLLD duration was estimated using year-level information, a duration endpoint convention of (year of death + 1) was applied in the exemplar year to approximate near-complete exposure in the final calendar year without altering the recorded year of death in the mortality data. YLLD from complications was then derived. Across all components, YLLD was calculated additively (without multiplicative comorbidity adjustment) to preserve interpretability, reproducibility in the IDI, and consistent decision rules across individuals.

Finally, the chapter describes how YLL and YLLD were integrated into a joint-burden matrix to support individual-level outcome classification. Within each study year, YLL and YLLD values were ranked across the combined Māori and non-Māori population and assigned quartiles to position each individual within the year-specific distributions. These quartile positions were then combined to classify individuals into four joint-burden outcome areas: Area 1 (YLL Q1 and YLLD Q1); Area 2 (both measures in Q1–Q2, but not both in Q1); Area 3 (both measures in Q1–Q3 with at least one in Q3 and neither in Q4); and Area 4 (YLL in Q4 or YLLD in Q4, regardless of the other measure's quartile). For comparative analysis, Areas 1 and 2 were consolidated as the favourable outcome group and Area 4 was defined as the adverse outcome group, with Area 3 used as an intermediate category and excluded from comparisons. Together, these procedures produced the individual-level outcome measures and classification framework required for the descriptive and comparative analyses that follow, including examination of the distribution of fatal and non-fatal burden across study years and identification of the sociodemographic and cultural characteristics associated with favourable and adverse outcomes among Māori.

Chapter 6. Findings on YLL, YLLD, and Joint Burden

This chapter answers the first research question: Do Māori with DI experience outcomes that rank among the best observed across Māori and non-Māori? It has four parts. Part 1 identifies the annual number of deaths and the corresponding population-based burden ratios (PBRs) for Māori compared to non-Māori. Part 2 reports the total YLL and YLLD for Māori and non-Māori. Part 3 presents the quartile distributions of YLL and YLLD, showing how burden is distributed across individuals. Part 4 concludes the chapter by reporting joint-burden results.

In advance of Part 1, the cohort size and composition are described below.

Cohort Size and Composition

The study cohort for each of the five years (2013, 2014, 2016, 2018, and 2019) comprised all individuals whose underlying cause of death was recorded as DI (ICD-10 E11) in the New Zealand Mortality Collection and who were linked within the IDI as described in Chapter 4. Across the study years, 3,915 individuals were identified, with annual deaths ranging from 711 in 2013 to 891 in 2019.

Age at death was captured in the Mortality Collection and used as a direct input to YLL calculations (Chapter 4). Age-specific patterns are therefore reflected with YLL distributions.

Part 1. Annual DI Mortality and Population-Based Burden Ratios

This section reports the annual proportion of DI deaths and the corresponding Māori representation ratio relative to their share of the national population for each study year.

Steady Increase in Diabetes-Related Deaths

Across the study period, the total number of deaths from DI increased steadily (Table 12). In 2013, there were 711 deaths, rising to 732 in 2014 (a 3.0% increase). By 2016, deaths had reached 774 (a further 5.7% increase from 2014). The trend continued in 2018, with 807 deaths (up 4.3% from 2016). By 2019, the number had climbed to 891, which is a 10.4% rise from 2018. Between 2013 and 2019, the number of deaths from DI rose overall by 25.3%. This upward trajectory indicates that the population-level burden of mortality from DI was not only persistent but continued to grow across the study years.

Table 12: Deaths Attributed to DI in Study Years

Study year	Deaths	Increase (n)	Increase (%)
2019	891	84	10.4
2018	807	33	4.3
2016	774	42	5.7
2014	732	21	3.0
2013	711		

Disclaimer: These results are not official statistics. They have been created for research purposes from the IDI which is carefully managed by Statistics NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/

Māori Experienced Consistently Higher Mortality Risk

Across all study years, Māori were significantly over-represented among deaths from DI relative to their share of the national population. The population-based representation ratio ranged from 1.38 in 2014 (95% CI: 1.38–1.75, p<0.001) to 1.55 in 2018 (95% CI: 1.19 – 1.59, p<0.001) (Table 13).

From a Kaupapa Māori Research perspective, this persistent over-representation indicates a failure to achieve equality of health outcomes as envisaged under Article 3 of the Treaty.

Table 13: Likelihood of Dying from DI for Māori and non-Māori

Study year	Individuals	Number	Proportion deaths (%)	Proportion population (%)	PBR	95% CI	p-value
2019	All	891					
	Māori	222	24.9	16.6	1.50	1.34 – 1.75	<0.001
	non-Māori	669	75.1	83.4			
2018	All	807					
	Māori	207	25.7	16.5	1.55	1.19 – 1.59	<0.001
	non-Māori	600	74.3	83.5			
2016	All	774					
	Māori	180	23.3	15.5	1.50	1.32 – 1.71	<0.001
	non-Māori	594	76.7	84.5			
2014	All	732					
	Māori	150	20.5	14.9	1.38	1.38 – 1.75	<0.001
	non-Māori	582	79.5	85.1			
2013	All	711					
	Māori	162	22.8	14.9	1.53	1.34 – 1.68	<0.001
	non-Māori	549	77.2	85.1			

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Although the representation ratio fluctuated between years, at no point did Māori experience parity with non-Māori. The disparity therefore remained structurally embedded across the study period.

Part 2. Total YLL and YLLD Burdens

This part reports the total fatal and non-fatal burden from DI for Māori and non-Māori in each study year, starting with YLL. Presenting these totals before moving to quartile-based relative positions establishes the absolute scale of YLL and YLLD and reveals gaps that may not be visible when data are expressed in relative terms.

Total YLL from DI

Table 14 shows the total number of YLL for each study year together with changes over time.

Table 14: Total YLL, 2013-2019

Study year	YLL	Increase (n)	Increase (%)
2019	12506.5	1193.9	10.6
2018	11312.6	1051.3	10.2
2016	10261.3	706.8	7.4
2014	9554.5	-372.7	-3.8
2013	9927.2		

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Overall, YLL increased over time, rising from 9,927.2 years in 2013 to 12,506.5 years in 2019, representing a net increase of approximately 2,579.3 life years lost across the period.

Year-on-year changes were not uniform. Between 2013 and 2014, total YLL decreased by 372.7 years (−3.8%). However, this decline was followed by sustained increases in subsequent periods. From 2014 to 2016, YLL increased by 706.8 years (+7.4%), followed by further increases of 1,051.3 years (+10.2%) between 2016 and 2018, and 1,193.9 years (+10.6%) between 2018 and 2019. The largest absolute and relative annual increases occurred in the most recent interval (2018–2019).

Taken together, these results indicate a clear upward trend in premature mortality attributable to DI over the latter part of the study period, despite a brief decline earlier in the decade. The sustained increases observed after 2014 suggest a growing fatal burden

associated with DI at the population level, providing important context for the joint analysis of fatal and non-fatal burden presented later in this chapter.

Māori and Non-Māori Contributions to YLL

The following table provides a breakdown of the YLL for Māori and non-Māori across the study years (Table 15).

Table 15: Break Down of YLL for Māori and non-Māori, 2013-2019

Study year	Individuals	(n)	YLL	Increase (n)	Increase (%)
2019	Māori	222	4096.2	123.3	3.1
	non-Māori	669	8410.3	1070.6	14.6
2018	Māori	207	3972.9	783.2	24.6
	non-Māori	600	7339.7	268.1	3.8
2016	Māori	180	3189.7	370.2	13.1
	non-Māori	594	7071.6	336.6	5
2014	Māori	150	2819.5	-273.9	8.9
	non-Māori	582	6735.0	-98.8	1.4
2013	Māori	162	3092.4		
	non-Māori	549	6833.8		

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For Māori, YLL decreased by 8.9% between 2013 and 2014 (from 3,093.4 to 2,819.5) before rising by 13.1% to 3,189.7 in 2016. This upward trend continued, with a further increase of 24.6% to 3,972.9 life years lost in 2018 and a smaller increase of 3.1% to 4,096.2 in 2019.

For non-Māori, life years lost declined slightly between 2013 and 2014 (–1.4%, from 6,833.8 to 6,735.0) and then increased by 5% to 7,071.6 in 2016, 3.8% to 7,339.7 in 2018, and by 14.6% to 8,410.3 in 2019.

Proportionate Burden on Māori

Across all study years, Māori consistently contributed a substantially greater proportion of YLL from DI than would be expected based on their share of the national population (Table 16). In 2019, Māori accounted for 32.8% of total YLL while comprising 16.6% of the national population, yielding a proportionate burden ratio of 1.98 (95% CI: 1.92–2.02, $p<0.001$). This ratio was calculated as the percentage of total YLL attributable to Māori divided by the percentage of the national population identifying as Māori.

Similar disparities were observed in earlier years, with Māori contributing between 29.5% and 35.1% of total YLL despite representing between 14.9% and 16.6% of the population.

This persistent imbalance reflects both higher mortality and a younger average age at death among Māori, which together increase the total years of life lost per death. From a Kaupapa Māori research perspective, these findings make visible the scale of systemic inequity: Māori not only experience a higher burden of DI mortality but also lose more potential years of life when death occurs, resulting in a compounded burden of excess mortality and lost life opportunity.

Table 16: Proportionate Burden of YLL for Māori and non-Māori, 2013–2019

Study year	Individuals	YLL	% cohort	% population	PBR	95% CI	p-value
2019	Māori	4096.2	32.8	16.6	1.98	1.92 - 2.02	<0.001
	non-Māori	8410.3	67.2	83.4			
2018	Māori	3972.9	35.1	16.5	2.13	2.08 - 2.18	<0.001
	non-Māori	7339.7	64.9	83.5			
2016	Māori	3189.7	31.1	15.5	2.01	1.95 - 2.06	<0.001
	non-Māori	7071.6	68.9	84.5			
2014	Māori	2819.5	29.5	14.9	1.98	1.92 - 2.04	<0.001
	non-Māori	6735	70.5	85.1			
2013	Māori	3093.4	31.2	14.9	2.09	2.03 - 2.15	<0.001
	non-Māori	6833.8	68.8	85.1			

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Summary of Findings for YLL Burden

Analysis of YLL from DI across the study period reveals three consistent findings.

First, the total fatal burden increased overall, rising from 9,927.2 YLL in 2013 to 12,506.5 YLL in 2019. Although there was a modest decline between 2013 and 2014, this was followed by sustained and accelerating increases from 2014 onward, with the steepest growth occurring after 2016. These patterns indicate a clear upward trajectory in premature mortality attributable to DI over the latter part of the study period.

Second, both Māori and non-Māori contributed to the increase in YLL, but the scale and timing of change differed between groups. Among Māori, YLL declined initially before increasing sharply from 2014 to 2018 and continuing to rise in 2019, reflecting both increasing numbers of deaths and younger ages at death. Among non-Māori, YLL increased more gradually early in the period but rose sharply between 2018 and 2019. These differing trajectories indicate that

while fatal diabetes burden is rising for both groups, Māori experienced earlier and more sustained increases in YLL across the study years.

Third, Māori consistently accounted for a disproportionate share of total YLL relative to their population size. Across all study years, Māori contributed approximately 30–35% of total YLL while comprising only 15–17% of the national population, corresponding to proportionate burden ratios close to or exceeding two in every year. This indicates that the share of premature mortality attributable to DI among Māori was roughly double what would be expected based on population representation alone. This imbalance reflects both higher mortality from DI among Māori and a younger average age at death, resulting in substantially greater years of life lost per death.

Total YLLD from DI

The following table provides the total number of YLLD for each of the study years (Table 17).

Table 17: Total YLLD from DI, 2013–2019

Study year	YLLD	Increase (n)	Increase (%)
2019	5972.6	1047.8	21.3
2018	4924.8	552.4	12.6
2016	4372.4	-82.6	-1.9
2014	4455	1408.6	46.2
2013	3046.4		

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Table 17 shows that across the study period, total annual YLLD increased substantially, rising from 3,046.4 years in 2013 to 5,972.6 years in 2019. This represents a net increase of approximately 2,926.2 YLLD over the period, indicating a marked growth in the non-fatal burden associated with DI.

Changes over time were not uniform. Between 2013 and 2014, total YLLD increased sharply by 1,408.6 years (+46.2%). This was followed by a small decline between 2014 and 2016, with YLLD decreasing by 82.6 years (−1.9%). After 2016, however, YLLD increased consistently. From 2016 to 2018, total YLLD rose by 552.4 years (+12.6%), followed by a further increase of 1,047.8 years (+21.3%) between 2018 and 2019. The largest absolute increase occurred in the most recent interval.

Taken together, these results indicate a strong upward trend in the non-fatal burden of DI over the study period, particularly after 2016. Despite a brief period of stability mid-decade, the sustained increases observed in later years suggest that morbidity associated with DI and its complications is increasing over time.

Māori and Non-Māori Contributions to YLLD

The following table provides a breakdown of the YLLD for Māori and non-Māori over the study years (Table 18).

Table 18: Breakdown of YLLD from DI for Māori and non-Māori, 2013–2019

Study year	Individuals	(n)	YLLD	Increase (n)	Increase (%)
2019	Māori	222	1820.6	316.8	21.1
	non-Māori	669	4152.0	731.0	21.4
2018	Māori	207	1503.8	248.6	19.8
	non-Māori	600	3421.0	303.8	9.7
2016	Māori	180	1255.2	69.9	5.9
	non-Māori	594	3117.2	-152.4	=4.7
2014	Māori	150	1185.3	360.3	43.7
	non-Māori	582	3269.6	1048.5	47.2
2013	Māori	162	825.0		
	non-Māori	549	2221.1		

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For Māori, total YLLD increased across the study period, rising from 825.0 years in 2013 to 1,820.6 years in 2019. This represents an overall increase of 995.6 YLLD over the period. Growth was uneven across years. Between 2013 and 2014, Māori YLLD increased sharply by 360.3 years (+43.7%). This was followed by more modest increases of 69.9 years (+5.9%) between 2014 and 2016 and 248.6 years (+19.8%) between 2016 and 2018. The largest absolute increase occurred between 2018 and 2019, when YLLD rose by a further 316.8 years (+21.1%).

For non-Māori, YLLD was consistently higher in absolute terms but followed a different temporal pattern. Total YLLD increased from 2,221.1 years in 2013 to 4,152.0 years in 2019, an overall increase of 1,930.9 YLLD. Between 2013 and 2014, non-Māori YLLD rose sharply by 1,048.5 years (+47.2%). This was followed by a decline of 152.4 years (−4.7%) between 2014

and 2016. Thereafter, YLLD increased steadily, rising by 303.8 years (+9.7%) between 2016 and 2018 and by a further 731.0 years (+21.4%) between 2018 and 2019.

Taken together, these results show that both Māori and non-Māori experienced substantial growth in non-fatal DI burden over the study period, with particularly large increases occurring after 2016. While non-Māori contributed a larger absolute volume of YLLD in every year, Māori experienced consistently high relative growth, especially in the later years of the study period.

Proportionate Burden on Māori

The following table shows the proportionate Burden of YLLD for Māori and non-Māori over the study years (Table 19).

Table 19: Proportionate Burden of YLLD for Māori and non-Māori, 2013–2019

Study year	Individuals	YLLD	% cohort	% population	PBR	95% CI	p-value
2019	Māori	1820.6	32.8	16.60	1.98	1.92 - 2.02	<0.001
	non-Māori	4152.0	67.2	83.40			
2018	Māori	1503.8	35.1	16.50	2.13	2.08 - 2.18	<0.001
	non-Māori	3421.0	64.9	83.50			
2016	Māori	1255.2	31.1	15.50	2.01	1.95 - 2.06	<0.001
	non-Māori	3117.2	68.9	84.50			
2014	Māori	1185.3	29.5	14.90	1.98	1.92 - 2.04	<0.001
	non-Māori	3269.6	70.5	85.10			
2013	Māori	825.0	31.2	14.90	2.09	2.03 - 2.15	<0.001
	non-Māori	2221.1	68.8	85.10			

Disclaimer: These results are not official statistics. They have been created for research purposes from the IDI which is carefully managed by Statistics NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/

Across all study years, Māori consistently accounted for a substantially greater share of total YLLD than would be expected based on their proportion of the national population. In 2019, Māori contributed 32.8% of total YLLD while comprising only 16.6% of the population, corresponding to a proportionate burden ratio (PBR) of 1.98 (95% CI 1.92–2.02, p<0.001). Similar disparities were observed in earlier years, with Māori contributing between 29.5% and 35.1% of total YLLD despite representing only 14.9%–16.6% of the population.

The magnitude of disproportionate burden was stable across time. PBRs ranged from 1.98 in 2014 and 2019 to a high of 2.13 in 2018, with all confidence intervals excluding 1.0 and all comparisons highly statistically significant (p<0.001). These results indicate that Māori experienced approximately twice the non-fatal DI burden expected based on population share in every study year.

This persistent imbalance reflects a sustained inequality in non-fatal DI burden, with Māori experiencing longer or more severe periods of disability attributable to DI and its complications. When considered alongside findings for fatal burden (YLL), these results indicate that inequality for Māori is expressed not only through earlier mortality but also through disproportionate years lived with disability prior to death.

From a Kaupapa Māori research perspective, these findings highlight a structural and enduring pattern of excess morbidity borne by Māori that demands accountability and a comprehensive health system response.

Summary of Findings for YLLD Burden

Analysis of YLLD from DI across the study period reveals three consistent findings.

First, the total non-fatal burden increased markedly over time, rising from 3,046.4 YLLD in 2013 to 5,972.6 YLLD in 2019. Although changes were not uniform, in so far as they featured a sharp increase between 2013 and 2014, a brief stabilisation between 2014 and 2016, and sustained growth thereafter, the overall trajectory indicates a substantial accumulation of disability associated with DI and its complications, particularly after 2016.

Second, both Māori and non-Māori contributed to the growth in YLLD, but with differing temporal patterns. Non-Māori consistently accounted for a larger absolute volume of YLLD in every year, reflecting population size, while Māori experienced persistently high relative growth, with especially pronounced increases in the later study years. These patterns suggest that non-fatal DI burden is increasing across the population, but that Māori are experiencing a more rapid accumulation of disability over time.

Third, Māori consistently bore a disproportionate share of total YLLD relative to their population size. Across all study years, Māori contributed approximately 30–35% of total YLLD while comprising only 15–17% of the national population, corresponding to proportionate burden ratios close to or exceeding two in every year. This indicates that Māori experienced around twice the non-fatal DI burden expected based on population share alone, with this inequality remaining stable across time.

Bringing the Findings Together

Taken together, the YLL and YLLD results demonstrate that the burden of DI increased substantially between 2013 and 2019 across both fatal and non-fatal dimensions. For both measures, total burden rose over time, with particularly pronounced growth after 2016.

Although short-term fluctuations were observed early in the study period, the dominant pattern for both YLL and YLLD was one of sustained increase in the latter years. This indicates that DI is not only remaining a major cause of premature mortality, but is also generating an expanding burden of disability prior to death.

Across all study years, Māori experienced a disproportionate share of both fatal and non-fatal burden relative to their population size. For YLL, Māori consistently accounted for approximately one-third of total years of life lost despite comprising only around one-sixth of the national population. A similar pattern was observed for YLLD, with Māori contributing between 29% and 35% of total non-fatal burden in every year. Proportionate burden ratios for both YLL and YLLD were close to or exceeded two across the study period, with all estimates highly statistically significant. These findings indicate that inequality for Māori is expressed across both dimensions of health loss, rather than being confined to either premature mortality or morbidity alone.

Importantly, the YLL and YLLD results point to different but compounding mechanisms of inequality. Elevated YLL among Māori reflects both higher mortality from DI and younger ages at death, resulting in greater years of life lost per individual. Elevated YLLD reflects longer or more severe periods of disability attributable to DI and its complications prior to death. Considered together, these results indicate that Māori not only die more often and younger from DI but also live with a greater burden of disability before death. This combination represents a dual and cumulative burden that is not visible when mortality or morbidity is examined in isolation.

While total YLL and YLLD provide critical information about the scale and persistence of inequality, they do not reveal how fatal and non-fatal burdens intersect within individuals. The aggregate results show that Māori bear disproportionate losses across both dimensions, but they do not indicate whether these losses are concentrated in the same people or distributed across different segments of the cohort. To address this limitation, the next part of this chapter moves beyond totals to examine the joint distribution of YLL and YLLD at the individual level.

Part 3. Distribution of YLL and YLLD by Quartile

By combining fatal and non-fatal burden into a joint-burden framework, it becomes possible to identify individuals with particularly favourable or adverse combined outcomes and to explore heterogeneity within the Māori cohort that is obscured by aggregate measures. Part 3 examines how burdens are distributed across individuals and how mortality and disability intersect within the same cohort.

Approach to Quartile Classification

Quartiles were defined by the 25th, 50th, and 75th percentiles of these rankings. The lowest quartile (Q1) captures the most favourable outcomes (lowest burden) and the highest quartile (Q4) captures those experiencing the most adverse outcomes or greatest burden.

Using quartiles makes inequalities visible in ways that align with Kaupapa Māori Research principles: it shows not only average outcomes, but also who is the most and least disadvantaged. In this way, quartile distributions help iwi and hapū see the full spread of outcomes rather than just averages that obscure variation. This approach also ensured that Māori outcomes were assessed against the best results observed in the entire dataset rather than against Māori-only distributions.

Quartile Distributions for YLL

Across all study years, Māori were consistently under-represented in the lowest YLL quartile (Q1) and over-represented in the highest quartile (Q4) compared with non-Māori (Table 20). Between 2013 and 2019, only 6.0% to 9.5% of Māori were in Q1, while 43.3% to 50.7% fell into Q4. In contrast, non-Māori were more likely to be in Q1 (29.9% to 31.0%) and less likely to be in Q4 (16.0% to 19.2%).

These results indicate that Māori deaths from DI more often occurred at younger ages, resulting in substantially greater YLL. These consistent distributions across study years highlight the structural nature of inequalities in premature mortality.

Differences in quartile distributions between Māori and non-Māori were assessed using chi-square tests of independence and were statistically significant in every study year (all $p<0.0001$).

Table 20: Distribution of Māori and non-Māori in Lowest and Highest YLLD quartiles, 2013–2019

Study year	Population	YLL Q1 (%)	YLL Q4 (%)
2019	Māori	9·5	44·6
	non-Māori	30·0	18·8
2018	Māori	7·2	50·7
	non-Māori	31·0	16·0
2016	Māori	6·7	43·3
	non-Māori	30·8	19·2
2014	Māori	6·0	50·0
	non-Māori	29·9	18·6
2013	Māori	7·4	46·3
	non-Māori	30·6	18·6

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Quartile Distributions for YLLD

The YLLD results show a similar but distinct pattern (Table 21). Māori were consistently more likely to appear in the highest YLLD quartile, reflecting greater non-fatal burden from DI and its complications prior to death. Across study years, 34.8% to 40.0% of Māori were in Q4, while only 14.9% to 22.2% were in Q1. The reverse pattern was observed for non-Māori, with 26.2% to 28.3% in Q1 and only 21.0% to 21.3% in Q4.

These distributions were stable over time, suggesting persistent inequalities in non-fatal burden alongside premature mortality. Together with the YLL results, these patterns confirm that Māori faced a dual burden of both earlier mortality and greater disability from DI.

As with YLL, chi-square tests confirmed that observed differences between Māori and non-Māori quartile distributions were statistically significant in every year (all $p<0.0001$).

Table 21: Distribution of Māori and non-Māori in Lowest (Q1) and Highest (Q4) Quartiles of YLLD, 2013–2019

Study year	Population	YLLD Q1 (%)	YLLD Q4 (%)
2019	Māori	14·9	36·5
	non-Māori	28·3	21·1
2018	Māori	20·3	34·8
	non-Māori	27·0	21·0
2016	Māori	18·3	36·7
	non-Māori	27·3	21·2
2014	Māori	18·0	40·0
	non-Māori	26·8	21·1

Study year	Population	YLLD Q1 (%)	YLLD Q4 (%)
2013	Māori	22·2	37·0
	non-Māori	26·2	21·3

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Implications For the Research Question

These quartile results address the first research question regarding whether there are Māori with among the best health outcomes for a major medical condition disproportionately affecting Māori.

The answer is yes: in every study year, a small proportion of Māori (6.0–9.5% for YLL; 14.9–22.2% for YLLD) were in the most favourable quartiles, indicating outcomes comparable to the best observed in the dataset.

This is significant not only statistically, but also conceptually. It demonstrates that Māori health outcomes are not uniformly negative, countering deficit narratives and showing that there are examples of resilience and positive deviance that can inform system change.

At the same time, Māori were far more likely to be concentrated in the worst outcomes. Nearly half were in the highest burden quartile for YLL in each year, and over one-third were in the highest quartile for YLLD. This skewed distribution highlights both the persistence and the severity of inequalities within the Māori cohort.

By highlighting both the few who achieve the best outcomes and the many who face the heaviest burdens, this analysis reflects the Kaupapa Māori principle of making visible the full spectrum of Māori experience and strengthens accountability to iwi and hapū.

Part 4. Joint Health Burden

Part 4 examines joint health outcomes, or how fatal and non-fatal burdens co-occur for individuals.

Distribution of Māori and non-Māori Across Joint Burden Areas, 2013–2019

Across all study years, Māori and non-Māori exhibited broadly similar within-cohort proportional distributions across the four joint burden categories (Table 22). This reflects the fact that areas and quartiles were defined using the combined cohort, not any genuine equivalence of outcomes between groups.

Table 22: Distribution of Māori and non–Māori in Area Outcomes

Study year	Individuals	Number	Area 1 (%, n)	Area 2 (%, n)	Area 3 (%, n)	Area 4 (%, n)
2019	Māori	222	7.2%	21.2%	26.1%	45.5%
	non-Māori	669	7.6%	19.1%	30.1%	43.1%
2018	Māori	207	5.8%	22.8%	29.1%	42.2%
	non-Māori	600	6.5%	19.5%	30.6%	43.4%
2016	Māori	180	7.8%	17.2%	31.7%	43.3%
	non-Māori	594	8.4%	19.2%	31.0%	41.4%
2014	Māori	150	6.8%	16.2%	33.1%	43.9%
	non-Māori	582	7.7%	20.5%	30.6%	41.1%
2013	Māori	162	4.9%	24.1%	27.8%	43.2%
	non-Māori	549	7.6%	18.9%	30.9%	42.5%

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While absolute numbers were consistently larger for non-Māori, reflecting their greater underlying population size, both groups showed the same overall shape. The smallest proportion of individuals were classified as having the best outcomes (or lowest joint burden) and the largest proportion as having the worst outcomes (or highest joint burden).

In 2019, for example, only 7.2% of Māori and 7.6% of non-Māori were classified as having the best outcomes, compared with 45.5% of Māori and 43.1% of non-Māori in the worst outcomes category. A similar pattern was observed across all study years.

Quartiles and joint-burden areas were defined using the combined Māori and non-Māori cohort, ensuring that both groups were assessed against the same thresholds. As a result, proportional similarity within the joint-burden areas reflects relative positioning among those who died rather than equivalence in population-level risk or total burden.

While this produced similar proportional distributions, it does not imply equivalence of outcomes. Māori were consistently over-represented in the underlying DI deaths and contributed disproportionately to the total YLL and YLLD, meaning that their apparent proportional similarity masks deeper inequality.

Distribution of Māori and non-Māori Across Favourable and Adverse Outcomes, 2013–2019

For interpretation, areas 1 and 2 (best and better) were combined into a single favourable outcomes category, while area 4 (worst) was considered adverse outcomes (Table 23).

Table 23: Distribution of Māori and non–Māori with Favourable and Adverse Joint Outcomes

Study year	Individuals	Number	Favourable outcomes % A1+A2	Adverse outcomes % A4
2019	Māori	222	28.4	45.5
	non-Māori	669	26.7	43.1
2018	Māori	207	28.6	42.2
	non-Māori	600	26.0	43.4
2016	Māori	180	25.0	43.3
	non-Māori	594	27.6	41.4
2014	Māori	150	23.0	43.9
	non-Māori	582	28.2	41.1
2013	Māori	162	29	43.2
	non-Māori	549	26.5	42.5

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In 2019, of the 222 Māori who died of DI, 28.4% were classified as having favourable outcomes, while 45.5% experienced adverse outcomes. Among non-Māori in the same year, 26.7% had favourable outcomes and 43.1% had adverse outcomes. Comparable proportions were observed in earlier years. For instance, in 2013, 29.0% of Māori and 26.5% of non-Māori had favourable outcomes, while 43.2% of Māori and 42.5% of non-Māori were in the adverse outcome group.

Viewed in isolation, these proportions suggest broadly similar distributions across outcome areas within the DI-death cohort. However, proportional similarity within the cohort should not be interpreted as equality in burden. Māori were consistently over-represented among DI deaths relative to their population share and contributed a disproportionate share of both YLL and YLLD. In other words, conditional on dying from DI, Māori and non-Māori showed parallel distributions across favourable and adverse outcome categories; yet Māori were more likely to be represented among DI deaths overall and bore a substantially greater share of fatal and non-fatal health loss across the study period.

Bringing the Joint-Burden Findings Together

The joint-burden analysis confirms that DI imposes severe and compounding losses of life for both Māori and non-Māori. In every study year, nearly half were concentrated in the worst outcome category.

When simplified into favourable versus adverse groupings, Māori and non-Māori appeared proportionally similar, but this similarity is misleading because Māori were consistently over-represented in DI deaths and recorded higher totals of YLL and YLLD.

The joint-burden matrix therefore highlights two truths: a small group of Māori achieved outcomes comparable to the best in the dataset, while the dominant Māori experience was one of concentrated and severe health loss. This dual finding underscores both the persistence of inequalities and the importance of identifying positive outliers as examples of strength and sources of learning.

Conclusion

This chapter has presented a comprehensive analysis of the burden of DI for Māori and non-Māori using both fatal (YLL) and non-fatal (YLLD) measures as well as their combined distribution through quartiles and joint-burden classifications. The results confirm that Māori consistently bear a disproportionate share of both premature mortality and disability attributable to DI. Across the study years (2013–2019), Māori accounted for substantially more burden than would be expected based on their share of the national population, with disparities evident in both the absolute totals and the corresponding population-based burden ratios (PBRs) for mortality.

The quartile analyses demonstrated that inequalities extend beyond totals and into the structure of outcomes: Māori were consistently under-represented in the lowest burden quartiles and over-represented in the highest. These findings highlight the persistence of systemic inequities, with Māori deaths more often associated with both younger ages at death and greater time lived with disability. At the same time, the quartile results provide an important answer to the first research question.

In every study year, a small proportion of Māori were found in the most favourable quartile for YLL (6.0–9.5%) and for YLLD (14.9–22.2%), which demonstrates that outcomes comparable to the best observed in the dataset are achieved within Māori populations.

While Māori and non-Māori showed broadly similar proportional distributions across outcome categories, this proportional similarity should not be mistaken for equality. Māori were consistently over-represented among DI deaths and recorded higher totals of YLL and YLLD. In other words, once in the cohort, Māori and non-Māori were distributed similarly, but Māori were more likely to be in the cohort in the first place and to lose more years once there.

Taken together, the findings of this chapter establish three key points. First, DI remains a growing cause of premature mortality and disability in Aotearoa New Zealand. Second, while most Māori experience worse outcomes, there are Māori with favourable outcomes. Third, the persistent over-representation of Māori in the highest burden categories underscores the structural nature of inequalities.

Chapter 7. Methodology for Comparing Similarities and Differences Among Māori

This chapter describes the steps taken to respond to the second research question i.e., "if there are Māori with DI who rank among the best observed, what distinguishes Māori with the most favourable outcomes from Māori with the most adverse outcomes?". It has two parts. Part 1 describes the process used to develop and refine hypotheses about similarities and differences between Māori with favourable and adverse joint outcomes. Part 2 reports the work undertaken in the IDI, including statistical testing, to test these hypotheses.

Part 1. Hypothesis Development

Five steps were taken to develop hypotheses regarding differences for testing in the IDI. These steps began with broad consideration of potential determinants and concluded with refined propositions that were testable within the IDI.

The five steps were as follows:

1. Build issues tree
2. Develop initial hypotheses
3. Conduct literature review
4. Refine hypotheses
5. Finalise hypotheses.

The remainder of this part of the chapter discusses each step in turn.

Step 1. Build Issues Tree

Having established a hypothesis-first approach consistent with SPS and clinical reasoning, the first task was to build an issues tree, which is a structured map of possible determinants that might explain why some Māori achieved favourable outcomes (Areas 1 and 2) while others experienced adverse outcomes (Area 4).

The tree was first divided into two broad branches: internal factors (characteristics intrinsic to the individual, such as income or cultural identity) and external factors (characteristics arising from the wider environment or systemic conditions, such as discrimination). This distinction mirrored the logic of both clinical reasoning and Mode 2 research by starting broad and then refining to elements that were both relevant and testable.

Justification for Using the McGovern et al. Framework

To populate the tree, the determinants framework developed by McGovern and colleagues was drawn on (McGovern et al., 2014). This framework organises determinants of health outcomes into five broad domains:

1. Behaviours (e.g., smoking, alcohol consumption, exercise, diet)
2. Social circumstances (e.g., income, education, deprivation)
3. Environment (e.g., exposure to toxins)
4. Genetics
5. Medical care.

This framework was selected for three reasons:

1. Comprehensiveness: It covers proximal and distal influences and internal and external factors, and it recognises the interdependence of socioeconomic, behavioural, biological, and systemic determinants. This breadth makes it well suited to a hypothesis-first approach, where the goal is to begin with the full range of plausible explanations before systematically pruning
2. Methodological transparency: Its structured nature supports hypothesis generation consistent with SPS. By beginning with an exhaustive set of determinants and then narrowing based on data availability and research relevance, the approach mirrors both SPS practice in management consulting and diagnostic reasoning in clinical medicine
3. Although developed in an international policy context, the framework aligns with Kaupapa Māori Research priorities. Determinants such as socioeconomic position; access to whānau and tūrangawaewae (place where one has rights of residence and belonging through kinship); cultural identity; and exposure to discrimination can be mapped directly to its structure.

The value of the framework for Kaupapa Māori Research is not in its origin but in its utility: it provides a systematic starting point for hypothesis generation while leaving space to integrate Māori concepts of wellbeing, equality, and health system accountability.

Refinement of the Issues Tree

After establishing the broad framework, the issues tree was refined to ensure it was both exhaustive and specific to the research aims. This refinement involved the following steps:

1. Behavioural factors (specifically smoking, alcohol consumption, and diet and exercise) were deliberately excluded from the issues tree to keep the analysis focused on upstream determinants

2. Social circumstances, including stress, were restructured into a socio-economic branch that explicitly incorporated deprivation
3. An “Other” branch was added to both internal and external factors to ensure the tree was mutually exclusive and collectively exhaustive (MECE)
4. Social circumstances were restructured into a socio-economic branch that explicitly incorporated deprivation
5. An “Other” branch was added to both internal and external factors to ensure the tree was mutually exclusive and collectively exhaustive (MECE)
6. Four internal sub-branches were added: health literacy (proxied through educational attainment in the IDI); cultural identity (e.g. knowledge of iwi/hapū, use of te reo Māori, Māori spiritual beliefs); access to whānau, tūrangawaewae, and cultural supports; and geographic locale (urban versus rural)
7. A discrimination sub-branch was added under external medical care to reflect the well-documented role of racism and bias in shaping Māori health outcomes
8. The genetics branch was flagged for later pruning, recognising both my limited expertise in this area and the absence of usable genetics data within the IDI.

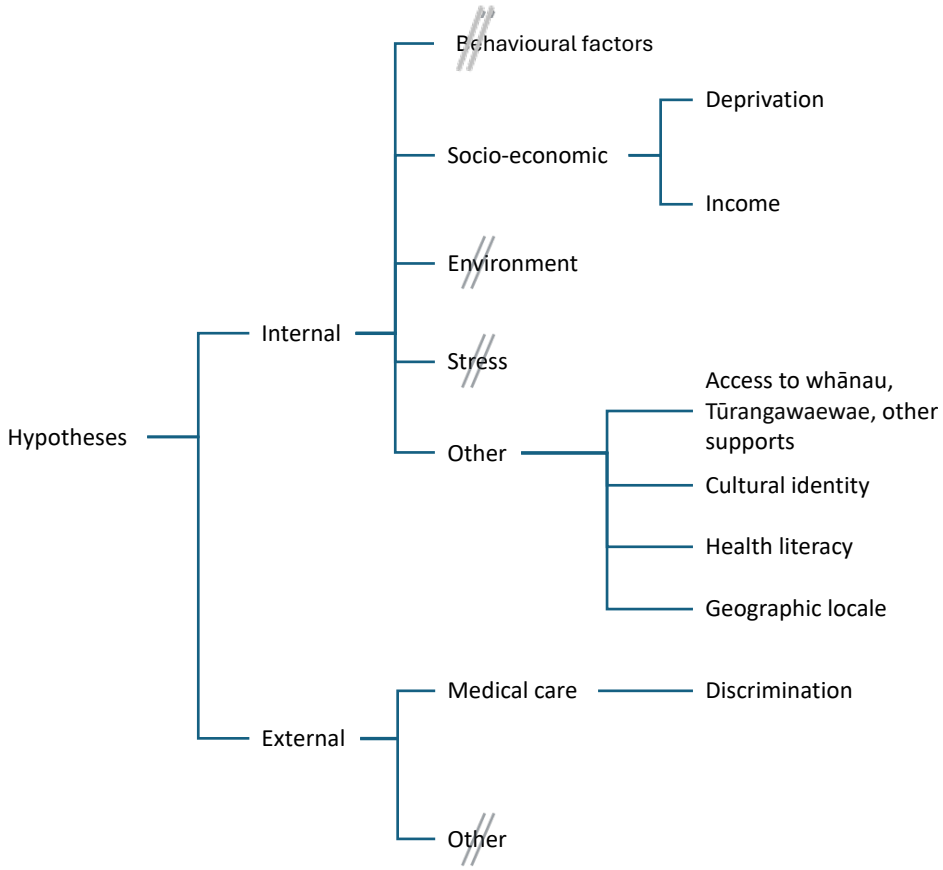
With a SPS approach, behaviours are more plausibly treated as downstream mediators of structural and system forces, including socioeconomic position, discrimination and bias within medical care, geographic access, cultural identity and supports, and connection to whānau and tūrangawaewae (Link & Phelan, 1995; Harris et al., 2012; Moewaka Barnes & McCreanor, 2019). Beginning upstream is consistent with both clinical reasoning and SPS discipline, which prioritise testing the highest-leverage drivers first (Elstein et al., 1978; Rasiel & Friga, 1999).

This change also reflects a Treaty-based equality analysis, which prioritises Crown and system accountabilities over individual responsibility. Treating behaviour as a primary explanatory node risks shifting attention away from institutional arrangements, resourcing decisions, and service design toward Māori individuals themselves, reproducing deficit narratives and weakening Treaty-based scrutiny of the structures that shape choice, exposure, and opportunity (Waitangi Tribunal, 2019; Came et al., 2020). Methodologically, excluding behaviour from the primary issues tree also reduces the risk of over-adjustment. If behaviours function as mediators of upstream conditions, foregrounding them can attenuate or obscure the pathways through which structural determinants exert their effects, undermining the explanatory purpose of the analysis (Schisterman et al., 2009).

This process produced a comprehensive but adaptable map of potential determinants that ensured that the hypotheses tested later using IDI data were grounded in both international evidence and Kaupapa Māori Research priorities, while avoiding omissions or arbitrary narrowing at the outset.

The following figure, drawing on work by McGovern et al. (2014), presents the issues tree after refinements described above (Figure 11).

Figure 11: Second Issues Tree



Step 2. Develop Initial Hypotheses

With the issues tree established, the next step was to generate specific hypotheses for each of the branches in Figure 11 above.

Table 24 sets out the hypotheses that were developed for each branch of the issues tree.

Table 24: Hypotheses for Branches of the Issues Tree

Branch	Sub-branch	Sub-sub-branch	Hypothesis
Internal	Socio-economic	Deprivation	Māori with favourable outcomes are more likely to have a lower deprivation than Māori with adverse outcomes
		Income	Māori with favourable outcomes are more likely to have higher average incomes than Māori with adverse outcomes
	Other	Access to whānau, tūrangawaewae, other supports	Māori with favourable outcomes are more likely to be able to access whānau, tūrangawaewae, and other supports than Māori with adverse outcomes
		Cultural identity	Māori with favourable outcomes are more likely to have a stronger cultural identity than Māori with adverse outcomes
		Health literacy	Māori with favourable outcomes are more likely to have a higher health literacy than Māori with adverse outcomes
		Geographic locale	Māori with favourable outcomes are more likely to live in larger urban areas than Māori with adverse outcomes
External	Medical care	Discrimination	Māori with favourable outcomes are less likely to have experienced discrimination in health settings than Māori with adverse outcomes

These hypotheses were deliberately stated in comparative terms, aligning directly with the study's second research question, which explores similarities and differences between Māori with favourable outcomes and those with adverse outcomes.

Step 3. Conduct Literature Review

Having developed hypotheses from the issues tree, the next step was to review existing evidence on each. The purpose of the review was not to exhaustively map all determinants of health as a conventional academic approach might require, but to assess whether each hypothesis was theoretically and empirically supported before testing it in the IDI. This is consistent with SPS and Mode 2 research approach: rather than beginning with a broad theoretical synthesis, hypotheses were generated and then tested against both the literature and available data.

Step 3.1. Develop Review Statements

Because few studies have directly examined differences between Māori with favourable and adverse outcomes, each hypothesis was translated into a broader review statement. These statements drew on the international literature on health determinants and, where available, New Zealand and Māori-specific studies. For example, the hypothesis that Māori with favourable outcomes were more likely to have stronger cultural identity was translated into the review statement: Having a strong cultural identity is positively associated with good health outcomes, including good health outcomes for chronic conditions (Table 25).

Table 25: Review Statements for Hypotheses

No	Review statement
1	Deprivation is positively associated with poor health outcomes, including poor health outcomes for chronic conditions
2	Lower income is positively associated with poor health outcomes, including poor health outcomes for chronic conditions
3	Having family and whānau support is positively associated with good health outcomes, including good health outcomes for chronic conditions
4	Having a strong cultural identity is positively associated with good health outcomes, including good health outcomes for chronic conditions
5	Health literacy is positively associated with good health outcomes, including good health outcomes for chronic conditions
6	Living in an urban locale is positively associated with good health outcomes, including good health outcomes for chronic conditions
7	There is a negative association between reporting experiencing racism or discrimination in a healthcare setting and the utilisation of care, and there is a negative association between reporting having an adverse service experience and poor health outcomes, including poor health outcomes for chronic conditions

Step 3.2. Conduct Search and Appraise the Literature

A threshold was applied to confirm the plausibility of each review statement, requiring support from at least two systematic reviews or meta-analyses published in peer-reviewed English-language journals. Where such high-level evidence was unavailable (for example, for Māori cultural identity), plausibility was established using robust single studies. This approach ensured that each hypothesis rested on an explicit evidential foundation while avoiding arbitrary or ungrounded assumptions. A separate search was also conducted to find Māori-related research that supports each of the review statements.

Step 3.3. Findings of the Review

Table 26 below summarises the review statements and findings from the threshold review of the literature.

Table 26: Findings from Literature

No.	Hypothesis	Review statement	Findings from Literature (see Appendix 4)
1	Deprivation	Deprivation is positively associated with poor health outcomes, including poor health outcomes for chronic conditions	Large, conclusive body of evidence confirms association (Wang et al., 2013; Grintsova et al., 2014).
2	Income	Lower income is positively associated with poor health outcomes, including poor health outcomes for chronic conditions	Early research showed clear gradients e.g. Whitehall studies (Marmot et al., 1984), but more recent reviews are mixed (Pathirana & Jackson, 2018). Some evidence of increased CVD and DI risk among lower income groups (Wang et al., 2013).
3	Whānau / tūrangawaewae supports	Having family and whānau support is positively associated with good health outcomes, including good health outcomes for chronic conditions	Strong evidence that family and social support improve outcomes (Shor et al., 2013; Hartmann et al., 2010). No direct meta-analyses for Māori whānau / tūrangawaewae support
4	Cultural identity	Having a strong cultural identity is positively associated with good health outcomes, including good health outcomes for chronic conditions	No meta-analyses, but New Zealand studies show positive associations (Brougham & Haar, 2013).
5	Health literacy	Health literacy is positively associated with good health outcomes, including good health outcomes for chronic conditions	Conclusive body of research supports this statement (DeWalt et al., 2004; Berkman et al., 2011; McGovern et al., 2014).
6	Urban/rural locale	Living in an urban locale is positively associated with good health outcomes, including good health outcomes for chronic conditions	Most studies support better outcomes in urban locales (Afshar et al., 2019; Khavjou et al., 2025), though findings are not universal (Gheasi et al., 2019).
7	Discrimination	Experiencing discrimination in health settings is negatively associated with good health outcomes, including good health outcomes for chronic conditions	Consistent evidence supports this statement (Ben et al., 2017).

Step 3.4. Implications for Hypothesis Testing

The review confirmed that most hypotheses had strong or at least plausible empirical support. Deprivation, health literacy, and discrimination were especially well supported in the literature. The income and urban/rural locale hypotheses had more mixed evidence but remained relevant for testing given their salience in the issues tree. The cultural identity hypothesis lacked support but was retained because of its central importance to Māori models of health.

Overall, the literature review established that each hypothesis was not only conceptually grounded but also had some empirical foundation, justifying its progression to Step 4.

Step 4. Refine Hypotheses

The next task was to assess which hypotheses could be tested within the IDI through the steps described below.

Step 4.1. Primary Data Source

The primary source for testing was the 2013 and 2018 New Zealand Censuses because these datasets provided near-universal coverage and could be linked within the IDI to the mortality cohort. Census data were used to test hypotheses for those who died of DI in 2013, 2014, and 2016 (linked to 2013 Census) and for those who died in 2018 and 2019 (linked to 2018 Census). This choice was justified by three considerations:

1. Comprehensiveness: Census data capture the majority of individuals in scope
2. Accuracy: Census data are more reliable than smaller-scale surveys for key sociodemographic variables
3. Feasibility: Census data are available and auditable within the IDI environment.

Step 4.2. Process for Refinement

Each hypothesis was assessed using a structured decision pathway. Each determinant was considered in turn, beginning with whether it could be measured directly from census data, whether an acceptable proxy existed, or whether it could be supplemented from other IDI data sources such as the New Zealand Health Survey (NZHS) or Te Kupenga. Where no valid measurement was possible, the hypothesis was excluded. This approach ensured that the set of retained hypotheses was not only theoretically grounded but also empirically testable within the scope of this study.

The results of this application are summarised in Table 27 below.

Table 27: Findings Regarding Data Availability

No	Hypothesis	Data availability	Decision
1	Deprivation	Directly measurable using census-linked NZDep scores	Retained
2	Income	Available in census but supplemented with longitudinal income measures in the IDI to avoid one-off income biases	Retained
3	Whānau, tūrangawaewae, and other supports	Not collected in censuses. Te Kupenga contains relevant measures but none of the in-scope individuals were sampled	Excluded
4	Cultural identity	Not measured directly, but proxies were available (knowledge of iwi/hapū, te reo Māori speaking ability, Māori spiritual beliefs)	Retained
5	Health literacy	Not directly measured, but highest educational qualification is a well-established proxy for health literacy in the literature	Retained
6	Urban/rural locale	Geographic classification collected in both censuses	Retained
7	Discrimination in health settings)	Collected in NZHS and Te Kupenga, but sampling was insufficient for this cohort	Excluded

Step 5. Finalise Hypotheses

The refinement process resulted in a streamlined set of five hypotheses that were both theoretically grounded and empirically testable within the IDI. These covered socioeconomic, cultural, and structural determinants, while excluding variables (whānau supports and discrimination) where valid measurement was not possible (Table 28).

Table 28: Final Hypotheses

No	Hypothesis	Review statement
1	Deprivation	Māori with favourable outcomes are more likely to have a lower deprivation than Māori with adverse outcomes
2	Average income	Māori with favourable outcomes are more likely to have higher average incomes than Māori with adverse outcomes
3	Cultural identity	Māori with favourable outcomes are more likely to have a stronger cultural identity than Māori with adverse outcomes
4	Health literacy	Māori with favourable outcomes are more likely to have a higher health literacy than Māori with adverse outcomes
5	Geographical locale – urban / rural	Māori with favourable outcomes are more likely to live in an urban locale than Māori with adverse outcomes, who are more likely to live in rural locales

Together, these hypotheses balance two imperatives:

1. Rigour and feasibility, by aligning with data that could be robustly tested in the IDI
2. Relevance to Kaupapa Māori Research, by incorporating determinants (such as cultural identity and educational proxies for health literacy) that extend beyond conventional biomedical variables.

This final set formed the foundation for the IDI-based hypothesis testing in Part 2 of this chapter.

Part 2. Test Hypotheses in the IDI

To assess whether five key determinants (deprivation, income, cultural identity, health literacy, and geographic locale) varied between Māori with favourable joint outcomes (Areas 1 and 2) and Māori with adverse outcomes (Area 4), measurable differences between these groups were examined.

Mann–Whitney U tests and equivalence tests were specified *a priori* and address distinct inferential questions. First, Mann–Whitney U tests were used to assess evidence of distributional differences in each determinant between groups. Second, equivalence testing was used to assess whether any observed group differences were small enough to be considered practically negligible relative to a pre-specified smallest effect size of interest (SESOI).

The distinction between an absence of evidence for difference and evidence of similarity is particularly important for Kaupapa Māori Research that seeks to understand both variation and consistency across populations. This approach enables a more nuanced interpretation of how Māori with contrasting outcomes differ or do not differ across key determinants and avoids treating non-significant p-values as if they automatically implied equivalence.

Testing Approach Across Hypotheses

To test each hypothesis, a standardised process was followed:

1. Identify and match variables to individuals from IDI and census sources based on their year of death
2. Group individuals into favourable (Areas 1 and 2) or adverse (Area 4) outcome groups using the joint-burden matrix described in Chapter 5
3. Conduct a Mann–Whitney U test to determine whether there was a statistically significant difference between groups with favourable and adverse outcomes

4. For comparisons where the Mann–Whitney result was non-significant, assess whether data coverage met a pre-specified threshold of ≥0.7 non-missing determinant data in each group
5. Where coverage was met, conduct an equivalence test using a non-parametric Two One-Sided Test (TOST) framework applied to the Hodges–Lehmann median difference, with equivalence concluded only if the entire 90% confidence interval lay within a pre-specified smallest effect size of interest (SESOI) relevant to the determinant's scale and context
6. For contrasts judged equivalent, conduct a tipping-point analysis to assess how stable the equivalence finding was to plausible patterns of missing data.

This staged process ensured that meaningful differences, meaningful similarities, and genuinely inconclusive cases could each be identified and interpreted in a transparent, auditable way.

Implementation of Statistical Testing

Mann–Whitney U tests

The primary inferential tool for detecting differences between Māori with favourable outcomes (Areas 1–2) and those with adverse outcomes (Area 4) was the Mann–Whitney U test. This non-parametric, rank-based test was selected for three reasons. First, many of the variables of interest were ordinal (e.g., NZDep deciles, qualification ladders, cultural-identity scores), making parametric tests such as the t-test inappropriate (Hollander et al., 2013). Second, several continuous variables (such as income) exhibited strong right-skewness, with a small number of very high values, making methods that assume normality and mean-based inference unreliable (Wilcox, 2022). Third, group sizes were modest once restricted to Māori within each study window, so avoiding normality assumptions was important for robustness (Hollander et al., 2013).

Mann–Whitney U tests assess whether values from one group tend to be systematically higher or lower than values from the other group when all observations are ranked together. It therefore aligns with the research question of whether Māori with favourable outcomes occupy a different part of the distribution for a given determinant than Māori with adverse outcomes, without assuming equal variances or a particular distributional form.

In practice, Mann–Whitney U tests were implemented in R within RStudio in the secure IDI environment using the base R wilcox.test() function (two-sided; continuity correction used where the normal approximation was applied). IDI-derived values for each group were imported into R and analysed using a standardised script applied consistently across

hypotheses and study years. The W statistic and corresponding p-values from the Mann–Whitney tests were used to assess evidence of differences between groups.

Where the Mann–Whitney result was statistically significant ($p < 0{\cdot}05$), this was interpreted as evidence of a difference between groups; these findings are reported in Chapter 8 alongside descriptive summaries (including group medians). Where results were non-significant ($p \geq 0{\cdot}05$), they were not interpreted as evidence of no difference; instead, they triggered the subsequent data-coverage check and, where appropriate, equivalence testing.

Rationale for Equivalence Testing

The Mann–Whitney U test is an appropriate first-line procedure for ordinal or skewed variables because it is non-parametric and does not rely on distributional assumptions; however, its inferential scope is limited. A non-significant Mann–Whitney result indicates insufficient evidence to detect a difference, not evidence that the groups are meaningfully similar.

Equivalence testing addresses this gap by reframing the inferential question. Rather than asking whether groups differ, it asks whether any true difference is likely to lie entirely within a smallest effect size of interest (SESOI) defined in advance on measurement, policy, and kaupapa Māori grounds. In this study, equivalence testing was applied only where the initial Mann–Whitney test did not provide evidence of a distributional difference and where data coverage met a pre-specified quality threshold, ensuring that equivalence claims were not made on the basis of sparse or highly selective data.

Where equivalence was demonstrated, results were interpreted as evidence that Māori with favourable and adverse outcomes were statistically similar within the smallest effect size of interest for that determinant. Where equivalence was not demonstrated and the Mann–Whitney test was also non-significant, results were treated as inconclusive with respect to similarity, that is, the data provided neither evidence of a meaningful difference nor evidence that any difference was small enough to be considered negligible.

This staged approach avoids collapsing distinct inferential situations into a single narrative and supports transparent interpretation across three analytically and substantively different cases:

1. Evidence of a meaningful difference
2. Evidence of practical similarity within a defined margin
3. Genuine uncertainty due to imprecision or data limitations.

From a Kaupapa Māori Research perspective, this distinction is essential. It prevents non-significant results from being misread as absence of inequality, while also allowing robust claims of similarity to be made where the data genuinely support them. The equivalence framework therefore strengthens accountability by making explicit when groups are meaningfully different, meaningfully similar, or when the available data cannot be used to determine difference or similarity.

Equivalence Testing Procedure

The procedure was implemented as follows:

1. The observed effect size was estimated using the Hodges–Lehmann location shift, which represents the median of all pairwise differences between values in the favourable and adverse outcome groups (favourable − adverse). This estimator was selected because it is robust to skewness and appropriate for ordinal or non-normally distributed data
2. A two-sided 90% confidence interval for the Hodges–Lehmann estimator was obtained using the Wilcoxon rank-sum test. This confidence level corresponds to the standard TOST equivalence-testing framework with $\alpha = 0.05$
3. Equivalence was evaluated by comparing the confidence interval bounds to the pre-specified SESOI margins. The lower one-sided test assessed whether the true median difference was greater than the lower equivalence bound (−SESOI), and the upper one-sided test assessed whether it was less than the upper equivalence bound (+SESOI)
4. Equivalence was concluded only if the entire 90% confidence interval lay within the interval defined by −SESOI and +SESOI, indicating that any true difference was smaller than the smallest effect size of interest.

If equivalence was not demonstrated under this procedure and the Mann–Whitney test was also non-significant, the result was treated as inconclusive with respect to practical similarity (i.e., the data provided neither evidence of a meaningful difference nor evidence that any difference was smaller than the pre-specified SESOI).

This implementation retains the decision logic of the Two One-Sided Tests (TOST) framework while relying on the Hodges–Lehmann estimator and its associated non-parametric confidence interval derived from the Wilcoxon rank-sum test, rather than on parametric assumptions. Equivalence is concluded when the (1 - 2\alpha) confidence interval for the location shift lies entirely within the pre-specified equivalence bounds. This approach is appropriate for ordinal or skewed data and aligns with established non-parametric equivalence-testing practice (Hodges & Lehmann, 1963; Schuirmann, 1987; Lakens, 2017).

The approach is also aligned with Kaupapa Māori Research by distinguishing between (1) meaningful differences; (2) meaningful similarities within a smallest effect size of interest; and (3) genuinely uncertain cases, rather than allowing non-significance alone to be interpreted as "no difference." The SESOI margins were determinant-specific (e.g., a fixed number of NZDep deciles, a proportion of the pooled median income, or a single step on an ordinal ladder) and are justified in the hypothesis-specific subsections that follow.

Coverage Thresholds for Equivalence Testing

Equivalence testing was only undertaken where data coverage was sufficient to support generalisable, near-census inference, where equivalence testing was restricted to strata in which each outcome group had at least 0.7 non-missing data for the determinant. Strata that did not meet this threshold were excluded from formal equivalence analyses and are reported descriptively.

This ≥0.7 rule was applied as a data-quality screen rather than a power calculation or formal sample-size criterion. In a near-census design, it serves three purposes:

1. It helps reduce the risk that comparisons based on data that are both well-linked and broadly representative of the finite Māori population with DI, rather than a small, potentially atypical subset
2. It reduces the risk that equivalence findings are driven by patterns of missingness that correlate with key characteristics such as age, mobility, or deprivation
3. It maintains transparency about where the data are sufficiently complete to sustain claims about similarity within SESOI bounds.

Determinants that did not satisfy the coverage requirement did not proceed to equivalence testing. This preserved the integrity of the equivalence design while still allowing difference tests to inform Māori equality and accountability discussions.

Tipping-Point Analysis for Stability of Equivalence Findings

For determinants where equivalence testing indicated that Māori with favourable and adverse joint outcomes were statistically similar within the pre-specified smallest effect size of interest (SESOI), a tipping-point sensitivity analysis was conducted to assess the stability of those equivalence conclusions. The purpose of this analysis was to determine whether equivalence findings were robust to plausible uncertainty arising from missing data, or whether they could be overturned by relatively small and extreme reallocations of unobserved values.

For each comparison classified as equivalent, the observed distributions in the favourable and adverse outcome groups were treated as fixed, while the number of missing observations in

each group defined the maximum pool of unobserved values. A series of worst-case scenarios was then evaluated in which missing observations were iteratively assigned to extreme values at one end of the determinant's scale (e.g., most or least deprived deciles, highest or lowest ladder positions), in directions that would most strongly challenge the equivalence conclusion.

After each incremental reassignment, the equivalence criterion was re-evaluated by recalculating the Hodges–Lehmann estimate of the median difference (favourable − adverse) and its associated confidence interval. Equivalence was considered no longer supported once the confidence interval extended beyond the pre-specified SESOI bounds. This ensured that the sensitivity analysis evaluated stability using the same inferential rule that defined equivalence in the primary analysis.

This process identified a tipping-point count: the minimum number of missing observations that would need to be concentrated at extreme values in order for equivalence to no longer be demonstrated (i.e., for the confidence interval around the median difference to cross one or both SESOI bounds). Where no such tipping point existed, because allocating all missing observations to extreme values still resulted in the confidence interval lying fully within the SESOI, the equivalence result was classified as impossible to overturn under the missing-data constraints of the study.

This tipping-point analysis is method-agnostic in the sense that it does not depend on distributional assumptions or parametric model specifications; instead, it stress-tests the equivalence conclusion itself under worst-case, policy-relevant missing-data scenarios using the same confidence-interval–based decision rule as the primary equivalence analysis.

Equivalence findings were interpreted as:

1. Impossible to overturn: Even assigning all missing observations (in both groups) to the most extreme values in the worst-case direction did not overturn the equivalence conclusion
2. Robust: Equivalence would be overturned only if a large proportion of missing observations were assigned extreme values in the worst-case direction (e.g., ≥ 0·66 of all missing values)
3. Moderately sensitive: Equivalence would be overturned if a moderate proportion of missing observations were assigned extreme values in the worst-case direction (e.g., 0·33–0·65 of all missing values)

4. Sensitive: Equivalence would be overturned if only a small proportion of missing observations were assigned extreme values in the worst-case direction (e.g., < 0·33 of all missing values).

Results are reported in Chapter 8.

From a Kaupapa Māori Research perspective, the tipping-point analysis was included to avoid overstating similarity when conclusions depended heavily on limited observed data. By making explicit how much unobserved information would be required to change an equivalence conclusion, this approach supports transparent, auditable interpretation and strengthens the accountability of claims about similarity in determinants between Māori with contrasting health outcomes.

Taken together, the equivalence testing and tipping-point analyses provide a structured framework for distinguishing between meaningful differences, robust similarities, and genuinely uncertain cases. The following sections apply this framework to each determinant in turn, beginning with area-level deprivation.

Hypothesis 1. Deprivation

Hypothesis 1 stated that Māori with favourable outcomes (Areas 1–2) are more likely to have lower deprivation than Māori with adverse outcomes (Area 4).

Measure

Deprivation was measured using NZDep2013 and NZDep2018, which are area-based indices derived from nine census variables and coded from 1 (least deprived) to 10 (most deprived).

Rationale For the Measurement Choice

NZDep was used as a pragmatic operationalisation of place-based deprivation for three reasons; because it provides national coverage as a small-area index constructed from census variables with publicly documented methods (Salmond et al., 2007; Atkinson et al., 2019); the stable, versioned release of NZDep across successive censuses (e.g., NZDep96, 2001, 2006, 2013, 2018, and now 2023) supports temporal comparability (Atkinson et al., 2019; Atkinson et al., 2024); and NZDep is explicitly linkable within the IDI via standard workflows that map residential address records to meshblock/SA1 and then to NZDep deciles (Atkinson et al., 2019).

Taken together, these features make the analytic pathway transparent, auditable, and reproducible across time and rohe and enable like-for-like comparisons essential for monitoring resource use and outcomes (Salmond et al., 2007; Atkinson et al., 2019).

Empirical Use as a Measure

NZDep has been applied extensively in epidemiology and public health to quantify socioeconomic gradients in morbidity and mortality and is widely used as the standard area-based measure of socioeconomic context in Aotearoa New Zealand (Salmond & Crampton, 2012; Exeter et al., 2017). Studies using NZDep demonstrate graded associations with outcomes including mortality and life expectancy (Tobias & Cheung, 2003) and cardiovascular mortality (Pearson et al., 2013). Its widespread use supports construct validity as an indicator of neighbourhood socioeconomic context and supports comparability across studies and reporting systems (Salmond & Crampton, 2012).

Limitations and Fit for Purpose

Although NZDep does not capture within-area variation, its standardised construction, consistent versioning, and explicit IDI linkage (from address to small-area unit to decile) allow independent re-analysis and like-for-like comparisons over time and across rohe. As a neighborhood-level proxy, NZDep is not an individual measure of deprivation. It cannot distinguish whānau with markedly different resources living in the same area, and it does not directly observe wealth, assets, or debt.

As with any area-based index, neighbourhood deprivation deciles capture contextual conditions rather than individual circumstances. Treating these area-level measures as personal attributes risks ecological fallacy, in which relationships observed for groups or places are incorrectly inferred to apply to individuals within those groups (Robinson, 1950; Diez Roux, 2001).

From a Kaupapa Māori Research perspective, NZDep also has important conceptual limitations. It does not directly encode Māori understandings of wealth or wellbeing (e.g., access to marae, reo, and tikanga), and it is not explicitly Treaty-framed. Used uncritically, it can naturalise deprivation as a property of Māori communities rather than as a consequence of Crown policies (Walter & Andersen, 2013; Waitangi Tribunal, 2019). In this study, NZDep is therefore treated as a pragmatic, structural indicator of place-based socio-economic status. It is used to support scrutiny of how upstream resourcing and infrastructure patterns align (or fail to align) with the distribution of DI outcomes, consistent with the broader emphasis on structural accountability.

Linkage

NZDep2013 was used for individuals who died in 2013, 2014, and 2016 (per cohort design) and NZDep2018 for individuals who died in 2018 and 2019.

Testing and Decision Rules

Inference for deprivation followed the general two-stage framework described at the start of Part 2. First, a Mann–Whitney U test was used to compare NZDep deciles (1–10) between Māori with favourable outcomes (Areas 1–2) and adverse outcomes (Area 4); $p < 0.05$ was taken as evidence of a distributional difference.

Where the Mann–Whitney result was non-significant ($p \geq 0.05$) and NZDep met the coverage threshold (≥0.7 non-missing in each group), equivalence was assessed using a confidence-interval approach based on the Hodges–Lehmann estimate of the median difference (favourable − adverse) from the Wilcoxon rank-sum framework, with a smallest effect size of interest (SESOI) of ±2 NZDep deciles.

Equivalence was concluded only if the 90% confidence interval for the Hodges–Lehmann median difference lay entirely within −2 to +2 deciles (i.e., within the pre-specified SESOI bounds). Where equivalence was demonstrated, Māori with favourable and adverse outcomes were interpreted as statistically similar with respect to area-level deprivation within two NZDep deciles. Where equivalence was not demonstrated and the Mann–Whitney result was also non-significant, the result was treated as inconclusive under the staged design, providing neither evidence of a meaningful difference nor evidence of practical similarity within the pre-specified margin.

The SESOI of ±2 NZDep deciles was selected for three reasons. First, a two-decile difference corresponds approximately to one deprivation quintile band, aligning with the granularity at which NZDep is commonly interpreted in national equity reporting and funding decisions (Salmond & Crampton, 2012). Second, NZDep is a ten-category ordinal scale rather than an interval metric; interpreting very small decile differences as substantively meaningful risks over-precision at category boundaries. Treating differences smaller than two deciles as practically negligible is therefore consistent with NZDep's measurement properties and its recommended use in grouped or rank-based analyses and reflects a conservative analytic judgement grounded in the ordinal construction of the NZDep scale (Atkinson et al., 2020). Third, because deprivation assignment relies on census-based small-area data and the 2018 Census required substantial imputation to address non-response, a two-decile band provides a conservative allowance for plausible misclassification at decile boundaries while remaining sensitive to substantively important deprivation gaps (Statistics New Zealand, 2018). Results from this staged testing process are presented in Chapter 8.

Hypothesis 2. Income

Hypothesis 2 stated that Māori with favourable outcomes (Areas 1–2) are more likely to have a higher income than Māori with adverse outcomes (Area 4).

Measure

Income was measured using longitudinal, person-level administrative income data derived from tax and benefit records within the IDI. For each individual, annual income amounts from 2007 up to and including the year of death were averaged to form an individual-level average nominal income (i.e., not inflation-adjusted).

Rationale For the Measurement Choice

Averaging income over multiple years prior to death reduces the influence of year-to-year volatility and one-off income shocks, producing a more stable indicator of material resources over the period. Retaining all values in nominal dollars within the same time window preserves a transparent, reproducible analytic pathway and avoids introducing additional assumptions through inflation adjustment.

Limitations and Fit for Purpose

Administrative income data capture taxable earnings and benefit income well but may not include all sources of income (e.g., untaxed or informal income). Because income values were averaged in nominal terms, cross-period pooling was not undertaken. All hypothesis tests were therefore conducted within study windows using internally consistent nominal income measures. Standard IDI linkage protocols and metadata support auditability and replication.

Linkage

For each decedent, annual income records were extracted for every available calendar year from 2007 through the year of death and averaged to yield a single pre-death income measure per person. Where individuals lacked income observations in some years, the available years were averaged.

Testing and Decision Rules

Inference for income followed the general two-stage framework described at the start of Part 2. First, a Mann–Whitney U test was used to compare average nominal annual income between Māori with favourable outcomes (Areas 1–2) and adverse outcomes (Area 4); $p < 0.05$ was taken as evidence of a distributional difference.

Where the Mann–Whitney result was non-significant ($p \geq 0.05$) and income met the coverage threshold for equivalence testing (≥70% non-missing in each group), equivalence was assessed

using a confidence-interval approach based on the Hodges–Lehmann estimate of the median difference (favourable − adverse) from the Wilcoxon rank-sum framework. The smallest effect size of interest (SESOI) was defined as ±20% of the pooled median income for the two groups within each study window.

Equivalence was concluded only if the 90% confidence interval for the Hodges–Lehmann median income difference lay entirely within ±20% of the pooled median (i.e., within the SESOI bounds). Where equivalence was demonstrated, Māori with favourable and adverse outcomes were interpreted as statistically similar with respect to income within the pre-specified margin. Where equivalence was not demonstrated and the Mann–Whitney test was also non-significant, the result was treated as inconclusive under the staged design, providing neither evidence of a meaningful difference nor evidence of practical similarity within the SESOI.

The SESOI of ±20% of the pooled median income was selected for three reasons. First, it scales the equivalence margin to the underlying income level so that what counts as a negligible difference is proportionate to typical earnings rather than an arbitrary fixed dollar amount. Second, it accommodates the skewed, heavy-tailed nature of income distributions observed in the IDI while still requiring a substantively meaningful gap before declaring non-equivalence. Third, from a Kaupapa Māori Research perspective, it defines a margin that is small enough to detect policy-relevant differences in material resources while avoiding the misclassification of trivial nominal fluctuations as inequities. Results from this staged testing process are presented in Chapter 8.

Hypothesis 3. Cultural Identity

Hypothesis 3 stated that Māori with favourable outcomes (Areas 1–2) are more likely to have a strongest cultural identity than Māori with adverse outcomes (Area 4).

Measure

Cultural identity was operationalised using New Zealand Census variables that capture key dimensions of Māori cultural connection. Three individual-level binary indicators were derived for each study window:

1. Iwi/hapū affiliation: respondent reports an iwi or hapū affiliation
2. Te reo Māori ability: respondent reports speaking te reo Māori (alone or alongside English and/or New Zealand Sign Language)
3. Māori spiritual beliefs: respondent reports having Māori spiritual beliefs or philosophies.

A composite cultural identity score was constructed using equal weights. Each present domain contributed 5 points (absent = 0), yielding a bounded ordinal score with four levels: 0, 5, 10, and 15 (higher scores indicate stronger cultural identity).

Rationale For the Measurement Choice

These census items were selected because they are standardised, nationally collected, and auditable at the individual level within the IDI, enabling transparent and reproducible cohort construction and comparability across study windows. Using multiple domains reflects the multidimensional character of cultural identity (including language, whakapapa/affiliation, and spiritual beliefs) while maintaining a simple and repeated construction. Equal weighting (5 points per domain) was adopted to avoid opaque scaling assumptions. The resulting four-level ordinal scale supports non-parametric testing and straightforward policy interpretation.

Limitations and Fit for Purpose

Census responses are self-reported and subject to non-response and coding shifts between waves, particularly in the 2018 Census. The selected items do not exhaust all relevant dimensions of Māori cultural identity (e.g., marae participation, tikanga practice), and equal weighting assumes comparable contributions across domains. To address these limitations, all construction rules were documented to support auditability, missing or indeterminate values were flagged and excluded from primary tests, and the robustness of equivalence findings to missingness was assessed using tipping-point analyses.

Linkage

For each decedent, cultural-identity variables were drawn from the Census corresponding to the study window and linked at the individual level in the IDI: 2013 window: values from the 2013 Census and 2018 window: values from the 2018 Census.

Where both censuses were available within a window (e.g., due to administrative updates or reconciliations), the later value within that window was used. Domains were coded as yes/no and combined into the 0–5–10–15 composite as described above. Records with missing or indeterminate values on all three domains were flagged.

Testing and Decision Rules

Inference for cultural identity followed the general two-stage framework described at the start of Part 2.

For the composite 0/5/10/15 cultural-identity scale, a Mann–Whitney U test was first used to compare scores between Māori with favourable outcomes (Areas 1–2) and adverse outcomes (Area 4); $p < 0.05$ was taken as evidence of a distributional difference.

Where the Mann–Whitney result for the composite was non-significant ($p \geq 0.05$) and cultural-identity data met the coverage threshold for equivalence testing (≥0.7 non-missing in each group), equivalence was assessed using a confidence-interval approach based on the Hodges–Lehmann estimate of the median difference (favourable − adverse) from the Wilcoxon rank-sum framework, with a smallest effect size of interest (SESOI) defined as ±5 points on the 0–15 scale.

Equivalence was concluded only if the 90% confidence interval for the Hodges–Lehmann median difference lay entirely within −5 to +5 points. Where equivalence was demonstrated, Māori with favourable and adverse outcomes were interpreted as statistically similar with respect to cultural identity within one composite domain. Where equivalence was not demonstrated and the Mann–Whitney test was also non-significant, the result was treated as inconclusive under the staged design.

The SESOI of ±5 points was selected for three reasons. First, it corresponds to the smallest possible step on the composite scale, representing the presence or absence of one cultural domain. Second, it respects the coarse, ordinal nature of the 0/5/10/15 structure by avoiding over-interpretation of sub-domain differences. Third, from a Kaupapa Māori Research perspective, it treats differences smaller than a one-domain shift as negligible for policy and accountability purposes, while still flagging larger gaps as potentially meaningful. Results from this staged testing process are presented in Chapter 8.

Hypothesis 4. Health Literacy

Hypothesis 4 stated that Māori with favourable outcomes (Areas 1–2) are more likely to have a higher health literacy than Māori with adverse outcomes (Area 4).

Measure

Health literacy was proxied using highest educational qualification recorded in the New Zealand Census and linked at the individual level within the IDI. Census qualification categories were harmonised to an eight-level ordinal ladder ranging from 0 to 7 (Table 29), with higher values indicating higher formal educational attainment.

Table 29: Eight-level Ladder for Health Literacy

No.	Level
0	No qualification
1	School-level (NZQF 1–3 plus Overseas secondary ← recoded pragmatically)
2	Certificate Level 4
3	Diplomas (NZQF 5–6)
4	Bachelor
5	Postgraduate certificate/diploma and Bachelor with honours
6	Masters
7	Doctorate

Rationale for the Measurement Choice

Using highest educational qualification as a proxy for health literacy is supported on both measurement and construct grounds. Education is widely used as a population-level stand-in because it is stable across the adult life course, consistently coded in censuses, and strongly associated with the foundational substrates of health literacy i.e., general literacy and numeracy (DeWalt et al., 2004; Baker, 2006; Berkman et al., 2011). International evidence from the Programme for the International Assessment of Adult Competencies (PIAAC) shows that higher educational attainment is associated with substantially greater literacy and numeracy proficiency, and New Zealand's PIAAC profile demonstrates the same education-related gradients in adult skills, supporting the use of education to approximate functional capabilities at scale (Organisation for Economic Co-operation and Development (OECD), 2024).

The health-literacy literature further recognises education as a practical proxy where direct testing is infeasible and documents robust links between literacy or health literacy and knowledge, self-management, service use, and clinical outcomes (DeWalt et al., 2004; Baker, 2006; Berkman et al., 2011). Conceptual models of health literacy, including Paasche-Orlow & Wolf (2007) position basic literacy and numeracy and the educational opportunities that develop them upstream of key pathways such as access to care, patient–provider interaction, and self-care. In this framing, highest qualification functions as a structural indicator of accumulated skills relevant to navigating information and health systems.

Limitations and Fit for Purpose

Educational attainment is an imperfect proxy for health literacy and does not directly capture reading comprehension, numeracy, or navigation skills in clinical contexts. Evidence shows that some adults with formal qualifications still struggle with health information, while others with limited formal education demonstrate strong practical health literacy (Paasche-Orlow & Wolf,

2007). In Aotearoa New Zealand, adult literacy surveys show substantial variation in functional skills within qualification bands, including among Māori (Ministry of Health, 2010). Census qualification is also self-reported and may vary across waves as recognition of overseas or non-standard credentials changes.

From a Kaupapa Māori Research perspective, formal qualifications do not capture mātauranga Māori, reo, or other culturally grounded forms of knowledge that shape how many Māori understand and act on health information. Lower formal attainment may therefore reflect constrained opportunity and institutional racism rather than limited capability.

Within these constraints, harmonising census qualification into an eight-level ordinal ladder provided a pragmatic way to use one of the few individual-level indicators of literate practice consistently available in the IDI. The ladder preserves a clear progression from no qualification through to doctoral study without assuming equal spacing between levels and avoids collapsing education into coarse categories that would obscure gradients relevant to diabetes prevention, diagnosis, and self-management. All recoding rules were documented to support auditability.

Linkage

Highest qualification was drawn from the Census corresponding to the study window and linked at the individual level in the IDI: 2013 window: values from the 2013 Census and 2018 window: values from the 2018 Census.

Where both were available within a window, the later value was used. Qualification categories were mapped to the 0–7 ordinal ladder.

Testing and Decision Rules

Inference for health literacy followed the first stage of the general framework described at the start of Part 2.

A Mann–Whitney U test was used to compare the 0–7 qualification ladder between Māori with favourable outcomes (Areas 1–2) and adverse outcomes (Area 4); $p < 0.05$ was taken as evidence of a distributional difference. Health-literacy data met the ≥70% non-missing coverage threshold in only one of the five study years (2019) so only one of five years were tested. A smallest effect size of interest (SESOI) of ±20% of the qualification ladder was specified at the design stage for potential equivalence testing. On an eight-level ordinal scale, this corresponds to ±1.6 qualification categories, representing approximately one to two steps on the ladder (e.g., from school-level to certificate, or from diploma toward bachelor's

degree). This margin reflects the smallest shift in formal educational opportunity that would ordinarily be interpreted as substantively meaningful. Results are presented in Chapter 8.

Hypothesis 5. Geographic Locale

Hypothesis 5 stated that Māori with favourable outcomes (Areas 1–2) are more likely to live in a different urban/rural locale than Māori with adverse outcomes (Area 4).

Measure

Geographic locale was operationalised using Statistics New Zealand's Urban–Rural 2018 (UR2018) classification and applied to usual residence linked at the individual level within the IDI (Table 30). UR2018 defines four urban classes (major, large, medium, and small urban areas) and two rural classes (rural settlement and rural other) (Statistics New Zealand, 2018).

Table 30: UR2018-Based Geographic Locale Categories Used in this Study

Level	Locale	Hypothesis
1	Major urban area	Cities and large towns with 100,000+ people e.g. Tāmaki Makaurau (Auckland), Ōtautahi (Christchurch)
2	Large urban area	30,000–99,999 people e.g. Napier (Ahuriri), Hastings (Heretaunga)
3	Medium urban area	10,000 – 29,999 people
4	Small urban area	1,000–9,999 people
5	Rural settlement	Small towns/settlements with 200–999 people (clustered)
6	Rural other	Everything else rural: dispersed farms/lifestyles, very small clusters

Rationale for the Measurement Choice

UR2018 is the national statistical standard for output geography since SSGA18. It is constructed from SA1/SA2 units and designed to represent urban footprints and rural areas consistently across Aotearoa New Zealand. Its methods and code lists are publicly documented, versioned, and auditable, and they integrate directly with Census usual-residence data, facilitating transparent and reproducible assignment in the IDI (Statistics New Zealand, 2018). In this study, UR2018 is treated as a pragmatic indicator of place-based access to services and infrastructure shaped by Crown decisions, rather than as a fixed attribute of Māori communities.

Limitations and Fit for Purpose

UR2018 is an area-based classification and does not capture within-category heterogeneity, such as variation in transport access, service availability, or local infrastructure within the same urban or rural class. For analyses aligned to the 2013 Census, many published outputs are rebased to 2018 geographies, requiring careful documentation of any concordance used. Water codes (31–33) represent non-residential areas and were excluded from analysis. These constraints were addressed by using the ordered 1–6 urbanicity scale, documenting any rebasing or concordance applied in the IDI extract, and interpreting results as indicative of broad patterns in spatial access rather than fine-grained community characteristics, in line with Statistics New Zealand guidance on the use of census geographies and urban–rural classifications (Statistics New Zealand, 2018).

Linkage

For each decedent, usual residence was linked in the IDI to SA1/SA2 and coded to UR2018 using standard Statistics New Zealand code lists. For the 2013 study window, residence was aligned to the 2013 Census and mapped to UR2018 with any rebasing documented. For the 2018 window, residence was aligned directly to the 2018 Census and UR2018. Records coded to water or with missing or indeterminate UR2018 values were flagged. Missing or indeterminate cases were excluded from primary tests and summarised descriptively.

Testing and Decision Rules

Inference for geographic locale followed the general two-stage framework described at the start of Part 2, using the ordered 1–6 urbanicity scale for both difference and equivalence testing.

First, a Mann–Whitney U test was used to compare the distribution of urbanicity values between Māori with favourable outcomes (Areas 1–2) and adverse outcomes (Area 4); $p < 0.05$ was taken as evidence of a distributional difference.

Where the Mann–Whitney result was non-significant ($p \geq 0.05$) and UR2018 met the coverage threshold for equivalence testing (≥0.7 non-missing in each group in a given year), equivalence was assessed using a confidence-interval approach based on the Hodges–Lehmann estimate of the median difference (favourable − adverse) from the Wilcoxon rank-sum framework, using a SESOI of ±20% of the urbanicity ladder. On a six-level (1–6) ordinal scale, this corresponds to a margin of ±1.2 categories.

Equivalence was concluded only if the 90% confidence interval for the Hodges–Lehmann median difference lay entirely within −1.2 to +1.2 categories. If equivalence was not demonstrated while the Mann–Whitney test also remained non-significant, the result was treated as inconclusive under the staged design.

The SESOI of ±1.2 categories was selected for three reasons. First, it corresponds to slightly more than a one-step shift on the urbanicity scale (e.g., from small urban area to rural settlement), representing the smallest difference typically interpreted as a meaningful change in geographic access and service environment. Second, it respects the coarse, ordinal nature of the scale by avoiding over-interpretation of sub-step differences that may reflect coding variation or minor boundary changes rather than substantive shifts in access. Third, from a Kaupapa Māori Research perspective, specifying the SESOI as 20% of the scale encodes a normative judgement that differences smaller than approximately one urbanicity step are negligible for system-level accountability and planning, while larger shifts remain flagged as potentially important for Māori outcomes (Lakens, 2017). Results from this staged testing process are presented in Chapter 8.

Conclusion

This chapter sets out the methodology used to address the second research question: whether Māori with favourable joint outcomes (Areas 1–2) differ meaningfully from Māori with adverse outcomes (Area 4). Part 1 describes how hypotheses were generated beginning with an issues tree adapted from McGovern et al. (2014) and then reshaped to foreground Kaupapa Māori Research priorities. It describes how behavioural determinants were pruned to keep the analysis upstream and Treaty-based by focusing on Crown and system accountabilities rather than individual choice. It also sets out a five-step process (issues-tree development, hypothesis formulation, targeted literature review, IDI feasibility assessment, pruning, and finalisation), which resulted in five hypotheses on deprivation, income, cultural identity, health literacy, and geographic locale.

Part 2 then shows how these hypotheses were made testable in the IDI without losing transparency. Each determinant was defined using nationally recognised standards and pre-specified decision rules so that the analysis remains traceable and auditable. Deprivation and income were treated as structural conditions that shape life chances; cultural identity was represented using census domains that reflect connection and belonging; health literacy was approximated through educational attainment; and geographic locale captured the patterned effects of urbanicity and place. Across all measures, missingness and rebasing between 2013

and 2018 were handled explicitly, so that uncertainty is carried forward rather than hidden in the construction of variables.

The analytic approach was designed to do more than ask whether groups differ. It was built to distinguish three situations: evidence of meaningful difference, evidence of practical similarity, and evidence of inconclusiveness. Because many measures were ordinal or skewed, distribution-free, non-parametric methods were used as the default, and interpretation was anchored to distributional contrasts and pre-specified smallest-effect-size-of-interest margins rather than reliance on p-values alone. Where a difference was not detected, the analysis did not treat results as "no difference." Instead, where data quality was sufficient, formal equivalence testing procedures were used to assess whether observed contrasts were small enough to be considered practically similar under margins set in advance. Claims of similarity were made conservatively. Equivalence testing was only applied when coverage within outcome groups was adequate in a given year.

Taken together, Part 1 and Part 2 provide a Kaupapa Māori Research–aligned path from question to test: starting with hypotheses that centre system accountability; then translating them into measurable definitions; and then applying an inferential approach that can register difference, similarity, or genuine uncertainty without collapsing these into a single narrative. The next chapter applies this approach to report findings by determinant and study year and interprets what they imply for Māori health equality, Crown accountability, and future Kaupapa Māori Research.

Chapter 8. Results of Determinant Analyses Across Māori

This chapter reports the results of inferential analyses comparing Māori with favourable joint outcomes (Areas 1–2) and Māori with adverse joint outcomes (Area 4). It has three parts. Part 1 presents the results of Mann–Whitney U tests assessing whether the distribution of each determinant (i.e., deprivation, income, cultural identity, health literacy, and geographic locale) differed between the outcome groups within each study year. Part 2 reports the results of equivalence tests and associated tipping-point sensitivity analyses for determinant–year strata that met the pre-specified coverage criteria and did not show a statistically significant Mann–Whitney difference ($p \geq 0.05$). Part 3 integrates findings across both stages to summarise where the evidence indicated meaningful differences, where it supported practical similarity within the smallest effect size of interest, and where results remained inconclusive under the staged design.

Part 1. Results of Mann-Whitney Testing

This part of Chapter 8 reports the results of non-parametric Mann–Whitney U tests on differences in determinants between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4). Five hypotheses were tested (Table 31).

Table 31: Hypotheses Tested

No.	Hypothesis	Review statement
1	Deprivation	Māori with favourable outcomes are more likely to have lower deprivation than Māori with adverse outcomes.
2	Average income	Māori with favourable outcomes are more likely to have higher average incomes than Māori with adverse outcomes
3	Cultural identity	Māori with favourable outcomes are more likely to have a stronger cultural identity than Māori with adverse outcomes.
4	Health literacy	Māori with favourable outcomes are more likely to have higher health literacy than Māori with adverse outcomes.
5	Geographic locale	Māori with favourable outcomes are more likely to live in larger urban areas than Māori with adverse outcomes.

The testing results for each hypothesis is discussed below.

Hypothesis 1. Deprivation

Hypothesis 1 stated that Māori with favourable outcomes were hypothesised to have lower levels of deprivation than Māori with adverse outcomes. This hypothesis was assessed by

comparing area-level deprivation (NZDep decile; higher values indicate greater deprivation) between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4). NZDep was treated as an ordinal variable and two-sided Mann–Whitney U (Wilcoxon rank-sum) tests were applied separately for each eligible study year (2013, 2014, 2016, 2018, and 2019; $\alpha = 0.05$). Tied values were handled using average ranks. The results of testing are set out below (Table 32).

Table 32: Mann–Whitney U test results comparing NZDep deciles between Māori with favourable and adverse outcomes, by study year

Study year	2013	2014	2016	2018	2019
n (Area 1-2)[1]	27	24	36	39	54
n (Area 4)[1]	45	48	51	60	93
Median (Areas 1-2)	9	9	9.5	9	8
Median (Area 4)	9	9	9	9	9
W statistic	568.5	479.0	1080.5	985.0	2111.0
p-value	0.534	0.183	0.204	0.210	0.113
Result	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)

1: Counts (nA, nB) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

Disclaimer: These results are not official statistics. They have been created for research purposes from the IDI which is carefully managed by Statistics NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/

Across study years, Mann–Whitney U tests provided no evidence of statistically significant differences in NZDep deciles between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) in 2013 ($W = 568.5$, $p = 0.534$), 2014 ($W = 479.0$, $p = 0.183$), 2016 ($W = 1080.5$, $p = 0.204$), 2018 ($W = 985.0$, $p = 0.210$), and 2019 ($W = 2111.0$, $p = 0.113$) (Table 33). Median NZDep was similar between groups in each year (2013: 9 vs 9; 2014: 9 vs 9; 2016: 9.5 vs 9; 2018: 9 vs 9; 2019: 8 vs 9). These results indicate that deprivation distributions did not differ detectably by outcome group across the study period; however, non-significant results should not be interpreted as evidence of equivalence.

Hypothesis 2. Average Income

Hypothesis 2 stated that Māori with favourable outcomes were hypothesised to have higher average income than Māori with adverse outcomes. This hypothesis was assessed by

comparing pre-death average nominal annual income between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4). Income was treated as a continuous, right-skewed variable, and two-sided Mann–Whitney U (Wilcoxon rank-sum) tests were applied separately for each eligible study year (2013, 2014, 2016, 2018, and 2019; $\alpha = 0.05$). The results of testing are set out below (Table 33).

Table 33: Mann–Whitney U test results comparing pre-death average nominal annual income (NZD) between Māori with favourable and adverse outcomes, by study year

Study year	2013	2014	2016	2018	2019
n (Area 1-2)[1]	42	30	39	51	57
n (Area 4)[1]	69	60	63	78	93
Median (Areas 1-2)	18,255	19,875	20,755	21,352	19,833
Median (Area 4)	30,034	26,502	28,201	20,185	20,570
W statistic	652.1	469.0	1058.0	2308.0	2454.0
p-value	0.00000129	0.000228	0.121	0.141	0.353
Result	Significant (p>0.05)	Significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)

1: Counts (nA, nB) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

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Across study years, Mann–Whitney U tests provided evidence of statistically significant differences in pre-death average nominal annual income between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) in 2013 ($W = 652.1$, $p = 0.00000129$) and 2014 ($W = 469.0$, $p = 0.000228$) (Table 34).

In both years, median income was lower in the favourable-outcome group than in the adverse-outcome group (2013: NZD 18,255 vs. 30,034; 2014: NZD 19,875 vs. 26,502), indicating that, in these periods, Māori with favourable joint outcomes tended to have lower pre-death average nominal annual income than Māori with adverse outcomes. In 2016, 2018, and 2019, the Mann–Whitney tests provided no evidence of statistically significant differences in income

between outcome groups (2016: $W = 1058.0$, $p = 0.121$; 2018: $W = 2308.0$, $p = 0.141$; 2019: $W = 2454.0$, $p = 0.353$).

These results indicate that income distributions differed by outcome group in the earlier period but not in later years; however, non-significant results should not be interpreted as evidence of equivalence.

Hypothesis 3. Cultural Identity

Hypothesis 3 stated that Māori with favourable outcomes were hypothesised to demonstrate a stronger cultural identity than Māori with adverse outcomes. This hypothesis was assessed by comparing a composite cultural identity score derived from three New Zealand Census indicators (i.e., knowledge of iwi/hapū affiliation, te reo Māori speaking ability, and Māori spiritual beliefs) between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4). The composite score was treated as an ordinal variable and two-sided Mann–Whitney U (Wilcoxon rank-sum) tests were applied separately for each eligible study year (2013, 2014, 2016, 2018, and 2019; $\alpha = 0{\cdot}05$). Tied values handled using average ranks.

The results of testing are set out below (Table 34).

Table 34: Mann–Whitney U test results comparing cultural identity composite scores (0-15) between Māori with favourable and adverse outcomes, by study year

Study year	2013	2014	2016	2018	2019
n (Area 1-2)[1]	27	27	36	36	48
n (Area 4)[1]	45	48	51	39	72
Median (Areas 1-2)	10	5	10	5	10
Median (Area 4)	5	5	5	10	5
W statistic	766.5	576.0	1080.5	573.5	1821.5
p-value	0.143	0.667	0.186	0.095	0.434
Study year	2013	2014	2016	2018	2019
Result	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)

1: Counts (nA, nB) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

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Across study years, Mann–Whitney U tests provided no evidence of statistically significant differences in composite cultural identity scores between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) in any eligible year (2013: W = 766·5, p = 0·143; 2014: W = 576·0, p = 0·667; 2016: W = 1080·5, p = 0·186; 2018: W = 573·5, p = 0·095; 2019: W = 1821·5, p = 0·434) (Table 35). Median scores varied between groups across years but showed no consistent distributional separation (Areas 1–2 medians: 5–10; Area 4 medians: 5–10).

These non-significant results indicate that the available data did not detect systematic differences in the distribution of the composite cultural identity measure by outcome group; however, non-significant results should not be interpreted as evidence of equivalence.

Hypothesis 4. Health Literacy

Hypothesis 4 stated that Māori with favourable outcomes would have higher health literacy than Māori with adverse outcomes. This hypothesis was assessed by comparing the highest-qualification ladder (0–7, where higher values indicate higher attainment) between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4).

Highest qualification was treated as an ordinal variable and two-sided Mann–Whitney U (Wilcoxon rank-sum) tests were applied separately for each eligible study year (2013, 2014, 2016, 2018, and 2019; $\alpha = 0{\cdot}05$), with tied values handled using average ranks. Results are summarised in Table 35.

Table 35: Whitney U test results comparing health literacy proxy (highest educational qualification; 0–7 ordinal ladder) between Māori with favourable and adverse outcomes, by study year

Study year	2013	2014	2016	2018	2019
n (Area 1-2)[1]	27	21	21	30	45
n (Area 4)[1]	33	36	42	48	78
Median (Areas 1-2)	0	0	0	0	0
Median (Area 4)	0	0	0	1	0
W statistic	438.5	409.0	431.5	529.5	1520.0
p-value	0.958	0.976	0.746	0.016	0.341
Result	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Significant (p<0.05)	Non-significant (p>0.05)

1: Counts (nA, nB) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts

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In 2013, 2014, 2016, and 2019, Mann–Whitney U tests provided no evidence of a statistically significant difference in the qualification ladder between Māori with favourable and adverse outcomes in 2013 (W = 438·5, p = 0·958), 2014 (W = 409·0, p = 0·976), 2016 (W = 431·5, p = 0·746), and 2019 (W = 1520·0, p = 0·341) (Table 35).

In 2018, however, the Mann–Whitney U test indicated a statistically significant difference between groups (W = 529·5, p = 0·016). Median values were 0 in both groups in all years except 2018, when the adverse-outcome group had a median of 1 compared with 0 in the favourable-outcome group. As with other determinants, non-significant results should not be interpreted as evidence of equivalence.

Hypothesis 5. Geographic Locale

Hypothesis 5 stated that Māori with favourable outcomes would be more likely to live in larger urban centres than Māori with adverse outcomes. This hypothesis was assessed by comparing UR2018 geographic locale (an ordinal 1–6 urbanicity scale, where lower values indicate more urban residence and higher values indicate more rural residence) between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4).

Two-sided Mann–Whitney U (Wilcoxon rank-sum) tests were applied separately for each eligible study year (2013, 2014, 2016, 2018, and 2019; $\alpha = 0{\cdot}05$), with tied values handled using average ranks. Results are summarised in Table 36.

Table 36: Results Whitney U test results comparing geographic locale (Urban–Rural 2018 classification; 1–6 urbanicity ladder) between Māori with favourable and adverse outcomes, by study year

Study year	2013	2014	2016	2018	2019
n (Area 1-2)[1]	27	27	36	39	54
n (Area 4)[1]	45	48	51	60	93
Median (Areas 1-2)	1	2.5	3	3	2
Median (Area 4)	1	1	1	2	2
W statistic	641.5	731.0	1115.0	1276.0	2780.0
p-value	0.979	0.136	0.100	0.350	0.227

Study year	2013	2014	2016	2018	2019
Result	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)	Non-significant (p>0.05)

1: Counts (nA, nB) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

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Across all eligible study years, Mann–Whitney U tests provided no evidence of a statistically significant difference in UR2018 urbanicity between Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) (all p-values > 0·05; Table 37). Year-specific results were 2013 (W = 641.5, p = 0·979), 2014 (W = 731·0, p = 0·136), 2016 (W = 1115·0, p = 0·100), 2018 (W = 1276·0, p = 0·350), and 2019 (W = 2780·0, p = 0·227). Median UR2018 values were similar between groups in each year (Areas 1–2 medians: 2–3; Area 4 medians: 1–2).

These non-significant results indicate that the analysis did not detect systematic distributional separation in geographic locale by outcome group; however, non-significance should not be interpreted as evidence of equivalence.

Summary of Mann-Whitney results

Across determinants, Mann–Whitney U tests showed limited and inconsistent evidence of distributional differences between Māori with favourable and adverse joint outcomes across study years, with clear differences observed only for average income in 2013–2014 and for the health-literacy proxy in 2018. Because non-significant difference tests do not establish practical similarity, equivalence testing was then applied to eligible determinant–year contrasts that met the pre-specified coverage threshold and did not show statistically significant Mann–Whitney differences.

Part 2. Results of Equivalence Testing

Part 1 of this chapter applied Mann–Whitney U tests (and, where appropriate, proportion tests) to compare Māori with favourable joint outcomes (Areas 1–2) and those with adverse joint outcomes (Area 4) across five hypothesised determinants. Many contrasts were non-significant at $\alpha = 0.05$. However, non-significance does not, on its own, establish that groups are meaningfully similar. Part 2 therefore reports the results of equivalence testing for those contrasts that met the design criteria set out in Chapter 7.

Whereas Part 1 assessed whether there was evidence of a difference between groups, the equivalence analyses addressed a complementary question: whether the groups could be considered practically similar within pre-specified smallest effect sizes of interest (SESOIs). For determinant–year combinations where the Mann–Whitney test was non-significant and data coverage was sufficient, equivalence was assessed using a Two One-Sided Tests (TOST) framework implemented via the Hodges–Lehmann location shift (favourable − adverse) from the Wilcoxon rank-sum procedure. A 90% confidence interval for the location shift was constructed and equivalence was concluded where the entire interval lay within the pre-specified SESOI bounds for that determinant.

Coverage and Eligible Contrasts

Equivalence testing was undertaken only for determinant–year strata where both outcome groups had rounded non-missing coverage ≥0·7 (rounded to one decimal place using standard rounding) and where the Mann–Whitney comparison between favourable and adverse outcome groups was non-significant (p>0·05).

Table 38 summarises data completeness for each determinant by study year and outcome group, showing observed sample sizes (nA, nB), missing counts (mA, mB), and resulting coverage proportions (cA, cB) for Māori with favourable outcomes (Areas 1–2) versus adverse outcomes (Area 4), alongside the Mann–Whitney test result.

Under this two-stage eligibility rule:

1. Deprivation met coverage requirements in 2014, 2016, 2018, and 2019, and in each of these years the Mann–Whitney test was non-significant; these strata proceeded to equivalence testing. Deprivation did not meet coverage criteria in 2013
2. Average income met coverage criteria in all years (2013–2019), but the Mann–Whitney test was statistically significant in 2013 and 2014; equivalence testing was therefore undertaken only for 2016, 2018, and 2019
3. Cultural identity met both coverage and non-significance criteria in 2014, 2016, and 2019, but failed coverage thresholds in 2013 and 2018
4. Health literacy met both criteria only in 2019; earlier years failed the coverage threshold and/or showed statistically significant between-group differences
5. Geographic locale met both criteria in 2014, 2016, 2018, and 2019, but not in 2013 due to insufficient coverage.

Table 37: Eligibility for Equivalence Testing

Study year	nA[1]	nB[1]	mA[1]	mB[1]	cA	cB	Coverage	MW result	Eligibility
Deprivation									
2019	54	93	9	6	0.8	0.9	Y	Non-sig	y
2018	39	60	21	27	0.7	0.7	Y	Non-sig	Y
2016	36	51	9	27	0.8	0.7	Y	Non-sig	Y
2014	24	48	9	18	0.7	0.7	Y	Non-sig	Y
2013	27	45	21	24	0.6	0.7	N	Non-sig	N
Average income									
2019	57	93	6	6	0.9	0.9	Y	Non-Sig	Y
2018	51	78	9	9	0.9	0.9	Y	Non-Sig	Y
2016	39	63	6	15	0.9	0.8	Y	Non-sig	Y
2014	30	60	3	6	0.9	0.9	Y	Sig	N
2013	42	69	6	0	0.9	0.9	Y	Sig	N
Cultural identity									
2019	48	72	15	30	0.7	0.7	Y	Non-sig	Y
2018	36	39	24	48	0.6	0.5	N	Non-sig	N
2016	36	51	9	27	0.8	0.7	Y	Non-sig	Y
2014	27	48	9	18	0.8	0.7	Y	Non-sig	Y
2013	27	45	18	24	0.6	0.7	N	Non-sig	N
Health literacy									
2019	45	78	18	24	0.7	0.8	y	Non-sig	Y
2018	30	48	27	39	0.5	0.6	N	Sig	N
2016	21	42	24	36	0.5	0.6	N	Non-sig	N
2014	21	36	12	27	0.6	0.6	N	Non-sig	N
2013	27	33	21	36	0.6	0.5	N	Non-sig	N
Geographic locale									
2019	54	93	9	6	0.8	0.9	y	Non-sig	Y
2018	39	60	21	27	0.7	0.7	y	Non-sig	Y
2016	36	51	9	24	0.8	0.7	y	Non-sig	Y
2014	27	48	9	18	0.8	0.7	y	Non-sig	Y
2013	27	45	18	24	0.6	0.7	N	Non-sig	N

1: Counts (nA, nB, mA, and mB) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

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Equivalence Results. Deprivation

To assess whether Māori with favourable and adverse outcomes experienced meaningfully similar levels of area-level deprivation, median-difference equivalence tests were conducted for study years with adequate coverage (2014, 2016, 2018, 2019; Table 39).

Equivalence was evaluated against a smallest effect size of interest (SESOI) of ±2 NZDep deciles using a Two One-Sided Tests (TOST) framework implemented via the Hodges–Lehmann location shift (favourable − adverse) from the Wilcoxon rank-sum procedure. A 90% confidence interval for the location shift was constructed and equivalence was concluded where the entire interval lay within ±2 deciles. A tipping-point analysis was then used to assess the robustness of equivalence conclusions to missing NZDep values. The results are summarised in Table 38.

Table 38: Equivalence and tipping-point sensitivity results for NZDep (SESOI ±2 deciles), favourable (Areas 1–2) vs adverse (Area 4), by study year

Study year	2013	2014	2016	2018	2019
Equivalence test results					
n (Favourable)[1]	27	24	36	39	54
n (Adverse)[1]	45	48	51	60	93
Median (Favourable)	9.0	9.0	9.5	9.0	8.0
Median (Adverse)	9.0	9.0	9.0	9.0	9.0
HL shift[c]	0.00	0.00	0.00	0.00	0.00
CI low[2]	-0.99	-1.99	0.00	-1.00	-1.00
CI high[2]	0.00	0.00	1.00	0.00	0.00
Study year	2013	2014	2016	2018	2019
Result	Equivalent but coverage not met	Equivalent	Equivalent	Equivalent	Equivalent
Tipping point results					
mA[1]		9	9	21	9
mB[1]		18	27	27	6
Tip_n[1]		—	21	42	—
Tip_pct		—	0.57	0.85	—
Result	Not interpreted	Impossible to overturn	Moderate	Robust	Impossible to overturn

1: Counts (nA, nB, mA, mB, and Tip_n) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

2. HL_shifts and confidence intervals are presented to two decimal places. All inferential analyses were conducted using full-precision, unrounded values within the secure environment, with rounding applied solely for publication formatting.

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Definitions

HL shift: Denotes the Hodges–Lehmann location-shift estimate (favourable − adverse) derived from the Wilcoxon rank-sum test. Rounded to 2 decimal places for reporting; equivalence decisions were made using full-precision estimates.

CI low and CI high: The lower and upper bounds of the corresponding 90% confidence interval. Rounded to 2 decimal places for reporting.

Tip_n: The minimum number of missing observations that would need to be assigned extreme values in the worst-case direction to overturn the equivalence conclusion.

Tip_pct: The proportion of total missing observations required, under worst-case allocation, to overturn the equivalence conclusion; higher values indicate greater robustness to missing data.

Impossible to overturn: Even assigning all missing observations (in both groups) to the most extreme values in the worst-case direction did not overturn the equivalence conclusion.

Robust: Equivalence would be overturned only if a large proportion of missing observations were assigned extreme values in the worst-case direction (e.g., ≥ 0·66 of all missing values).

Moderately sensitive: Equivalence would be overturned if a moderate proportion of missing observations were assigned extreme values in the worst-case direction (e.g., 0·33–0·65 of all missing values).

Sensitive: Equivalence would be overturned if only a small proportion of missing observations were assigned extreme values in the worst-case direction (e.g., < 0·33 of all missing values).

Across the four study years that met eligibility for testing (2014, 2016, 2018, and 2019), Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) were statistically equivalent with respect to area-level deprivation within the pre-specified SESOI of ±2 NZDep deciles. In each eligible year, the Hodges–Lehmann location shift (favourable − adverse) was 0·00 (to two decimal places), and the 90% confidence interval for the location shift lay entirely within the equivalence bounds. Median deprivation levels ranged from 8·0 to 9·5 in the favourable group and 9·0 in the adverse group across eligible years, indicating that both outcome groups were concentrated in high-deprivation neighborhoods.

Tipping-point sensitivity analyses indicated that the robustness of equivalence conclusions varied by year. In 2016, equivalence was moderately sensitive to missingness: overturning equivalence required reassignment of 21 of 36 missing observations to extreme values in the worst-case direction (tip_pct = 0·57). In 2018, the equivalence conclusion was robust: overturning equivalence required reassignment of 42 of 48 missing observations (tip_pct = 0·85). In both 2014 and 2019, no tipping point was identified: even assigning all missing observations to extreme values in the worst-case direction did not overturn equivalence, and these findings were therefore classified as impossible to overturn under the observed missing-data constraints.

Although 2013 yielded an equivalent estimate (Hodges–Lehmann shift 0·00; 90% CI −0·99 to 0·00), NZDep coverage in that year did not meet the eligibility threshold and the result was therefore not interpreted as evidence of practical similarity under the staged design.

Overall, in years with adequate coverage, deprivation did not distinguish Māori with favourable versus adverse joint outcomes. Rather, both groups experienced similarly high levels of area-level deprivation, suggesting that deprivation functioned as a pervasive structural background condition within this cohort rather than as a differentiating determinant of favourable outcomes.

Equivalence Results. Average Income

To assess whether Māori with favourable and adverse outcomes experienced meaningfully similar levels of average income, median-difference equivalence tests were conducted for study years with adequate coverage (2016, 2018, 2019; Table 39). Mann–Whitney tests for 2013 and 2014 were statistically significant (reported above), so these years were excluded from equivalence testing.

Equivalence was evaluated against a smallest effect size of interest defined as ±20% of the pooled median income for each year using a Two One-Sided Test (TOST) equivalence framework implemented via the Hodges–Lehmann location-shift estimator (favourable − adverse) and its 90% confidence interval from the Wilcoxon rank-sum procedure. Equivalence was concluded if the entire 90% confidence interval lay within the SESOI bounds. A tipping-point analysis was used to assess robustness to missing income values. The results are summarised in Table 39.

Table 39: Equivalence and tipping-point sensitivity results for pre-death average nominal annual income (SESOI ±20% of pooled median), favourable (Areas 1–2) vs adverse (Area 4), by study year

Study year	2013	2014	2016	2018	2019
Equivalence test results					
n (Favourable)[1]			39	51	57
n (Adverse)[1]			69	78	93
Median (favourable)			20,755	21,352	19,833
Median (adverse			28,210	20,185	20,570
HL shift			-3,314	1,932	-796
CI low			-6690	-212	-2,394
CI high			190	4149	753
Result	Significant difference	Significant difference	Not equivalent	Not equivalent	Equivalent

Study year	2013	2014	2016	2018	2019
Tipping point results					
mA[1]					6
mB[1]					6
Tip_n[1]					9
Tip_pct					0.77
Result					Robust

1: Counts (nA, nB, mA, mB, and Tip_n) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

2. HL_shifts and confidence intervals are presented to two decimal places. All inferential analyses were conducted using full-precision, unrounded values within the secure environment, with rounding applied solely for publication formatting.

See Table 39 for all table definitions

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Across the three study years eligible for equivalence testing (2016, 2018, and 2019), evidence for practical similarity in average income was limited. In 2016 and 2018, equivalence was not supported under the pre-specified SESOI of ±20 percent of the pooled median (2016: favourable − adverse = −$3,314; 90% CI −$6,690 to $190; 2018: $1,932; 90% CI −$212 to $4,149). Median incomes were not consistently aligned across these years: the adverse group had a higher median than the favourable group in 2016, whereas the favourable group had a higher median in 2018. In both years, the confidence interval crossed the equivalence margin and practical similarity therefore could not be concluded.

In contrast, 2019 met the equivalence criterion. The Hodges–Lehmann shift was small (favourable − adverse = −$796), and the 90 percent confidence interval (−$2,394 to $753) lay entirely within the ±20 percent SESOI bounds, supporting practical equivalence in average income between outcome groups for that year. The tipping-point analysis indicated that this conclusion was robust to worst-case missingness: equivalence would have been overturned only if 9 of the 12 missing income observations (tip_pct = 0.77) were assigned to extreme values in the direction most likely to challenge equivalence.

2013 and 2014 were not eligible for equivalence testing because the Mann–Whitney difference tests were statistically significant (reported in Part 1). Overall, the results do not support a consistent conclusion of practical similarity in average income across study years.

Equivalence Results. Cultural Identity

To assess whether Māori with favourable and adverse outcomes experienced meaningfully similar levels of cultural identity, median-difference equivalence tests were conducted for study years with adequate coverage (2014, 2016, 2019; Table 39).

Equivalence was evaluated against a smallest effect size of interest of ±5 points on the cultural identity scale using a Two One-Sided Test (TOST) equivalence framework implemented via the Hodges–Lehmann location-shift estimator (favourable − adverse) and its 90% confidence interval from the Wilcoxon rank-sum procedure. Equivalence was concluded if the entire 90% confidence interval lay within the SESOI bounds. A tipping-point analysis was used to assess robustness to missing values. The results are summarised in Table 40.

Table 40: Equivalence and tipping-point sensitivity results for cultural identity composite score (0–15; SESOI ±5 points), favourable (Areas 1–2) vs adverse (Area 4), by study year

Study year	2013	2014	2016	2018	2019
Equivalence test results					
n (Favourable)[1]	27	27	36	36	48
n (Adverse)[1]	45	48	51	39	72
Median (favourable)	10	5	10	5	10
Median (adverse	5	5	5	10	5
HL shift[2]	0.00	0.00	0.00	0.00	0.00
CI low[2]	0.00	0.00	0.00	-5.00	0.00
CI high[2]	4.99	0.00	4.99	0.00	0.00
Result	Equivalent but coverage not met	Equivalent	Equivalent	Equivalent but coverage not met	Equivalent
Study year	2013	2014	2016	2018	2019
Tipping point results					
mA[1]		9	9		15
mB[1]		18	27		30
Tip_n[1]		21	18		36
Tip_pct		0.80	0.49		0.76
Result	Not interpreted	Robust	Moderate	Not interpreted	Robust

1: Counts (nA, nB, mA, mB, and Tip_n) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

2. HL_shifts and confidence intervals are presented to two decimal places. All inferential analyses were conducted using full-precision, unrounded values within the secure environment, with rounding applied solely for publication formatting.

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Across the study years meeting the thresholds for equivalence testing (2014, 2016, and 2019), Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) were statistically equivalent on the cultural-identity composite score within the pre-specified SESOI of ±5 points (Table 41). In each eligible year, the Hodges–Lehmann location shift (favourable − adverse) was approximately zero and the 90 percent confidence interval lay within the equivalence bounds. Median cultural-identity scores were also closely aligned in these years: medians were identical in 2014 (5 vs. 5), while the favourable group had a higher median in 2016 (10 vs. 5) and 2019 (10 vs. 5) but still within the equivalence margin, consistent with practical similarity on this four-step 0–15 scale.

A tipping-point sensitivity analysis indicated that the robustness of this equivalence evidence varied by year. In 2014, equivalence was classified as robust: overturning the equivalence conclusion would have required an extreme reallocation of missing values (tip_n = 21; tip_pct = 0·80). In 2016, the result was moderately sensitive (tip_n = 18; tip_pct = 0·49), indicating that equivalence could be overturned if a substantial proportion of missing observations were concentrated at extreme values in the worst-case direction. In 2019, equivalence was again classified as robust (tip_n = 36; tip_pct = 0·76), suggesting resilience to worst-case missing-data patterns.

Results for 2013 and 2018 were not interpreted as evidence of practical similarity because the ≥0·7 coverage threshold was not met, despite the equivalence test statistic and confidence interval falling within the SESOI bounds.

Overall, where data completeness supported equivalence inference, the cultural-identity composite did not distinguish Māori with favourable from adverse joint outcomes, although the robustness of that conclusion depended on the extent and potential distribution of missing data, most notably in 2016 where the tipping-point analysis indicated only moderate robustness.

Equivalence Results: Health Literacy

To assess whether Māori with favourable and adverse outcomes experienced meaningfully similar levels of health literacy, median-difference equivalence tests were conducted for study years with adequate coverage (2019; Table 39).

For transparency, the single year that met coverage threshold (2019) was examined for equivalence using a Two One-Sided Test (TOST) equivalence framework implemented via the Hodges–Lehmann location-shift estimator (favourable − adverse) and its 90% confidence interval from the Wilcoxon rank-sum procedure, with a smallest effect size of interest (SESOI) of ±1·6 categories on the 0–7 qualification ladder. Equivalence was concluded if the entire 90% confidence interval lay within the SESOI bounds, and a tipping-point analysis was used to assess robustness to missing qualification data. In 2019, the observed Hodges–Lehmann shift was approximately 0 and the 90% confidence interval lay within ±1·6. Results are summarised in Table 41.

Table 41: Equivalence comparison of health-literacy proxy (qualification ladder, 0–7); equivalence testing not undertaken due to coverage thresholds

Study year	2013	2014	2016	2018	2019
Equivalence test results					
n (Favourable)[1]	27	21	21		45
n (Adverse)[1]	33	36	42		78
Median (favourable)	0	0	0		0
Median (adverse)	0	0	0		0
HL shift[2]	0.00	0.00	0.00		0.00
CI low[2]	0.00	0.00	0.00		0.00
CI high[2]	0.00	0.00	0.00		0.00
Study year	2013	2014	2016	2018	2019
Result	Equivalent but coverage not met	Equivalent but coverage not met	Equivalent but coverage not met	Significant difference	Equivalent
Tipping point results					
mA[1]					18
mB[1]					24
Tip_n[1]					12
Tip_pct					0.26
Result	Not interpreted	Not interpreted	Not interpreted		Sensitive

1: Counts (nA, nB, mA, mB, and Tip_n) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

2. HL_shifts and confidence intervals are presented to two decimal places. All inferential analyses were conducted using full-precision, unrounded values within the secure environment, with rounding applied solely for publication formatting.

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Only 2019 met the coverage threshold and was eligible for equivalence inference. In that year, Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) were statistically equivalent within the pre-specified SESOI of ±1·6 categories. The Hodges–Lehmann location shift (favourable − adverse) was 0·00 and the 90 percent confidence interval lay entirely within the equivalence bounds. Median qualification-ladder values were 0 in both groups.

Results for 2013, 2014, and 2016 were not interpreted as evidence of practical similarity because the coverage threshold was not met, despite the Hodges–Lehmann estimates and confidence intervals falling within the SESOI bounds. 2018 was not eligible for equivalence testing because the Mann–Whitney test indicated a statistically significant difference between outcome groups.

A tipping-point sensitivity analysis was informative only for 2019 where the equivalence conclusion would have been overturned by reallocating a moderately small proportion of missing observations to extreme values in the worst-case direction (tip_n = 12; tip_pct = 0·26), indicating sensitivity to missing-data assumptions. For the remaining years, tipping-point results were not interpreted because the staged requirements for equivalence inference were not satisfied.

Overall, the available data provide limited support for interpretable equivalence inference for the health-literacy proxy.

Equivalence Results. Geographic Locale

To assess whether Māori with favourable and adverse outcomes experienced meaningfully similar patterns of geographic residence, median-difference equivalence tests were conducted for study years with adequate coverage (2014, 2016, 2018, 2019; Table 39).

Equivalence was evaluated against a smallest effect size of interest (SESOI) of ±1·2 categories on the urbanicity scale using a Two One-Sided Test (TOST) equivalence framework implemented via the Hodges–Lehmann location-shift estimator (favourable − adverse) and its 90% confidence interval from the Wilcoxon rank-sum procedure. Equivalence was concluded if the entire confidence interval lay within the pre-specified SESOI bounds. The results are summarised in Table 42.

Table 42: Equivalence and tipping-point sensitivity results for geographic locale (UR2018 urbanicity scale; SESOI ±1.2 categories), favourable (Areas 1–2) vs adverse (Area 4), by study year

Study year	2013	2014	2016	2018	2019
Equivalence test results					
n (Favourable)[1]	27	27	36	39	54
n (Adverse)[1]	45	48	51	60	93
Median (favourable)	1	2.5	3.0	3.0	2.0
Median (adverse	1	1.0	1.0	2.0	2.0
HL shift[2]	0.00	0.00	0.00	0.00	0.00
CI low[2]	0.00	0.00	0.00	0.00	0.00
CI high[2]	0.00	1.00	1.99	1.00	0.99
Result	Equivalent but coverage not met	Equivalent	Not equivalent	Equivalent	Equivalent
Tipping point results					
mA[1]		9		21	9
mB[1]		18		27	6
Tip_n[1]		3		6	—
Tip_pct		0.08		0.13	—
Result	Not interpreted	Sensitive		Sensitive	Impossible to overturn

1: Counts (nA, nB, mA, mB, and Tip_n) are random rounded to base 3 in accordance with Stats NZ confidentiality requirements. All inferential statistics were computed using unrounded counts within the secure environment; consequently, derived values may not correspond exactly to calculations based on the published rounded counts.

2. HL_shifts and confidence intervals are presented to two decimal places. All inferential analyses were conducted using full-precision, unrounded values within the secure environment, with rounding applied solely for publication formatting.

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Across the study years eligible for equivalence testing (2014, 2016, 2018, and 2019), evidence for practical similarity in geographic locale varied (Table 42).

In 2014, 2018, and 2019, Māori with favourable outcomes (Areas 1–2) and Māori with adverse outcomes (Area 4) were statistically equivalent within the specified margin. In each of these years, the Hodges–Lehmann location shift (favourable − adverse) was 0·00 (to two decimal places), and the 90 percent confidence interval lay entirely within the ±1·2 category equivalence bounds. Median urbanicity categories were closely aligned in 2018 (3·0 vs. 2·0) and identical in 2019 (2·0 vs. 2·0). In 2014, although the favourable group had a higher median urbanicity category than the adverse group (2·5 vs. 1·0), the corresponding confidence interval remained within the pre-specified equivalence margin, supporting practical similarity.

In contrast, 2016 did not meet the equivalence criterion. Although the Hodges–Lehmann shift was 0·00, the upper bound of the 90 percent confidence interval (1·99) exceeded the ±1·2 equivalence margin, and equivalence was therefore not supported for that year. Median categories also differed (3·0 vs. 1·0), and the associated uncertainty was outside the pre-specified equivalence bounds.

Tipping-point sensitivity analyses indicated that the robustness of equivalence conclusions varied across years. In 2014, equivalence was classified as sensitive: only 3 of 27 missing observations (tip_pct = 0·08) would need to be assigned extreme values in the worst-case direction to overturn the conclusion. Similarly, in 2018, equivalence was sensitive (tip_n = 6 of 48 missing; tip_pct = 0·13), indicating vulnerability to plausible missing-data patterns. In 2019, no tipping point was identified: even assigning all missing observations to extreme values did not overturn the equivalence conclusion, and the result was therefore classified as impossible to overturn.

Results for 2013 were not interpreted as evidence of practical similarity because the ≥0·7 coverage threshold was not met, despite the equivalence test statistic and confidence interval falling within the SESOI bounds.

Overall, geographic locale did not consistently distinguish Māori with favourable versus adverse joint outcomes. While equivalence was supported in most eligible years, the robustness of those findings varied, with some years sensitive to missing-data assumptions and others demonstrating strong stability.

Part 3. Bringing the Results Together

Part 3 integrates findings across the staged analytic design. First-stage Mann–Whitney U tests evaluated whether determinants differed between Māori with favourable (Areas 1–2) and adverse (Area 4) joint outcomes within each study year. Where difference tests were non-significant and coverage criteria were met, second-stage equivalence testing assessed whether groups could be considered practically similar within pre-specified smallest effect sizes of interest (SESOIs). Tipping-point sensitivity analyses then indicated how robust any equivalence conclusions were to worst-case allocations of missing data.

Hypothesis 1. Deprivation (NZDep)

Across study years, Mann–Whitney U tests provided no evidence of statistically significant differences in NZDep deciles between outcome groups. Importantly, these non-significant findings were not interpreted as evidence of similarity. Where the coverage threshold was met (2014, 2016, 2018, and 2019), equivalence testing consistently supported practical similarity in deprivation within the SESOI of ±2 NZDep deciles. Medians were high in both groups across eligible years, indicating that favourable and adverse outcome groups were both concentrated in high-deprivation neighborhoods.

Tipping-point results suggested that these equivalence conclusions were generally robust to missingness, though not uniformly so. Robustness ranged from moderate sensitivity in 2016 to robust in 2018, while no tipping point was identified in 2014 and 2019 (classified as impossible *to* overturn under observed missingness). Taken together, the staged evidence indicates that deprivation did not differentiate Māori with favourable versus adverse joint outcomes in years where equivalence inference was supported; rather, high deprivation appeared to operate as a pervasive structural background condition within this cohort.

Hypothesis 2. Average income (pre-death nominal annual income)

For income, the two-stage evidence was heterogeneous across time. In the earlier period (2013–2014), Mann–Whitney tests identified statistically significant differences between groups, and the direction of association was opposite to the hypothesis: Māori with favourable outcomes had lower median income than Māori with adverse outcomes. In later years (2016–2019), Mann–Whitney tests were non-significant, but these results were not treated as evidence of similarity.

Equivalence testing clarified that non-significance did not imply practical similarity. Under the ±20% SESOI framework, 2016 and 2018 were not equivalent. Only 2019 supported equivalence, and the tipping-point analysis indicated this conclusion was robust to worst-case missingness.

Hypothesis 3. Cultural identity (composite 0–15)

For cultural identity, Mann–Whitney tests were non-significant across study years, but these results were not interpreted as similarity. Where coverage supported the staged design (2014, 2016, and 2019), equivalence testing consistently supported practical similarity within the SESOI of ±5 points. Median values varied between groups across years, but the equivalence margin was sufficiently wide that observed differences were still consistent with practical similarity on the 0–15 scale.

Tipping-point analyses indicated that robustness varied across years. Equivalence was robust in 2014 and 2019, but only moderately sensitive in 2016, indicating greater vulnerability to worst-case missing-data allocations that year. Overall, the staged evidence suggests that cultural identity (as operationalised in this study) did not systematically distinguish Māori with favourable from adverse joint outcomes in years where equivalence inference was supported, although the stability of that conclusion depended on missing-data patterns in some strata.

Hypothesis 4. Health literacy proxy (qualification ladder 0–7)

Health literacy was the determinant most constrained by measurement and completeness. Mann–Whitney tests were non-significant in four of five years, with a statistically significant difference in 2018. However, equivalence inference under the staged design was limited because the coverage threshold was not met in 2013–2016, and 2018 was ineligible for equivalence testing due to the significant difference-test result.

Only 2019 satisfied staged eligibility and that year supported equivalence within the SESOI of ±1·6 categories. Tipping-point analysis was informative only in 2019, where results appeared sensitive to missingness. Overall, the staged evidence provides limited support for health literacy as a differentiating determinant, primarily due to missingness and a proxy measure with restricted variation.

Hypothesis 5. Geographic locale (UR2018 urbanicity scale 1–6)

Where staged eligibility were satisfied (2014, 2016, 2018, and 2019), equivalence conclusions were mixed: equivalence was supported in 2014, 2018, and 2019, but not supported in 2016, where the confidence interval extended beyond the SESOI of ±1·2 categories.

Tipping-point sensitivity analyses indicated that some equivalence conclusions were fragile. In 2014 and 2018, equivalence could be overturned by reallocating only a small proportion of missing observations to extreme values, indicating high sensitivity to missing-data assumptions. In 2019, no tipping point was identified (classified as impossible to overturn). Overall, geographic locale did not show a stable pattern of differentiation between outcome groups, and where equivalence was supported, robustness varied substantially across years.

Synthesis across determinants

Across determinants, the staged approach indicated that most contextual factors examined here did not consistently differentiate Māori with favourable versus adverse joint outcomes within the cohort. Where evidence was strongest, deprivation and cultural identity most often supported practical similarity in eligible years, while geographic locale showed mixed equivalence and variable robustness. Income was the main exception: early-year differences were statistically detectable and contrary to the hypothesised direction, and later years showed equivalence in only one year under the SESOI framework. Health literacy remained largely inconclusive due to missingness. Collectively, these findings suggest that the marked differences in joint diabetes burden observed earlier in the thesis are unlikely to be explained by these contextual determinants alone, at least as captured by the available administrative and census-linked measures and within the pre-specified equivalence margins.

Conclusion

This chapter examines whether Māori with markedly favourable outcomes differed from those with adverse outcomes across five contextual determinants: area-level deprivation; average income; cultural identity; health literacy (proxied by educational attainment); and geographic locale. Using a structured two-stage analytic approach, the chapter combines non-parametric difference testing with determinant-specific equivalence testing to distinguish meaningful differences, practical similarity within policy-relevant margins, and results that remain genuinely inconclusive. Overall, this chapter suggests that the substantial contrasts in health outcomes identified earlier in the thesis are not explained by the contextual determinants examined here.

Chapter 9. Study Limitations, Implications, and Final Reflections

This chapter concludes the thesis by outlining study limitations, describing the implications of the findings, and providing reflections on this research. It has four parts. Part 1 outlines limitations to frame how the findings should be interpreted. Part 2 examines the major implications of the research findings, focusing on methodological contributions and their relevance for Māori health, accountability, and burden-of-disease measurement. Part 3 considers what the empirical findings imply for Māori Treaty Partners, whānau, and individual Māori; for future research; for public policy; for service planning and funding; for service providers; and for Māori health data and infrastructure. Part 4 concludes with reflections on data availability and the need to strengthen Māori health measurement.

Part 1. Study Limitations

All research is subject to constraints. This study is no exception, and the limitations outlined in this part of Chapter 9 identify where the methodology and approach could be refined in future work.

There are four main types of limitations:

1. Limitations associated with the methodology used to calculate YLLD
2. Limitations associated with the generalisability of the findings
3. Limitations associated with the research design
4. Limitations associated with Māori data gaps.

Each is discussed below.

1. Limitations Associated with the Methodology Used to Calculate YLLD

YLLD was calculated by multiplying the number of years an individual had a diagnosed condition by the disability weight for the condition. Two limitations are associated with the way YLLD was calculated, and each is discussed below.

1.1. Data Availability and Undercounting

The first limitation is that complication diagnoses could only be identified from public and private hospital discharge data. Although additional sources of diagnosis exist (including general practice and outpatient settings), they were not linkable for this study within the IDI environment. As a result, conditions diagnosed in primary care or in outpatient settings were

not captured, and YLLD attributable to DI is likely undercounted where substantial morbidity was managed outside hospital settings.

Despite this limitation, the hospital-based approach is likely to capture a substantial share of disability-weighted burden because the highest disability weights attach to severe complications that commonly generate hospital contact (e.g., acute metabolic crises, advanced renal disease, and major cardiovascular or cerebrovascular events). In contrast, many conditions predominantly managed in primary care or outpatient settings tend to carry lower disability weights. The consequence of this limitation is that it gives rise to a structured undercount: the estimates are more complete for severe, hospital-detected morbidity and less complete for lower-severity, community-managed morbidity. Accordingly, the YLLD results should be interpreted as conservative for total non-fatal burden but still informative regarding the distribution of severe disability associated with DI.

1.2. Use of Global Burden of Disease Study's Disability Weights

The second limitation is that YLLD was calculated using disability weights from the Global Burden of Disease (GBD) Study rather than weights developed for Aotearoa New Zealand. This matters because the perceived severity of health states (and the social and cultural consequences attached to them) can vary across populations and contexts. If locally derived disability weights differed from GBD weights, absolute YLLD estimates for DI and its complications could shift.

At the same time, using GBD disability weights has two advantages. First, they are the international standard and have been used in Aotearoa New Zealand, so the YLLD estimates in this thesis remain comparable with national and international burden-of-disease analyses. Second, because the same weights were applied to all individuals, the study's comparative findings (i.e., between Māori and non-Māori and between Māori with favourable and adverse outcomes) continue to reflect differences in observed duration and complication profiles, even if locally derived weights would change absolute YLLD values.

This limitation highlights the need for future Aotearoa New Zealand-led work to develop disability weights that reflect local understandings of health, illness, and disability. Such work would strengthen the validity of YLLD estimates.

2. Limitations Associated with the Generalisability of the Findings

The empirical patterns reported in this thesis arise from a specific setting: Māori adults who died of DI in Aotearoa New Zealand, analysed within the IDI-linked administrative data environment. For that reason, the findings should not be generalised to other conditions,

jurisdictions, health systems, or time periods. Differences in care pathways, service access, coding practices, clinical thresholds, and determinant distributions may alter both the measured burden and who is classified as having favourable or adverse outcomes.

3. Limitations Associated with the Research Design

The quantitative design used in this study was selected to enable use of the IDI to construct a national cohort of Māori and non-Māori with DI. This design made it possible to calculate individual-level YLL and YLLD, develop the joint-burden matrix, and examine equality questions using methods that are scalable and reproducible. However, it could not provide the depth of understanding that a mixed-methods approach incorporating qualitative research with Māori whānau and communities would offer.

Accordingly, the interpretations in this thesis focus on the patterns observed in the data research rather than on direct accounts of how Māori with contrasting outcomes understand and navigate their health. Future research that pairs the quantitative framework developed here with qualitative studies would address this limitation and strengthen interpretation of the mechanisms underlying the observed patterns.

4. Limitations Associated with Māori Data Gaps

The fourth limitation is that this study could not test whether discrimination in health settings or access to cultural supports differed between Māori with favourable and adverse outcomes. This was because the census does not collect data on access to cultural supports or discrimination. While the New Zealand Health Survey (NZHS) and Te Kupenga do collect data on access to cultural supports, discrimination, and other variables, the sample design of both the New Zealand Health Survey and Te Kupenga do not support comparisons between Māori with contrasting health outcomes. Specifically, neither the Health Survey nor Te Kupenga include a representative subset of Māori with contrasting DI health outcomes. This limitation matters because the determinants that could not be tested (i.e., discrimination in health settings and access to cultural supports) remain plausible contributors to within-Māori outcome variation and warrant direct investigation in future work.

More broadly, the absence of suitable measures of racism, cultural connection, and structural support within the IDI is itself a finding about the current data environment. It shows that key determinants identified in Māori health research and by Māori communities remain largely invisible in national administrative data. As a result, the explanatory power of this study is constrained to what can be observed in the available datasets.

Summary of Limitations and Implications for Interpretation

The limitations highlight both technical issues (such as the reliance on hospital diagnoses for YLLD, the use of GBD Study disability weights, and the boundaries of a quantitative design) and structural issues (including the lack of suitable measures of racism, cultural support, and other key determinants in national data collections).

These constraints mean that the estimates of fatal and non-fatal burden presented in this thesis should be interpreted as conservative. They capture severe, hospital-detected morbidity and quantifiable determinants but not the full spectrum of diabetes-related ill-health or the cultural and structural forces that shape Māori health outcomes.

At the same time, working within these limitations has generated a set of tools and insights, including individual-level YLL and YLLD measures, a joint-burden matrix, and a framework for comparing Māori with favourable and adverse outcomes. These can be refined and extended in future Māori health research.

Part 2. Major Implications of Research Findings

Several findings from this study have direct implications for Māori health equality and health system research and accountability. Four are particularly important and are discussed in this part of the chapter:

1. The methodology developed in this research makes four epidemiological contributions: individual-level measurement of fatal and non-fatal burden; joint-outcome classification; explicit benchmarking to identify favourable and adverse cases; and an inferential framework that distinguishes difference, similarity, and genuine inconclusiveness
2. The methodology provides a tool for Māori Treaty Partners to quantify burden, identify where outcomes are concentrated, and hold Crown Treaty Partners to account for whether services align with Māori health need
3. The methodology extends global burden-of-disease approaches by retaining disability-weighted logic while shifting estimation to the individual-level, an approach that requires IDI-style linked data infrastructure to implement at scale
4. The within-Māori findings challenge common assumptions about what drives outcome variation once a chronic condition is established and point to the likely importance of system-level mechanisms and currently unmeasured determinants.

Each of these implications is discussed in turn below.

1. Epidemiological Contribution of this Thesis

This thesis makes four interrelated epidemiological contributions that together extend how health outcomes for Māori with chronic conditions can be measured, classified, and interpreted using administrative data. Rather than introducing a single methodological innovation, the contributions form a coherent analytical shift from population averages to individuals; from single summary outcomes to joint outcome profiles; from implicit assumptions about "good" outcomes to explicit case identification; and from binary difference testing to disciplined inference about difference, similarity, and uncertainty.

Taken together, these contributions respond to a central limitation in much epidemiological research on Māori health. While existing approaches are highly effective at documenting inequality between Māori and non-Māori, they offer limited capacity to identify heterogeneity within Māori populations, to make favourable outcomes analytically visible, to support accountability grounded in individual trajectories, or to learn from these. The contributions developed in this thesis address these gaps while remaining firmly within the conventions of quantitative epidemiology, using transparent rules, auditable measures, and reproducible logic.

Each contribution builds on the previous one. The shift to individual-level outcome measurement provides the foundation for separating fatal and non-fatal burden, which in turn enables explicit benchmarking and case identification of favourable and adverse outcomes. These design choices then necessitate a more rigorous inferential framework capable of distinguishing meaningful difference, practical similarity, and genuine inconclusiveness. Together, they establish an epidemiological approach that is not only equality-focused, but also oriented toward identification, explanation, and accountability in ways that are aligned with Kaupapa Māori Research priorities.

The four contributions are described in turn below.

Shifting the Unit of Analysis from Population Averages to Individuals

Much of the Māori health outcomes literature is dominated by between-group comparative designs that quantify inequalities in incidence, care pathways, and endpoints such as mortality or survival. These approaches are indispensable because they establish the existence, direction, and magnitude of inequality between Māori and non-Māori. However, they typically rely on single endpoints or summary measures that describe average differences at the group level. While effective for documenting inequality, such approaches are not designed to answer a different but equally important epidemiological question: whether there are Māori with

favourable outcomes for major chronic conditions, and if so, how such individuals can be identified using transparent and reproducible rules. Population-average comparisons obscure within-group variation and offer limited capacity to detect heterogeneity or positive deviance within Māori populations.

The first epidemiological contribution of this thesis is to operationalise a shift from population averages to individuals by specifying and implementing individual-level outcome metrics that retain distinct dimensions of health impact. Two complementary measures are used: fatal burden, measured as YLL, and non-fatal burden, measured as YLLD. These measures are calculated at the individual level using linked administrative data within the IDI, using explicit inclusion criteria, decision rules, and temporal logic.

By shifting from condition-level averages to individual-level burden, this thesis enables a different class of epidemiological inference. It becomes possible to identify individuals with among the most favourable and most adverse outcomes rather than relying solely on mean differences or population-level burden ratios. This reorientation extends epidemiology beyond documenting inequality to learning from variation and strengthening accountability grounded in individual outcomes, rather than population averages alone.

Separating and Recombining Fatal and Non-Fatal Burden through Joint-Outcome Measurement

Epidemiological analyses of chronic disease burden often rely on composite summary measures that collapse multiple dimensions of health loss into a single metric. While useful for ranking conditions or comparing populations, such measures can obscure whether apparent differences reflect premature mortality, non-fatal disability, or trade-offs between the two. This is especially consequential for chronic conditions, where individuals can follow markedly different trajectories.

The second epidemiological contribution of this thesis is the development of a joint-outcome framework that retains fatal and non-fatal impacts as analytically separable but jointly informative dimensions of health loss. For example, individuals may have low YLL but high YLLD (surviving longer with substantial disability) or high YLL but low YLLD (dying early with limited measured disability), with each pattern implying different clinical priorities, service requirements, and equity considerations. By making explicit which dimension is driving burden at the individual-level, the framework supports deeper insights into chronic disease outcomes.

Identifying Favourable and Adverse Outcomes through Benchmarking and Case Definition Methods

Much of the Māori health outcomes literature is organised around between-group comparisons that estimate average differences between Māori and non-Māori. Within this paradigm, favourable Māori outcomes are typically treated as incidental or residual findings, and there is an overarching narrative of inequality. While such analyses are essential for documenting inequities, they do not define, identify, or examine favourable outcomes as a distinct analytic focus.

The third epidemiological contribution of this thesis is the application of performance benchmarking methods to health outcomes research through explicit case definition of favourable and adverse outcomes. Clear and reproducible rules are used to identify individuals located in favourable and adverse segments of the outcome distribution based on YLL and YLLD.

This represents a departure from treating Māori status primarily as an exposure and estimating an average effect. Instead, individuals are classified according to their outcome profiles, and Māori with favourable and adverse outcomes are identified directly within the data. This outcome-first logic supports a positive deviance–style inquiry within routine administrative datasets, enabling analysis to focus on who is doing well, who is doing poorly, and how these groups differ, rather than only on whether groups differ on average.

By embedding benchmarking and explicit case-finding approaches into the epidemiological research, this contribution extends the methodological repertoire of Māori Health Research beyond the dominant between-group comparative paradigm. It supports learning from heterogeneity within Māori populations, makes favourable outcomes analytically visible rather than incidental, and strengthens equity-focused accountability by grounding inference in explicitly defined outcome categories rather than population averages alone.

Strengthening Inference: Distinguishing Difference, Similarity, and Inconclusiveness

Much epidemiological research relies on null-hypothesis significance testing to assess whether groups differ on key determinants. Within this tradition, non-significant p-values are frequently interpreted as evidence that groups are similar or that no meaningful difference exists. This practice is common in determinant analyses comparing population subgroups, including Māori and non-Māori or subgroups within Māori populations.

However, non-significance does not establish similarity. It may instead reflect limited statistical power, measurement error, incomplete data, or imprecision arising from small or uneven samples. Treating non-significant results as evidence of equivalence risks overstating conclusions and obscuring genuine uncertainty. This can be particularly problematic as it may prematurely close off inquiry into whether groups are meaningfully similar or whether important differences remain unresolved.

The fourth epidemiological contribution is the development and application of an inferential framework that explicitly distinguishes between difference, similarity, and inconclusiveness. This is achieved by pairing non-parametric difference testing (Mann–Whitney U and tests for proportions) with equivalence testing anchored to pre-specified smallest effect sizes of interest (SESOIs), and by applying explicit data-coverage eligibility criteria before making any equivalence claim. Where equivalence testing is undertaken, similarity is evaluated using a Two One-Sided Test (TOST) equivalence framework implemented through confidence-interval inclusion: the Hodges–Lehmann estimator of the between-group location shift (or the difference in proportions) is calculated, and equivalence is concluded only if the corresponding 90% confidence interval lies entirely within the pre-specified SESOI bounds. Tipping-point analyses are then applied to evaluate the robustness of equivalence findings under plausible patterns of missing data.

This approach strengthens epidemiological inference by separating three inferential states that can be conflated in practice: (1) evidence of difference; (2) evidence of similarity within a substantively meaningful margin; and (3) genuine inconclusiveness due to imprecision or incomplete data. By not treating non-significance as evidence of sameness, the framework is conservative in its findings while still enabling strong claims where the data support them.

2. The Methodology Provides a Tool for Māori Treaty Partners to Hold Crown Treaty Partners to Account

As part of exercising rangatiratanga, bodies that represent iwi and hapū have an obligation to quantify the burden of ill health experienced by their people, identify the medical conditions that contribute most to that burden, and determine the extent to which government services respond meaningfully to health needs.

Iwi-Māori Partnership Boards (IMPBs) established under the Pae Ora (Healthy Futures) Act 2022 were intended to help give effect to these responsibilities by representing local Māori perspectives on the needs and aspirations of Māori, how the health sector is performing, and how services and public health interventions are designed and delivered within localities. With

support from the Ministry of Health and Health New Zealand, several IMPBs have begun publishing regional profiles that establish baselines for measures such as life expectancy, all-cause mortality, and amenable mortality. These are important indicators for assessing the overall health of a population and the performance of a health system.

However, life expectancy, all-cause mortality, and amenable mortality do not tell Māori Treaty Partners which conditions are driving burden for Māori, and they do not show whether government-funded services are proportionate to that burden. For instance, a region may have high amenable mortality overall, but those measures cannot on their own reveal whether diabetes, heart disease, lung cancer, or injury are the primary contributors of ill-health for Māori in that rohe. Moreover, these measures cannot show whether services are disproportionately oriented towards conditions that mainly affect non-Māori or towards those that affect Māori most.

The governance context is changing in ways that make independent Māori evidence increasingly important. Recent reform proposals, including the Healthy Futures (Pae Ora) Amendment Bill (New Zealand Parliament, 2025), would strengthen the statutory role of the Hauora Māori Advisory Committee (HMAC) in advising the Minister of Health and Health New Zealand on hauora Māori (Māori health), while repositioning iwi-Māori partnership boards (IMPBs) to engage with Māori communities about local needs and provide advice into HMAC rather than operating as a direct conduit to decision-makers. In that context, iwi and rūnanga (as Māori Treaty Partners who exist independently of Crown structures) are likely to need an even stronger, Māori-led evidence base to support engagement with Crown agencies.

By calculating individual-level YLL and YLLD and combining them in a joint-burden matrix, the methodology developed in this thesis provides a way to build an evidence base that moves beyond generic mortality rates to a more granular description of health outcomes. For any given rohe (tribal area), an iwi or hapū could work with Statistics NZ to do the following:

1. Identify Māori and non-Māori with a particular chronic condition (such as DI)
2. Calculate YLL and YLLD for each individual using linked administrative data
3. Classify individuals into outcome areas that distinguish those with favourable outcomes (i.e., low YLL and low YLLD) from those with adverse outcomes (i.e., high YLL and high YLLD).

Once individuals are classified in this way, Māori Treaty Partners can examine the distribution of outcomes for their own people and compare it with non-Māori. If, for example, the proportion of Māori with favourable health outcomes is markedly lower than the proportion of

non-Māori, and the proportion of Māori with adverse outcomes is markedly higher, Māori Treaty partners can point to concrete evidence that Māori are not enjoying equal health outcomes as non-Māori. This provides practical insight into Article 3 guarantees of equal rights for Māori and triggers the principle of active protection, which requires the Crown to take vigorous action to achieve equality.

The methodology also allows Māori Treaty Partners to identify which conditions contribute most to the burden of disability-weighted life years lost among their people. By summing YLLD across all Māori in their rohe and ranking conditions, they could construct a profile of the leading contributors to non-fatal burden for their population. This, in turn, can be compared with the pattern of services and investments funded by Health New Zealand and other agencies in the same region. For example, if diabetes, renal disease, and heart failure account for a large share of YLLD among Māori, but local services and funding are disproportionately focused on different conditions that mainly affect non-Māori, Māori Treaty Partners can use that misalignment as the basis for specific questions and demands. They can ask why the service mix does not focus on conditions that generate the greatest burden of ill health for Māori. They can also ask what changes in funding, workforce, and service design are needed to bring investment into line with Māori health needs.

The methodology is scalable. Māori Treaty Partners could choose to collaborate across rohe. For instance, several rūnanga could work together to build a larger sample and strengthen their collective voice. They could invite whānau to share their National Health Index (NHI) numbers with appropriate governance and safeguards so that specific iwi and hapū populations can be identified within the IDI and tracked over time. Over time, repeated YLL and YLLD analyses could be used to assess whether Crown actions are improving Māori outcomes rather than relying on generic national indicators that may mask persistent local inequalities.

Using these tools will not, on its own, resolve the political and practical challenges involved in shifting health resources. Realigning services to meet Māori health needs would require confronting resource constraints, workforce shortages, and resistance from those whose relatively favourable service access would be questioned.

3. The Methodology Extends the Global Burden-of-Disease Study's Approaches but Requires IDI-style Data Infrastructure

The methodology developed in this thesis sits alongside the Global Burden of Disease (GBD) Study. Both approaches are concerned with quantifying the health loss associated with disease

and both do so by combining information on premature mortality and non-fatal disability. The key differences lie in the level of analysis, the use of metrics, and the data infrastructure required.

In the GBD Study framework, the central construct is the disability-adjusted life year (DALY), which is defined as the sum of YLL due to premature mortality and Years Lived with Disability (YLD) due to non-fatal health states. These quantities are typically estimated at the population-level (e.g., countries, regions, or age–sex groups). YLL is calculated by multiplying the number of deaths from a given cause at each age by a standard life expectancy at that age, while YLD is calculated by multiplying the prevalence or incidence of specific sequelae by their disability weights and average duration. The resulting DALYs are used to rank diseases, inform resource allocation, and monitor trends over time.

There are strong continuities with the GBD Study. This study uses the same building blocks (life tables, cause-of-death data, hospital diagnoses, and disability weights), and the resulting measures are conceptually comparable to YLL and YLD. In that sense, the methodology can be viewed as a reorientation of established tools rather than an attempt to invent an entirely new metric. Where the GBD study emphasises global comparability and disease ranking, this thesis emphasises individual-level trajectories, equality, and the ability of Māori to hold the Crown to account for specific obligations.

An implication of adopting this approach is the requirements for IDI-like data infrastructure. Calculating individual-level YLL and YLLD for an entire national cohort depends on having individual-level, longitudinally linked data on deaths, hospitalisations, and ideally other health events and the ability to connect these data to sociodemographic information. Without such an infrastructure, most jurisdictions would be limited to traditional, aggregated DALY calculations based on cross-sectional or cause-specific data.

4. The Similarities and Differences Among Māori with Contrasting Outcomes Challenge Assumptions About What Drives Health Outcomes

The fourth major implication of this study arises from what it reveals about who experiences favourable and adverse outcomes. The similarities and differences observed between outcome groups challenge some of the standard assumptions about what drives health inequalities for Māori. To make sense of these findings, they are first situated in relation to the existing literature. Then their implications for Māori Treaty Partners, whānau, research, policy, and service funding and delivery are considered.

4.1. What This Study Found

Most research on DI and chronic condition inequities in Aotearoa New Zealand compares Māori and non-Māori at a population level and treats familiar determinants (i.e., deprivation, income, geographic locale, and health literacy) as core drivers of observed inequalities.

A large body of literature shows that Māori are more likely to live in deprived areas, face barriers to care, and be over-represented in rural or peripheral localities (Joshy et al., 2009; Exeter et al., 2017; Came et al., 2020; Ben et al., 2017).

These patterns are commonly used to explain disparities in DI incidence, complications, and mortality (Joshy et al., 2009; Teng et al., 2019). In that framing, deprivation and geography can function as default explanations for why Māori outcomes are worse. This study approaches this issue differently. Rather than focusing only on between-group comparisons, it used individual-level YLL, YLLD, and a joint-burden matrix to identify Māori with among the most favourable outcomes and Māori with among the most adverse outcomes. It then established whether the determinants that dominate the literature meaningfully distinguish between these two Māori groups.

The results were consistent across the main study years. Deprivation measures did not show statistically significant differences between Māori with favourable and adverse outcomes, and equivalence testing suggested that any observed differences were small and often within pre-specified margins of practical importance. Geographic locale also showed limited separation: Māori with favourable and adverse outcomes were distributed across major urban, secondary urban, and rural categories in broadly similar proportions. Health literacy and cultural identity measures likewise did not consistently distinguish between the two groups. In short, within the Māori cohort living with diabetes, these determinants provided limited predictive or explanatory value.

These results do not indicate that deprivation, geography, or related factors are irrelevant. Māori in this cohort were still more likely than non-Māori to experience structural disadvantage and barriers to care. What these findings indicate is that, among Māori who already have DI, these disadvantages do not neatly sort people into favourable- and adverse-outcome groups.

The findings challenge a straightforward reading of the literature in which deprivation and geography are expected to explain outcome variation once a chronic condition is established. They suggest that key drivers of within-Māori variation are not captured or not captured well by standard census-based indicators used in much quantitative research. They also raise the

question of what more specific factors might drive outcomes. Plausible candidates include whānau support; continuity and quality of care; experiences of racism in health services; cultural safety; engagement with Kaupapa Māori services; and other forms of social, cultural, and system-level support or harm that are not visible in administrative data (Came et al., 2020; Ben et al., 2017).

This study therefore recalibrates rather than refutes findings in the existing literature. Its findings suggest that adverse outcomes may be driven by deeper system-level mechanisms and that when analysis shifts to within-Māori benchmarking, the explanatory picture is more complex than conventional models typically allow.

Part 3. Implications Arising from the Empirical Findings

This part considers what the observed similarities and differences between Māori with favourable and adverse DI outcomes imply for Māori Treaty Partners, whānau, and individual Māori; for future research; for public policy; for service planning and funding; for service providers; and for Māori health data and infrastructure. The emphasis here is not on methods, but on what these findings mean for how Māori health inequities are understood, addressed, and acted upon.

The weak or inconsistent associations between determinants and health outcomes:

1. Challenge common assumptions about what drives inequities for Māori once a chronic condition is established
2. Show a need to rethink how public health policies and health services are designed, targeted, and evaluated, particularly where deprivation or place are treated as primary equality levers
3. Highlight significant gaps in Māori health data and research infrastructure, including the absence of New Zealand disability weights and robust measures of racism, cultural support, and system responsiveness
4. Shift attention toward system-level mechanisms, care quality, and accountability as central determinants of Māori health outcomes rather than treating inequities as primarily upstream or unavoidable.

Each of these implications is explored below across five overlapping domains: Māori Treaty Partners and whānau; future research; public policy; service planning and funding; and health service providers.

Implications for Māori Treaty Partners, Whānau, and Individual Māori

If deprivation, geographic locale, and health literacy do not distinguish between Māori with favourable and adverse outcomes in this cohort, the first implication is both conceptual and deeply practical: Māori are not simply destined to poor outcomes because they are deprived, rural, or have lower formal health literacy. Within each of those categories there are Māori who are doing relatively well and Māori who are doing poorly. For Māori Treaty Partners and whānau, this challenges a deficit narrative that links poverty or rurality to probable failure and poses a more demanding question: what characterises those Māori who are achieving favourable outcomes despite living in structurally constrained circumstances?

For iwi and hapū, this suggests that maps of deprivation and rurality are not sufficient for prioritisation. They remain important for understanding structural context, but they cannot identify which Māori with DI in a rohe are carrying the heaviest burden or which whānau are sustaining good outcomes in difficult conditions. Using tools such as individual-level YLL, YLLD, and the joint-burden matrix, Māori Treaty Partners can locate both areas of positive deviance (where whānau outcomes are unexpectedly good) and areas of concentrated burden that are not obvious from deprivation maps alone. This shifts the focus from locating poor places to identifying who is most affected and what can be learned from those who are doing better in similar environments.

For whānau and individual Māori, the findings also carry a more personal implication. They suggest that agency, resilience, and collective strength can shape outcomes even within the constraints of structural inequality. Favourable outcomes are not confined to affluent urban areas, and adverse outcomes are not limited to the most deprived communities. This supports a narrative that encourages whānau to demand better care, insist on culturally safe services, and recognise their own knowledge and practices as part of the solution rather than internalising the idea that ethnicity, a postcode, or income determines their future.

At the same time, Māori Treaty Partners can use these findings to push back on Crown explanations that rely too heavily on deprivation and geography as catch-all reasons for inequalities. If, even within a deprived Māori cohort, deprivation does not distinguish who does well and who does not, it becomes harder for Crown agencies to point to poverty or rurality alone as justification for slow progress. The focus shifts to other obligations, including addressing racism in health services, ensuring genuine Māori governance, and responding to Māori-identified priorities in service design.

Implications for Future Research

For research, the clearest implication is methodological: more within-Māori studies are needed that examine variation among Māori, not just differences between Māori and non-Māori.

Much of the existing epidemiological literature treats Māori as a single disadvantaged group and focuses on quantifying the overall gap — a pattern documented in the literature review in Chapter 1 (see pp.28–30). When analysis shifts to within-Māori benchmarks using individual-level burden measures, as this study does, the usual determinants do not demonstrate the expected result.

Second, the findings underline the limits of current data for answering the questions that matter most to Māori. The IDI does not contain robust, routinely linked measures of racism in healthcare, cultural safety, engagement with Kaupapa Māori services, or many forms of cultural connection and whānaungatanga that Māori have identified as important for health. If deprivation, geography, and census-based proxies are not distinguishing Māori with favourable and adverse outcomes, it is plausible that some of the real drivers sit in these missing data points.

Third, the results highlight the importance of mixed-methods and partnership-based research. Quantitative analysis can identify unexpected patterns, but it cannot explain why some Māori whānau achieve low YLL and YLLD in high-deprivation contexts or how racism, disrespect, or system qualitative failure are experienced by those with high burden. Addressing these questions will require Kaupapa Māori Research that centres Māori voices while being informed by quantitative patterns such as those identified here.

Finally, the findings warrant replication and extension. They are sufficiently counter-intuitive that skepticism is reasonable. Replication across other cohorts and conditions using enhanced measures of cultural and structural determinants will be critical for determining whether these patterns are specific to DI or reflect a broader feature of how inequalities manifest for Māori with chronic conditions.

Implications for Public Policy

If deprivation, geographic locale, and health literacy do not distinguish Māori with favourable and adverse DI outcomes, then policy frameworks that treat these factors as the primary levers for improving outcomes among Māori with DI are likely to be incomplete. This does not imply that policies addressing poverty, housing, or rural infrastructure should be abandoned,

but it does mean that DI policy cannot rely on these alone and claim to have addressed Māori needs.

The findings suggest that equality policies built solely around deprivation gradients risk mis-specifying the problem. If policymakers assume that moving Māori up one or two deprivation deciles will automatically translate into better outcomes once DI is present, they may overlook how care is delivered, how racism operates in clinical encounters, how systems respond when Māori seek help, and how effectively services support whānau to manage complex conditions over time. The evidence from this thesis suggests that two Māori with similar deprivation can experience very different YLL and YLLD.

Geographic targeting as a primary equality strategy is also challenged. If Māori with DI in rural areas experience similar joint outcomes to those in urban areas, despite less formal access to services, then simply replicating urban service models in rural settings may miss what is actually making people healthier. The findings invite policy to consider place-based strengths such as whānau networks, hapū-level support, and community connection as potential protective factors rather than assuming that service volume alone will close the gap.

More broadly, these results support a shift toward Treaty-based, Māori-led policy approaches that start from Māori evidence about what matters, rather than importing generic Western social determinant frameworks. This includes embedding measures such as YLL and YLLD into equality monitoring while interpreting them through a Kaupapa Māori lens grounded in active protection, partnership, and accountability.

Implications for Service Planning and Funding

For service planning and funding, the implications are both practical and uncomfortable. If deprivation and geography do not reliably identify who is doing well and who is not, then allocating services primarily on the basis of area-level deprivation or rurality is unlikely to reach those with the highest burden. Well-resourced services may exist in high-deprivation areas where many Māori with DI are doing relatively well, while pockets of very high burden elsewhere remain under-served.

Using individual-level YLL, YLLD, and joint-burden classifications, planners could identify which Māori with DI are experiencing the worst combined outcomes and examine their care pathways. This would support more targeted approaches to case management, proactive follow-up, and whānau-centred support, regardless of where individuals live. Funding mechanisms could then be aligned with demonstrable improvements in joint-burden outcomes rather than service volume alone.

The findings also suggest that sustained investment in Māori-led and kaupapa Māori services may be crucial, even if these do not fit neatly into deprivation-based business cases. If variation in outcomes is driven by cultural safety, whānaungatanga, continuity, and addressing racism and disrespect, then funding models that privilege short-term programmes over relational care are unlikely to succeed.

Implications for Service Providers

Finally, the findings imply that health services cannot attribute Māori DI inequalities solely to upstream social factors and conclude that little can be done within the sector itself. The results of this study suggest that once Māori have diabetes, what health services do, how they relate to Māori, and how accountable they are for individual-level outcomes can matter as much as socio-economic context.

Service providers who are serious about improving Māori DI outcomes must therefore consider internal factors such as their own decisions, practices, and assumptions as potential determinants of inequality rather than as neutral responses to external gradients beyond their control.

Implications for Māori Health Data and Research Infrastructure

The findings in this thesis highlight structural gaps in Māori health data and research infrastructure. As outlined earlier in this chapter, disability weights have not been developed for Aotearoa New Zealand, surveys such as Te Kupenga cannot support comparisons between Māori with contrasting health outcomes, and the IDI lacks robust measures of racism, cultural safety, and cultural support.

Strengthening Te Kupenga and the New Zealand Health Survey to include representative samples of Māori with contrasting outcomes for major chronic conditions would significantly enhance their utility for Kaupapa Māori Research. Developing Aotearoa New Zealand-specific, disability weights would similarly strengthen the cultural validity of burden-of-disease measures.

More broadly, the findings underscore the need for Māori leadership in deciding what is measured, how it is measured, and for what purposes. Quantitative cultural variables derived from large datasets should be treated as partial, context-bound indicators and not as proxies for Māori health models themselves. Any interpretation of non-significant or equivalent cultural identity findings must be grounded in explicit acknowledgement of these limits and a continued commitment to Māori-defined understandings of health and wellbeing.

A Fifth Wave of Māori Health Research

Taken together with the whakapapa traced in Chapter 1, the implications discussed in this chapter point to the possibility of a fifth wave of Māori health research — one that brings back elements earlier waves left undeveloped and one that introduces new methodological approaches. Five features could shape such a wave, each emerging directly from the contributions of Pōmare (1980), Pōmare and de Boer (1988), Reid and Robson (2007), Harris and colleagues (2006, 2012), Cormack and Robson (2010), and Durie (1985).

1. Restoring equality of outcomes as the goal for Māori health

The founding wave of Māori health research focused on identifying and closing gaps between Māori and non-Māori, with equity understood as the means of reaching that end (Pōmare, 1980; Pōmare & de Boer, 1988). More recent work has inverted that relationship, treating equity as the objective and widening the comparison from Māori and non-Māori toward a general standard of equity across all ethnicities (CSDH, 2008; Waitangi Tribunal, 2019).

This thesis proposes a return to the original objective by treating equality of outcomes between Māori and non-Māori as the goal against which progress is judged, and equity — the differential resourcing and effort required to close the gap — as the means of pursuing it. Restoring equality as the goal, however, requires methods capable of determining whether equality has been achieved, and that in turn demands more than the population averages on which the field has relied. This is because an average captures only one feature of a distribution and cannot show whether two populations share the same underlying distribution (Wasserstein & Lazar, 2016).

Measuring fatal and non-fatal burden at the level of the individual, and comparing the Māori and non-Māori distributions directly, allows equality to be tested against a defined standard: statistical equality between two distributions. As set out in Chapter 5, difference testing can be paired with equivalence testing against a pre-specified margin, allowing the analysis to distinguish genuine difference, genuine similarity, and inconclusiveness. For the first time, the field's founding objective — that Māori should attain the same health outcomes as non-Māori — can be treated as a measurable claim rather than a statement of intent.

2. Distinguishing the collective Treaty relationship from the individual outcome comparison

The field has too often left unresolved a distinction that matters for how Māori health is measured and governed: the distinction between the collective relationship established by Te Tiriti and the individual comparison by which outcomes are judged.

The collective relationship is between the Crown and Māori as Treaty partners, exercised through institutions that represent iwi and hapū. The comparison used to assess equality of outcomes operates at the individual level.

Conflating the collective and individual levels has costs. Accountability framed only at the collective level cannot detect shifts in how burden is distributed across individuals and subgroups, including cases where one group absorbs a rising share despite overall improvement. A statement that Māori health is improving may hold for the population as a whole and still be consistent with a subgroup carrying a rising share of the burden. Conversely, accountability framed only at the individual level can create granular data about Māori health that can be used selectively to produce mis-leading, politically charged narratives. Notwithstanding these risks, the same resolution that makes within-Māori variation visible also makes individuals sortable. It can support profiling, risk scoring, and targeting, and it can invite explanations that locate the cause of poor outcomes in the characteristics of the people who experience them rather than in the system that produced them.

This thesis proposes differentiating (1) the collective Treaty relationship, which defines to whom the research is accountable and for whose benefit it is conducted, and (2) the individual comparison, which defines what is measured. The individual-level joint-burden method developed in this thesis is designed to hold both levels in view. It measures outcomes at the level of the individual, where equality can be defined and tested, while remaining accountable in its purpose and use to Māori as Treaty partners.

3. Revealing within-Māori variation through individual-level analysis

For four decades the field measured Māori health by comparing the average outcome for Māori with the average for non-Māori — an approach established in the early *Hauora* volumes (Pōmare, 1980; Pōmare & de Boer, 1988) and continued in *Hauora III* (Pōmare et al., 1995). This was the only instrument available at the time for demonstrating that a gap existed and endured. However, averages are silent about the distribution of outcomes within a population. Comparing the Māori average with the non-Māori average treats Māori as a single, homogeneous group, and cannot show which Māori experience favourable outcomes, which experience adverse ones, or how far apart the two lie.

The empirical findings of this thesis show why that distinction matters. Among Māori who already had the index condition (diabetes), the determinants conventionally invoked to explain outcome variation — deprivation, geographic locale, and health literacy — did comparatively little to separate Māori with favourable and adverse outcomes. Within each category, there

were Māori doing relatively well and Māori doing poorly. A population-average analysis would have missed this entirely, because it would have reported only the position of the Māori mean relative to the non-Māori mean. By resolving Māori into individuals and describing the full distribution of their outcomes, the individual-level joint-burden approach highlights those achieving favourable outcomes in circumstances where poor outcomes might be expected.

This has a direct consequence for how Māori health inequalities are understood. If deprivation and rurality do not, in this cohort, distinguish who does well from who does poorly, then the assumption that poverty and place predict poor outcomes cannot be sufficient — and the more challenging question becomes what allows some Māori to achieve favourable outcomes where that assumption would predict failure. This is a question the population-average paradigm could not ask, and one with practical force: it allows Māori Treaty Partners to contest Crown explanations that treat deprivation and geography as catch-all reasons for slow progress.

How each finding is interpreted is itself shaped by researcher positioning, discussed in Chapter 3. To read the within-Māori variation as a question about what enables Māori to achieve favourable outcomes, rather than as unexplained variation around a mean, reflects a standpoint that looks for Māori strength as well as Māori disadvantage. A different positioning might have read the same distribution differently.

4. Commanding administrative data

There are concerns about Māori data sovereignty and the governance of Crown-held data (Carroll et al., 2020; Kukutai & Taylor, 2016). These include questions about whether administrative data should be used for Māori health research at all, with some proposing co-governed and adequately funded Māori data infrastructures outside the public sector (Kukutai et al., 2023), and others calling for the abolition of the IDI itself (Greaves et al., 2024). That caution is understandable given the histories the field has documented.

This thesis takes a different stance than those who believe that the use of administrative data, including the IDI, creates risk. It treats the administrative collections within the IDI as a resource that Māori researchers can and should command directly. The IDI is the only source able to measure Māori outcomes at the individual level, across the whole population, and over time — and so the only tool capable of testing whether Māori and non-Māori outcomes are equal, which is the very question the field exists to answer.

Commanding the data directly, however, does not mean overlooking its limits. It means meeting them with method rather than avoidance. The clearest case is the recording of

ethnicity itself. Ethnicity in administrative data is not a fixed attribute of a person. It is a value recorded on a particular occasion by a particular process, whether self-reported at enrolment, given by a family member at registration, or assigned by staff. Each collection holds whatever was recorded at that moment, and different collections often hold different values for the same individual. A single-source construction takes the value held in one collection and treats it as the person's ethnicity, so whatever error that collection carries passes into the analyses unchecked. This is the error Cormack and Robson (2010) identified in the classification and output of multiple ethnicities, and the error Harris et al. (2022) measured when they compared ethnicity recorded on the National Health Index against self-identified ethnicity in the 2018 Census.

This thesis reduces that dependence by classifying ethnicity from the standardised ethnicity tables held in the IDI, which derive ethnicity across multiple linked collections rather than from a value recorded on one occasion. A record missed or in-correctly recorded in one collection can be recovered from another, so the analysis does not rest on the accuracy of any single field. Misclassification is not eliminated. A person never recorded as Māori in any contributing collection remains uncounted, and the direction of that residual error is known, in that it understates rather than overstates Māori burden.

Command also means being precise about what the data cannot yet do. The IDI holds no robust, routinely linked measures of racism in healthcare, cultural safety, or the whānau and cultural connections that Māori identify as important for health. Closing these gaps is now an urgent priority for Māori health data infrastructure.

5. Publishing to the highest international standard, so that findings can hold the Crown to account

The earlier waves asserted the right of Māori, as tangata whenua, to monitor the Crown and to evaluate Crown action and inaction (Reid & Robson, 2007). However, monitoring is only as strong as the evidence through which it is exercised. Findings that can be dismissed on methodological grounds do not hold the Crown to account, and much Māori health research has been produced in domestic and grey-literature forms that are more readily set aside by officials and ministers than work certified by independent international review.

This thesis proposes that robustness and international publication be treated not as academic conventions but as a means of holding Crown Treaty partners to account. Evidence reviewed by experts with no stake in the New Zealand policy debate, and robust enough to withstand methodological challenge, is far harder for officials to set aside.

Measuring health loss at the individual level, defining favourable and adverse outcomes through explicit and reproducible rules, and testing equality against a pre-specified standard produce claims that are difficult to contest technically. Where Māori Treaty Partners can point to individual-level, internationally peer-reviewed evidence that Māori are not attaining equal health outcomes, the Article 3 guarantee of equal rights and the principle of active protection gain a factual basis the Crown cannot easily deny.

Drawing the waves together

This thesis promotes both a restoration and an advance. It seeks to recover the objective the field began with – equality of outcomes between Māori and non-Māori – and the bilateral comparison on which that objective rests, both of which the most recent wave set aside. At the same time, it seeks to extend the field into methods it has not previously used: measurement at the level of the individual, a testable standard of statistical equality, the joint treatment of fatal and non-fatal burden, and the identification of favourable as well as adverse Māori health outcomes. It seeks to achieve these changes through the confident command of administrative data, an exact account of that data's limits, a clear distinction between the collective Treaty relationship and the individual outcome comparison, and a commitment to evidence robust enough to hold the Crown to account.

The first four waves brought the field to the point of asking whether Māori attain equal health outcomes. A fifth wave provides a way to answer that question and to keep answering it until the answer is yes.

Part 4. Conclusion

In this final part, I step back from the technical detail to reflect more broadly on whose realities are captured in our data and whose are still missing using a literary reference that resonated strongly with me.

In the final months of completing this thesis, I read the novel *The Dictionary of Lost Words* (Williams, 2021). Spanning over 40 years and starting in the Victorian era, this novel is a work of historical fiction about the people working on the development of the first Oxford English Dictionary (OED). It follows Esme, the daughter of one of the OED's lexicographers who becomes part of the dictionary team as an adult. As Esme watches a male-dominated process of selecting and recording words, she gradually realises that the words and experiences of women, working-class people, and other marginalised groups are routinely excluded from the dictionary. Some words are never written down and others are discarded as slang, improper, or not important enough to be preserved. Over time, Esme comes to see that the OED is not a

neutral record of the English language but a statement of whose voices count, whose knowledge is considered legitimate, and whose words are taken seriously enough to be captured.

Against this backdrop, the methodological work in this thesis can be read as a case for changing what data is captured. By developing individual-level YLL and YLLD measures, a joint-burden matrix, and a framework for comparing Māori with favourable and adverse outcomes, I sought to create tools that are both scientifically robust and usable by iwi and hapū to assert evidence-based claims. But these tools can only ever be as strong as the data they rest on. To make them truly fit for Kaupapa Māori purposes, changes in data infrastructure are needed.

The first change involves expanding the scope and scale of Te Kupenga so that it includes a representative sample of Māori with contrasting health outcomes for major chronic conditions, including but not limited to diabetes, lung cancer, and heart disease. If Te Kupenga survey respondents could be reliably linked to IDI health records, researchers and Māori Treaty Partners could begin to answer the questions that today they can only pose: are cultural supports, discrimination in healthcare settings, or engagement with Kaupapa Māori services associated with differences in health outcomes?

The second change involves the timely release of health data into the IDI (i.e., no more than a year after it collected). Today, it takes three years for data to be released. More timely release would remove an important structural barrier to accountability. Māori providers, iwi, and hapū would be able to see within a reasonable timeframe whether policy changes and service investments are shifting individual-level YLL and YLLD for their people, rather than being asked to accept assurances that cannot be independently verified.

Like the OED in Victorian England, our data sets are not neutral records. What we choose to capture, what we treat as legitimate data, and what we choose to make accessible and when are decisions with ethical and political consequences. For Māori, those decisions affect whether inequalities can be named precisely, whether obligations under the Treaty can be monitored in meaningful ways, and whether iwi and hapū can ground their advocacy in evidence that reflects their own understanding of health and harm.

My hope is that the tools and findings presented here will help expand what is counted in Māori health; make visible some of what has been missing; and support Māori Treaty Partners, whānau, and communities to make their experiences and priorities central in how health is measured, understood, and strengthened.

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Appendix 1: Life Tables for Calculating YLL

Total male population period table, 2017-2019

Total male population period life table, 2017–2019

Exact age (years)[1]	Out of 100,000 males born									Probability that a male who reaches this age						Central death rate for the age interval			Expected number of years of life remaining at age x		
	Number alive at exact age			Average number alive in the age interval			Number dying in the age interval			Lives another year			Dies within a year								
x	l_x			L_x			d_x			p_x			q_x			m_x			e_x		
	Estimated credible interval (percentile[2])																				
	2.5%	50% (Median)	97.5%	2.5%	50% (median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%
0	100,000	100,000	100,000	99,502	99,542	99,581	444	486	530	0.99470	0.99514	0.99556	0.00444	0.00486	0.00530	0.00446	0.00488	0.00533	79.9	80.0	80.1
1	99,470	99,514	99,556	99,452	99,497	99,539	28	35	44	0.99956	0.99965	0.99972	0.00028	0.00035	0.00044	0.00028	0.00035	0.00044	79.3	79.3	79.4
2	99,433	99,479	99,523	99,420	99,467	99,512	21	24	29	0.99971	0.99975	0.99979	0.00021	0.00025	0.00029	0.00021	0.00025	0.00029	78.3	78.4	78.5
3	99,406	99,455	99,500	99,397	99,445	99,491	15	19	22	0.99978	0.99981	0.99984	0.00016	0.00019	0.00022	0.00016	0.00019	0.00022	77.3	77.4	77.5
4	99,387	99,436	99,483	99,379	99,429	99,476	12	14	17	0.99983	0.99986	0.99988	0.00012	0.00014	0.00017	0.00012	0.00014	0.00017	76.3	76.4	76.5
5	99,371	99,422	99,469	99,365	99,416	99,463	10	12	14	0.99986	0.99988	0.99990	0.00010	0.00012	0.00014	0.00010	0.00012	0.00014	75.3	75.4	75.5
6	99,359	99,410	99,458	99,354	99,405	99,453	9	11	13	0.99987	0.99989	0.99991	0.00009	0.00011	0.00013	0.00009	0.00011	0.00013	74.3	74.4	74.5
7	99,348	99,399	99,448	99,343	99,394	99,443	8	10	12	0.99988	0.99990	0.99992	0.00008	0.00010	0.00012	0.00008	0.00010	0.00012	73.3	73.4	73.5
8	99,337	99,389	99,438	99,332	99,384	99,433	8	10	12	0.99988	0.99990	0.99992	0.00008	0.00010	0.00012	0.00008	0.00010	0.00012	72.3	72.4	72.5
9	99,327	99,379	99,428	99,322	99,374	99,423	9	10	13	0.99987	0.99989	0.99991	0.00009	0.00011	0.00013	0.00009	0.00011	0.00013	71.4	71.5	71.5
10	99,316	99,369	99,418	99,310	99,363	99,412	10	12	14	0.99986	0.99988	0.99990	0.00010	0.00012	0.00014	0.00010	0.00012	0.00014	70.4	70.5	70.6
11	99,304	99,357	99,406	99,297	99,350	99,400	11	14	16	0.99984	0.99986	0.99988	0.00012	0.00014	0.00016	0.00012	0.00014	0.00016	69.4	69.5	69.6
12	99,290	99,343	99,393	99,281	99,335	99,385	14	17	20	0.99980	0.99983	0.99986	0.00014	0.00017	0.00020	0.00014	0.00017	0.00020	68.4	68.5	68.6
13	99,272	99,326	99,377	99,261	99,316	99,366	18	21	25	0.99975	0.99979	0.99982	0.00018	0.00021	0.00025	0.00018	0.00021	0.00025	67.4	67.5	67.6
14	99,250	99,305	99,356	99,237	99,292	99,343	23	26	31	0.99969	0.99973	0.99977	0.00023	0.00027	0.00031	0.00023	0.00027	0.00031	66.4	66.5	66.6
15	99,223	99,279	99,330	99,205	99,262	99,314	29	34	39	0.99961	0.99966	0.99970	0.00030	0.00034	0.00039	0.00030	0.00034	0.00039	65.4	65.5	65.6
16	99,188	99,245	99,298	99,166	99,224	99,277	37	42	48	0.99952	0.99958	0.99963	0.00037	0.00042	0.00048	0.00037	0.00042	0.00048	64.4	64.5	64.6
17	99,144	99,203	99,257	99,118	99,177	99,232	45	51	57	0.99942	0.99949	0.99955	0.00045	0.00051	0.00058	0.00045	0.00051	0.00058	63.5	63.6	63.7
18	99,092	99,152	99,207	99,062	99,122	99,178	52	59	66	0.99933	0.99941	0.99947	0.00053	0.00059	0.00067	0.00053	0.00059	0.00067	62.5	62.6	62.7
19	99,032	99,093	99,150	98,999	99,060	99,118	58	65	74	0.99926	0.99934	0.99941	0.00059	0.00066	0.00074	0.00059	0.00066	0.00074	61.5	61.6	61.7
20	98,965	99,028	99,086	98,928	98,992	99,052	63	71	79	0.99920	0.99929	0.99936	0.00064	0.00071	0.00080	0.00064	0.00071	0.00080	60.6	60.7	60.8
21	98,892	98,957	99,018	98,853	98,919	98,981	68	76	84	0.99915	0.99924	0.99931	0.00069	0.00076	0.00085	0.00069	0.00076	0.00085	59.6	59.7	59.8
22	98,814	98,881	98,944	98,774	98,842	98,905	71	78	87	0.99912	0.99921	0.99929	0.00071	0.00079	0.00088	0.00071	0.00079	0.00088	58.7	58.8	58.9
23	98,733	98,803	98,868	98,692	98,763	98,829	71	80	87	0.99911	0.99920	0.99928	0.00072	0.00080	0.00089	0.00072	0.00080	0.00089	57.7	57.8	57.9
24	98,651	98,723	98,791	98,610	98,684	98,752	71	79	88	0.99911	0.99919	0.99928	0.00072	0.00081	0.00089	0.00072	0.00081	0.00089	56.8	56.9	56.9
25	98,569	98,644	98,714	98,529	98,605	98,676	71	78	87	0.99912	0.99921	0.99928	0.00072	0.00079	0.00088	0.00072	0.00079	0.00088	55.8	55.9	56.0
26	98,490	98,566	98,637	98,451	98,528	98,600	68	76	84	0.99915	0.99923	0.99931	0.00069	0.00077	0.00085	0.00069	0.00077	0.00085	54.9	54.9	55.0
27	98,412	98,490	98,563	98,374	98,453	98,526	68	75	83	0.99916	0.99924	0.99931	0.00069	0.00076	0.00084	0.00069	0.00076	0.00084	53.9	54.0	54.1
28	98,336	98,415	98,490	98,298	98,378	98,453	68	75	82	0.99916	0.99924	0.99931	0.00069	0.00076	0.00084	0.00069	0.00076	0.00084	52.9	53.0	53.1
29	98,260	98,340	98,416	98,222	98,302	98,378	69	76	84	0.99914	0.99922	0.99929	0.00071	0.00078	0.00086	0.00071	0.00078	0.00086	52.0	52.1	52.2
30	98,184	98,264	98,341	98,143	98,224	98,301	72	80	88	0.99910	0.99919	0.99927	0.00073	0.00081	0.00090	0.00073	0.00081	0.00090	51.0	51.1	51.2
31	98,102	98,184	98,262	98,059	98,142	98,220	76	84	92	0.99906	0.99915	0.99923	0.00077	0.00085	0.00094	0.00077	0.00085	0.00094	50.1	50.2	50.2
32	98,017	98,100	98,179	97,972	98,056	98,135	79	87	97	0.99901	0.99911	0.99919	0.00081	0.00089	0.00099	0.00081	0.00089	0.00099	49.1	49.2	49.3
33	97,928	98,013	98,091	97,881	97,967	98,047	83	92	101	0.99897	0.99907	0.99916	0.00084	0.00093	0.00103	0.00084	0.00093	0.00103	48.2	48.2	48.3
34	97,833	97,921	98,003	97,784	97,874	97,956	86	94	104	0.99893	0.99903	0.99912	0.00088	0.00097	0.00107	0.00088	0.00097	0.00107	47.2	47.3	47.4
35	97,736	97,827	97,910	97,686	97,779	97,863	88	97	106	0.99891	0.99901	0.99910	0.00090	0.00099	0.00109	0.00090	0.00099	0.00109	46.2	46.3	46.4
36	97,638	97,730	97,815	97,587	97,680	97,766	90	100	109	0.99888	0.99898	0.99908	0.00092	0.00102	0.00112	0.00092	0.00102	0.00112	45.3	45.4	45.5
37	97,536	97,630	97,716	97,483	97,577	97,664	96	106	117	0.99881	0.99892	0.99902	0.00098	0.00108	0.00119	0.00099	0.00108	0.00119	44.3	44.4	44.5
38	97,428	97,524	97,612	97,370	97,468	97,556	103	113	124	0.99873	0.99884	0.99895	0.00105	0.00116	0.00127	0.00105	0.00116	0.00127	43.4	43.5	43.6
39	97,312	97,411	97,501	97,252	97,352	97,443	108	118	129	0.99867	0.99879	0.99890	0.00110	0.00121	0.00133	0.00111	0.00121	0.00133	42.4	42.5	42.6
40	97,191	97,293	97,386	97,127	97,230	97,325	116	127	138	0.99858	0.99870	0.99881	0.00119	0.00130	0.00142	0.00119	0.00130	0.00142	41.5	41.6	41.7
41	97,062	97,166	97,263	96,994	97,100	97,199	121	132	144	0.99852	0.99864	0.99875	0.00125	0.00136	0.00148	0.00125	0.00136	0.00148	40.5	40.6	40.7
42	96,926	97,034	97,134	96,852	96,964	97,063	131	141	155	0.99840	0.99853	0.99865	0.00135	0.00147	0.00160	0.00135	0.00147	0.00160	39.6	39.7	39.8
43	96,778	96,893	96,993	96,696	96,816	96,917	142	154	168	0.99826	0.99841	0.99853	0.00147	0.00159	0.00174	0.00147	0.00159	0.00174	38.7	38.7	38.8
44	96,615	96,739	96,842	96,532	96,656	96,760	152	166	179	0.99815	0.99829	0.99843	0.00157	0.00171	0.00185	0.00157	0.00171	0.00185	37.7	37.8	37.9
45	96,449	96,573	96,679	96,357	96,483	96,590	167	180	196	0.99798	0.99813	0.99827	0.00173	0.00187	0.00202	0.00173	0.00187	0.00203	36.8	36.9	36.9
46	96,265	96,393	96,501	96,169	96,296	96,407	177	192	206	0.99786	0.99801	0.99817	0.00183	0.00199	0.00214	0.00184	0.00199	0.00214	35.8	35.9	36.0
47	96,070	96,201	96,313	95,964	96,096	96,208	193	209	224	0.99767	0.99784	0.99800	0.00200	0.00216	0.00233	0.00201	0.00217	0.00233	34.9	35.0	35.1
48	95,860	95,992	96,105	95,741	95,876	95,990	214	231	249	0.99740	0.99759	0.99777	0.00223	0.00241	0.00260	0.00224	0.00241	0.00260	34.0	34.1	34.2
49	95,623	95,761	95,876	95,496	95,636	95,753	233	250	269	0.99719	0.99739	0.99757	0.00243	0.00261	0.00281	0.00243	0.00261	0.00281	33.1	33.2	33.2
50	95,370	95,511	95,629	95,232	95,373	95,494	257	277	296	0.99690	0.99711	0.99731	0.00269	0.00289	0.00310	0.00270	0.00289	0.00310	32.2	32.2	32.3
51	95,091	95,234	95,358	94,939	95,082	95,208	284	305	326	0.99657	0.99680	0.99702	0.00298	0.00320	0.00343	0.00299	0.00321	0.00343	31.3	31.3	31.4
52	94,785	94,929	95,058	94,614	94,760	94,889	317	338	362	0.99619	0.99643	0.99666	0.00334	0.00357	0.00381	0.00335	0.00358	0.00382	30.4	30.4	30.5
53	94,442	94,591	94,723	94,255	94,408	94,541	345	367	390	0.99587	0.99612	0.99636	0.00364	0.00388	0.00413	0.00365	0.00389	0.00414	29.5	29.5	29.6
54	94,070	94,224	94,360	93,868	94,025	94,163	374	398	423	0.99551	0.99578	0.99603	0.00397	0.00422	0.00449	0.00398	0.00423	0.00450	28.6	28.7	28.7
55	93,667	93,826	93,968	93,455	93,616	93,762	394	419	445	0.99525	0.99554	0.99580	0.00420	0.00446	0.00475	0.00421	0.00447	0.00476	27.7	27.8	27.8
56	93,243	93,407	93,554	93,016	93,181	93,333	424	451	477	0.99489	0.99518	0.99547	0.00453	0.00482	0.00511	0.00455	0.00483	0.00512	26.8	26.9	27.0
57	92,790	92,956	93,113	92,539	92,709	92,867	466	494	523	0.99437	0.99468	0.99499	0.00501	0.00532	0.00563	0.00502	0.00533	0.00564	25.9	26.0	26.1
58	92,292	92,462	92,623	92,022	92,192	92,354	509	540	570	0.99384	0.99416	0.99449	0.00551	0.00584	0.00616	0.00552	0.00586	0.00618	25.1	25.2	25.2
59	91,750	91,922	92,087	91,443	91,618	91,787	575	608	643	0.99301	0.99340	0.99375	0.00625	0.00660	0.00699	0.00627	0.00662	0.00702	24.2	24.3	24.4
60	91,137	91,314	91,485	90,817	90,994	91,166	606	640	676	0.99259	0.99300	0.99337	0.00663	0.00700	0.00741	0.00665	0.00703	0.00744	23.4	23.5	23.5
61	90,496	90,674	90,848	90,160	90,341	90,518	630	665	702	0.99226	0.99267	0.99306	0.00694	0.00733	0.00774	0.00697	0.00735	0.00777	22.5	22.6	22.7
62	89,825	90,009	90,190	89,459	89,648	89,831	686	724	764	0.99151	0.99195	0.99238	0.00762	0.00805	0.00849	0.00765	0.00808	0.00852	21.7	21.8	21.9
63	89,092	89,285	89,473	88,697	88,888	89,079	750	792	832	0.99068	0.99115	0.99160	0.00840	0.00885	0.00932	0.00844	0.00889	0.00937	20.9	21.0	21.0
64	88,298	88,493	88,688	87,872	88,067	88,265	809	851	897	0.98986	0.99037	0.99086	0.00914	0.00963	0.01014	0.00918	0.00968	0.01019	20.1	20.1	20.2
65	87,439	87,642	87,844	86,983	87,188	87,392	863	909	954	0.98911	0.98964	0.99016	0.00984	0.01036	0.01089	0.00989	0.01041	0.01095	19.3	19.3	19.4
66	86,525	86,733	86,945	86,025	86,238	86,452	946	991	1,043	0.98797	0.98855	0.98910	0.01090	0.01145	0.01203	0.01096	0.01151	0.01210	18.5	18.5	18.6
67	85,526	85,742	85,958	84,995	85,216	85,433	1,002	1,053	1,102	0.98714	0.98775	0.98831	0.01169	0.01225	0.01286	0.01176	0.01233	0.01294	17.7	17.7	17.8
68	84,462	84,689	84,911	83,907	84,138	84,363	1,052	1,103	1,158	0.98632	0.98696	0.98758	0.01242	0.01304	0.01368	0.01250	0.01313	0.01377	16.9	17.0	17.0
69	83,350	83,586	83,818	82,741	82,980	83,212	1,157	1,214	1,268	0.98483	0.98549	0.98616	0.01384	0.01451	0.01517	0.01393	0.01461	0.01528	16.1	16.2	16.2
70	82,126	82,372	82,613	81,480	81,721	81,966	1,243	1,302	1,362	0.98347	0.98421	0.98491	0.01509	0.01579	0.01653	0.01521	0.01592	0.01667	15.3	15.4	15.5
71	80,825	81,070	81,325	80,129	80,376	80,633	1,325	1,388	1,447	0.98215	0.98290	0.98366	0.01634	0.01710	0.01785	0.01647	0.01724	0.01801	14.6	14.6	14.7
72	79,434	79,682	79,946	78,600	78,856	79,119	1,582	1,653	1,731	0.97827	0.97926	0.98014	0.01986	0.02074	0.02173	0.02006	0.02096	0.02197	13.8	13.9	14.0
73	77,762	78,029	78,296	76,858	77,136	77,410	1,710	1,787	1,863	0.97613	0.97710	0.97810	0.02190	0.02290	0.02387	0.02214	0.02316	0.02416	13.1	13.2	13.2
74	75,957	76,242	76,525	74,999	75,290	75,573	1,828	1,909	1,992	0.97386	0.97495	0.97604	0.02396	0.02505	0.02614	0.02426	0.02537	0.02648	12.4	12.5	12.5
75	74,041	74,333	74,627	72,963	73,258	73,556	2,061	2,149	2,245	0.96982	0.97111	0.97228	0.02772	0.02889	0.03018	0.02811	0.02931	0.03065	11.7	11.8	11.8
76	71,878	72,184	72,491	70,781	71,087	71,398	2,102	2,193	2,284	0.96834	0.96962	0.97089	0.02911	0.03038	0.03166	0.02954	0.03085	0.03217	11.0	11.1	11.2
77	69,673	69,991	70,304	68,488	68,805	69,120	2,281	2,373	2,467	0.96473	0.96610	0.96743	0.03257	0.03390	0.03527	0.03311	0.03449	0.03590	10.4	10.4	10.5
78	67,290	67,618	67,944	65,944	66,277	66,605	2,576	2,679	2,792	0.95871	0.96035	0.96193	0.03807	0.03965	0.04129	0.03881	0.04046	0.04216	9.7	9.8	9.9
79	64,589	64,939	65,276	63,128	63,478	63,818	2,806	2,921	3,038	0.95322	0.95504	0.95678	0.04322	0.04496	0.04678	0.04417	0.04600	0.04790	9.1	9.2	9.2
80	61,657	62,018	62,369	60,095	60,461	60,816	2,992	3,115	3,234	0.94786	0.94980	0.95178	0.04822	0.05020	0.05214	0.04941	0.05149	0.05354	8.5	8.6	8.6
81	58,524	58,903	59,277	56,828	57,202	57,576	3,277	3,404	3,536	0.93995	0.94220	0.94441	0.05559	0.05780	0.06005	0.05718	0.05952	0.06191	7.9	8.0	8.1
82	55,118	55,499	55,884	53,318	53,694	54,084	3,474	3,607	3,745	0.93252	0.93501	0.93741	0.06259	0.06499	0.06748	0.06461	0.06717	0.06984	7.4	7.5	7.5
83	51,505	51,892	52,285	49,634	50,026	50,424	3,589	3,730	3,873	0.92532	0.92813	0.93083	0.06917	0.07187	0.07468	0.07165	0.07455	0.07758	6.9	7.0	7.0
84	47,747	48,162	48,569	45,778	46,194	46,600	3,785	3,935	4,082	0.91531	0.91836	0.92139	0.07861	0.08164	0.08469	0.08183	0.08512	0.08843	6.4	6.5	6.5
85	43,803	44,227	44,641	41,732	42,153	42,559	3,993	4,146	4,310	0.90258	0.90630	0.90964	0.09036	0.09370	0.09742	0.09463	0.09830	0.10240	5.9	6.0	6.0
86	39,656	40,081	40,502	37,551	37,962	38,372	4,088	4,236	4,391	0.89054	0.89436	0.89797	0.10203	0.10564	0.10946	0.10751	0.11154	0.11579	5.5	5.6	5.6
87	35,424	35,845	36,254	33,310	33,715	34,118	4,102	4,259	4,415	0.87693	0.88124	0.88542	0.11458	0.11876	0.12307	0.12155	0.12626	0.13114	5.1	5.2	5.2
88	31,182	31,586	31,991	29,089	29,483	29,874	4,047	4,204	4,354	0.86222	0.86692	0.87179	0.12821	0.13308	0.13778	0.13700	0.14256	0.14797	4.7	4.8	4.8
89	26,986	27,382	27,779	24,965	25,353	25,741	3,908	4,058	4,218	0.84614	0.85168	0.85721	0.14279	0.14832	0.15386	0.15377	0.16021	0.16669	4.4	4.4	4.5
90	22,927	23,324	23,706	21,031	21,406	21,772	3,690	3,835	3,987	0.82929	0.83555	0.84166	0.15834	0.16445	0.17071	0.17195	0.17918	0.18664	4.0	4.1	4.2
91	19,117	19,489	19,859	17,366	17,722	18,074	3,388	3,537	3,680	0.81172	0.81866	0.82565	0.17435	0.18134	0.18828	0.19100	0.19942	0.20784	3.8	3.8	3.9
92	15,601	15,952	16,306	14,037	14,370	14,703	3,037	3,168	3,305	0.79351	0.80130	0.80895	0.19105	0.19870	0.20649	0.21123	0.22062	0.23027	3.5	3.6	3.7
93	12,462	12,784	13,112	11,097	11,399	11,701	2,638	2,766	2,892	0.77445	0.78363	0.79277	0.20723	0.21637	0.22555	0.23119	0.24262	0.25422	3.2	3.3	3.4
94	9,727	10,018	10,310	8,577	8,844	9,116	2,235	2,351	2,466	0.75458	0.76553	0.77594	0.22406	0.23447	0.24542	0.25233	0.26561	0.27975	3.0	3.1	3.2
95	7,412	7,667	7,937	6,459	6,698	6,949	1,838	1,937	2,044	0.73512	0.74726	0.75935	0.24065	0.25274	0.26488	0.27357	0.28929	0.30532	2.8	2.9	3.0
96	5,498	5,730	5,972	4,739	4,953	5,177	1,468	1,555	1,645	0.71405	0.72884	0.74296	0.25704	0.27116	0.28595	0.29494	0.31369	0.33365	2.6	2.7	2.9
97	3,973	4,175	4,393	3,383	3,568	3,769	1,138	1,214	1,290	0.69216	0.70943	0.72614	0.27386	0.29057	0.30784	0.31731	0.33996	0.36384	2.4	2.5	2.7
98	2,782	2,961	3,153	2,339	2,501	2,679	854	921	990	0.66828	0.68925	0.71004	0.28996	0.31075	0.33172	0.33913	0.36792	0.39768	2.2	2.4	2.6
99	1,888	2,040	2,208	1,563	1,702	1,853	621	677	736	0.64189	0.66839	0.69365	0.30635	0.33161	0.35811	0.36176	0.39752	0.43622	2.1	2.2	2.4
100	1,231	1,363	1,505	1,003	1,123	1,252	437	481	531	0.61578	0.64740	0.67696	0.32304	0.35260	0.38422	0.38526	0.42807	0.47558	1.9	2.1	2.3
101	774	882	1,003	620	717	824	296	330	369	0.58646	0.62548	0.66049	0.33951	0.37452	0.41354	0.40892	0.46081	0.52134	1.8	2.0	2.2
102	463	552	649	363	442	528	191	219	251	0.55794	0.60215	0.64297	0.35703	0.39785	0.44206	0.43461	0.49664	0.56750	1.6	1.9	2.1
103	263	333	410	202	263	331	117	141	165	0.52672	0.57813	0.62833	0.37167	0.42187	0.47328	0.45650	0.53464	0.62000	1.5	1.8	2.1
104	141	192	252	106	149	201	67	86	105	0.48728	0.55250	0.61764	0.38236	0.44750	0.51272	0.47274	0.57649	0.68948	1.4	1.7	2.1
105	71	106	151	96	170	300	71	106	151	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	0.47927	0.62155	0.79100	1.3	1.6	2.1

1. For figues in columns Lx, dx, px, qx, and mx the age interval relates to a 1-year period, except for age 105 which relates to remaining lifespan.
2. The 2.5th to 97.5th percentiles represent a 95% credible interval. We can say there is a 95% chance that the true value lies between these two values.

Total female population period table, 2017-2019

Total female population period life table, 2017–2019

Exact age (years)[1]	Out of 100,000 females born									Probability that a female who reaches this age						Central death rate for the age interval			Expected number of years of life remaining at age x		
	Number alive at exact age			Average number alive in the age interval			Number dying in the age interval			Lives another year			Dies within a year								
	l_x			L_x			d_x			p_x			q_x			m_x			e_x		
x	Estimated credible interval (percentile[2])																				
	2.5%	50% (Median)	97.5%	2.5%	50% (median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%	2.5%	50% (Median)	97.5%
0	100,000	100,000	100,000	99,573	99,610	99,647	377	417	457	0.99543	0.99583	0.99623	0.00377	0.00417	0.00457	0.00378	0.00418	0.00459	83.4	83.5	83.6
1	99,543	99,583	99,623	99,528	99,568	99,610	23	29	37	0.99963	0.99970	0.99977	0.00023	0.00030	0.00037	0.00023	0.00030	0.00037	82.7	82.8	82.9
2	99,512	99,554	99,596	99,501	99,543	99,586	17	21	24	0.99976	0.99979	0.99983	0.00017	0.00021	0.00024	0.00017	0.00021	0.00024	81.8	81.9	82.0
3	99,490	99,533	99,577	99,482	99,525	99,570	13	15	17	0.99982	0.99985	0.99987	0.00013	0.00015	0.00018	0.00013	0.00015	0.00018	80.8	80.9	81.0
4	99,474	99,518	99,563	99,468	99,512	99,557	10	12	14	0.99986	0.99988	0.99990	0.00010	0.00012	0.00014	0.00010	0.00012	0.00014	79.8	79.9	80.0
5	99,462	99,506	99,551	99,457	99,501	99,547	8	9	12	0.99988	0.99991	0.99992	0.00008	0.00009	0.00012	0.00008	0.00009	0.00012	78.8	78.9	79.0
6	99,452	99,497	99,542	99,448	99,492	99,538	7	9	10	0.99990	0.99992	0.99993	0.00007	0.00008	0.00010	0.00007	0.00008	0.00010	77.8	77.9	78.0
7	99,443	99,488	99,534	99,439	99,484	99,530	6	7	9	0.99991	0.99992	0.99994	0.00006	0.00008	0.00009	0.00006	0.00008	0.00009	76.8	76.9	77.0
8	99,435	99,481	99,527	99,431	99,477	99,523	6	8	9	0.99991	0.99992	0.99994	0.00006	0.00008	0.00009	0.00006	0.00008	0.00009	75.8	75.9	76.0
9	99,427	99,473	99,520	99,423	99,469	99,516	6	8	9	0.99991	0.99992	0.99994	0.00006	0.00008	0.00009	0.00006	0.00008	0.00009	74.8	74.9	75.0
10	99,419	99,465	99,512	99,414	99,461	99,508	7	8	10	0.99990	0.99992	0.99993	0.00007	0.00008	0.00010	0.00007	0.00008	0.00010	73.8	73.9	74.0
11	99,410	99,457	99,504	99,405	99,452	99,499	8	10	12	0.99988	0.99990	0.99992	0.00008	0.00010	0.00012	0.00008	0.00010	0.00012	72.8	72.9	73.0
12	99,399	99,447	99,494	99,394	99,441	99,489	9	11	14	0.99986	0.99988	0.99990	0.00010	0.00012	0.00014	0.00010	0.00012	0.00014	71.9	71.9	72.0
13	99,387	99,436	99,483	99,380	99,429	99,476	12	14	17	0.99983	0.99986	0.99988	0.00012	0.00014	0.00017	0.00012	0.00014	0.00017	70.9	71.0	71.0
14	99,372	99,422	99,469	99,363	99,413	99,461	15	18	20	0.99980	0.99983	0.99985	0.00015	0.00017	0.00020	0.00015	0.00017	0.00020	69.9	70.0	70.1
15	99,354	99,404	99,453	99,343	99,393	99,443	18	21	25	0.99975	0.99979	0.99982	0.00018	0.00021	0.00025	0.00018	0.00021	0.00025	68.9	69.0	69.1
16	99,332	99,383	99,433	99,319	99,370	99,420	22	25	29	0.99971	0.99975	0.99978	0.00022	0.00025	0.00029	0.00022	0.00025	0.00029	67.9	68.0	68.1
17	99,306	99,358	99,408	99,291	99,343	99,394	25	29	33	0.99967	0.99971	0.99975	0.00025	0.00029	0.00033	0.00025	0.00029	0.00033	66.9	67.0	67.1
18	99,276	99,329	99,380	99,260	99,312	99,364	28	33	37	0.99963	0.99967	0.99972	0.00028	0.00033	0.00037	0.00028	0.00033	0.00037	65.9	66.0	66.1
19	99,243	99,296	99,348	99,225	99,279	99,331	31	35	40	0.99960	0.99965	0.99969	0.00031	0.00035	0.00040	0.00031	0.00035	0.00040	65.0	65.1	65.1
20	99,207	99,261	99,314	99,188	99,243	99,296	32	37	42	0.99958	0.99963	0.99967	0.00033	0.00037	0.00042	0.00033	0.00037	0.00042	64.0	64.1	64.2
21	99,169	99,224	99,278	99,150	99,205	99,259	34	38	43	0.99956	0.99961	0.99966	0.00034	0.00039	0.00044	0.00034	0.00039	0.00044	63.0	63.1	63.2
22	99,129	99,186	99,240	99,110	99,166	99,221	35	39	45	0.99955	0.99960	0.99965	0.00035	0.00040	0.00045	0.00035	0.00040	0.00045	62.0	62.1	62.2
23	99,089	99,147	99,202	99,069	99,127	99,182	34	39	44	0.99955	0.99961	0.99965	0.00035	0.00039	0.00045	0.00035	0.00039	0.00045	61.1	61.1	61.2
24	99,049	99,108	99,163	99,029	99,088	99,145	34	39	44	0.99956	0.99961	0.99966	0.00034	0.00039	0.00044	0.00034	0.00039	0.00044	60.1	60.2	60.3
25	99,009	99,069	99,126	98,989	99,050	99,108	33	37	43	0.99957	0.99962	0.99967	0.00033	0.00038	0.00043	0.00033	0.00038	0.00043	59.1	59.2	59.3
26	98,970	99,032	99,089	98,951	99,013	99,072	33	38	42	0.99958	0.99962	0.99967	0.00033	0.00038	0.00042	0.00033	0.00038	0.00042	58.1	58.2	58.3
27	98,931	98,994	99,054	98,912	98,976	99,036	33	37	42	0.99958	0.99962	0.99967	0.00033	0.00038	0.00042	0.00033	0.00038	0.00042	57.1	57.2	57.3
28	98,893	98,957	99,017	98,873	98,938	98,999	33	38	42	0.99957	0.99962	0.99966	0.00034	0.00038	0.00043	0.00034	0.00038	0.00043	56.2	56.3	56.3
29	98,854	98,919	98,981	98,834	98,900	98,962	34	39	44	0.99956	0.99961	0.99965	0.00035	0.00039	0.00044	0.00035	0.00039	0.00044	55.2	55.3	55.4
30	98,815	98,880	98,944	98,794	98,860	98,924	36	41	46	0.99953	0.99959	0.99963	0.00037	0.00041	0.00047	0.00037	0.00041	0.00047	54.2	54.3	54.4
31	98,773	98,839	98,904	98,750	98,817	98,883	39	43	49	0.99950	0.99956	0.99961	0.00039	0.00044	0.00050	0.00039	0.00044	0.00050	53.2	53.3	53.4
32	98,727	98,796	98,861	98,703	98,773	98,839	41	47	52	0.99947	0.99953	0.99958	0.00042	0.00047	0.00053	0.00042	0.00047	0.00053	52.3	52.3	52.4
33	98,678	98,749	98,816	98,653	98,724	98,792	44	50	56	0.99944	0.99950	0.99956	0.00044	0.00050	0.00056	0.00045	0.00050	0.00056	51.3	51.4	51.5
34	98,627	98,699	98,768	98,599	98,673	98,743	47	52	59	0.99940	0.99947	0.99953	0.00047	0.00053	0.00060	0.00047	0.00053	0.00060	50.3	50.4	50.5
35	98,572	98,647	98,717	98,544	98,619	98,691	49	55	61	0.99938	0.99945	0.99951	0.00049	0.00055	0.00062	0.00049	0.00055	0.00062	49.3	49.4	49.5
36	98,514	98,592	98,664	98,485	98,564	98,636	51	57	64	0.99935	0.99942	0.99948	0.00052	0.00058	0.00065	0.00052	0.00058	0.00065	48.4	48.5	48.5
37	98,456	98,535	98,609	98,424	98,504	98,579	55	61	68	0.99931	0.99938	0.99944	0.00056	0.00062	0.00069	0.00056	0.00062	0.00069	47.4	47.5	47.6
38	98,392	98,474	98,549	98,357	98,440	98,516	61	67	74	0.99925	0.99932	0.99939	0.00061	0.00068	0.00075	0.00061	0.00068	0.00075	46.4	46.5	46.6
39	98,322	98,407	98,484	98,286	98,371	98,449	64	72	79	0.99920	0.99928	0.99935	0.00065	0.00072	0.00080	0.00065	0.00072	0.00080	45.5	45.5	45.6
40	98,248	98,335	98,416	98,210	98,297	98,379	69	77	85	0.99914	0.99922	0.99929	0.00071	0.00078	0.00086	0.00071	0.00078	0.00086	44.5	44.6	44.7
41	98,171	98,258	98,342	98,129	98,217	98,302	74	82	90	0.99908	0.99917	0.99925	0.00075	0.00083	0.00092	0.00075	0.00083	0.00092	43.5	43.6	43.7
42	98,087	98,176	98,262	98,040	98,131	98,218	82	90	99	0.99899	0.99908	0.99917	0.00083	0.00092	0.00101	0.00083	0.00092	0.00101	42.6	42.6	42.7
43	97,994	98,086	98,174	97,945	98,037	98,125	90	99	109	0.99889	0.99899	0.99908	0.00092	0.00101	0.00111	0.00092	0.00101	0.00111	41.6	41.7	41.8
44	97,894	97,987	98,077	97,839	97,933	98,024	98	108	118	0.99880	0.99890	0.99900	0.00100	0.00110	0.00120	0.00100	0.00110	0.00121	40.6	40.7	40.8
45	97,784	97,879	97,971	97,723	97,818	97,913	111	122	132	0.99865	0.99877	0.99887	0.00113	0.00123	0.00135	0.00113	0.00123	0.00135	39.7	39.8	39.9
46	97,662	97,757	97,854	97,596	97,691	97,789	121	132	143	0.99854	0.99865	0.99876	0.00124	0.00135	0.00146	0.00124	0.00135	0.00146	38.7	38.8	38.9
47	97,530	97,625	97,724	97,456	97,554	97,652	133	144	156	0.99840	0.99852	0.99864	0.00136	0.00148	0.00160	0.00136	0.00148	0.00160	37.8	37.9	37.9
48	97,382	97,481	97,581	97,301	97,401	97,503	148	160	173	0.99823	0.99836	0.99848	0.00152	0.00164	0.00177	0.00152	0.00164	0.00178	36.8	36.9	37.0
49	97,219	97,321	97,424	97,131	97,234	97,338	160	174	187	0.99808	0.99822	0.99836	0.00164	0.00178	0.00192	0.00164	0.00178	0.00193	35.9	36.0	36.1
50	97,042	97,147	97,253	96,944	97,051	97,157	179	193	208	0.99786	0.99801	0.99816	0.00184	0.00199	0.00214	0.00184	0.00199	0.00215	35.0	35.0	35.1
51	96,844	96,954	97,061	96,736	96,847	96,955	199	213	230	0.99763	0.99780	0.99795	0.00205	0.00220	0.00237	0.00205	0.00220	0.00237	34.0	34.1	34.2
52	96,627	96,741	96,850	96,507	96,622	96,734	220	237	254	0.99738	0.99756	0.99773	0.00227	0.00244	0.00262	0.00227	0.00245	0.00263	33.1	33.2	33.3
53	96,387	96,504	96,618	96,259	96,378	96,495	234	251	270	0.99721	0.99739	0.99757	0.00243	0.00261	0.00279	0.00243	0.00261	0.00280	32.2	32.3	32.3
54	96,131	96,253	96,370	95,993	96,119	96,238	250	268	288	0.99701	0.99721	0.99740	0.00260	0.00279	0.00299	0.00261	0.00280	0.00299	31.3	31.4	31.4
55	95,856	95,985	96,105	95,712	95,841	95,964	268	288	306	0.99681	0.99701	0.99721	0.00279	0.00299	0.00319	0.00280	0.00299	0.00319	30.4	30.4	30.5
56	95,567	95,697	95,822	95,413	95,544	95,671	286	305	326	0.99659	0.99680	0.99701	0.00299	0.00320	0.00341	0.00300	0.00320	0.00341	29.5	29.5	29.6
57	95,259	95,392	95,520	95,087	95,223	95,355	314	336	358	0.99624	0.99648	0.99670	0.00330	0.00352	0.00376	0.00330	0.00353	0.00376	28.5	28.6	28.7
58	94,918	95,056	95,189	94,734	94,873	95,007	343	365	389	0.99591	0.99616	0.99639	0.00361	0.00384	0.00409	0.00362	0.00385	0.00410	27.6	27.7	27.8
59	94,549	94,691	94,827	94,351	94,494	94,631	371	394	420	0.99557	0.99583	0.99608	0.00392	0.00417	0.00443	0.00392	0.00417	0.00444	26.7	26.8	26.9
60	94,152	94,297	94,435	93,938	94,086	94,228	396	422	447	0.99525	0.99554	0.99580	0.00420	0.00446	0.00475	0.00421	0.00447	0.00476	25.9	25.9	26.0
61	93,724	93,875	94,019	93,498	93,653	93,801	418	445	472	0.99497	0.99526	0.99554	0.00446	0.00474	0.00503	0.00447	0.00475	0.00504	25.0	25.1	25.1
62	93,272	93,430	93,584	93,023	93,181	93,336	467	496	524	0.99439	0.99471	0.99500	0.00500	0.00529	0.00561	0.00501	0.00530	0.00562	24.1	24.2	24.2
63	92,771	92,934	93,094	92,491	92,655	92,816	526	558	591	0.99364	0.99400	0.99433	0.00567	0.00600	0.00636	0.00568	0.00602	0.00638	23.2	23.3	23.4
64	92,208	92,376	92,540	91,908	92,075	92,242	567	601	633	0.99315	0.99351	0.99387	0.00613	0.00649	0.00685	0.00615	0.00651	0.00688	22.4	22.4	22.5
65	91,605	91,775	91,946	91,282	91,455	91,628	604	640	676	0.99264	0.99303	0.99342	0.00658	0.00697	0.00736	0.00660	0.00700	0.00739	21.5	21.6	21.6
66	90,960	91,135	91,313	90,597	90,780	90,959	673	712	752	0.99175	0.99219	0.99262	0.00738	0.00781	0.00825	0.00741	0.00784	0.00828	20.6	20.7	20.8
67	90,238	90,423	90,609	89,857	90,047	90,237	712	753	793	0.99123	0.99168	0.99213	0.00787	0.00832	0.00877	0.00790	0.00835	0.00881	19.8	19.9	20.0
68	89,477	89,670	89,871	89,068	89,263	89,468	773	813	859	0.99042	0.99091	0.99138	0.00862	0.00909	0.00958	0.00866	0.00913	0.00963	19.0	19.0	19.1
69	88,657	88,857	89,064	88,202	88,408	88,619	850	896	943	0.98938	0.98993	0.99044	0.00956	0.01007	0.01062	0.00961	0.01013	0.01068	18.1	18.2	18.3
70	87,750	87,961	88,176	87,279	87,492	87,711	893	939	987	0.98878	0.98931	0.98986	0.01014	0.01069	0.01122	0.01019	0.01074	0.01129	17.3	17.4	17.5
71	86,804	87,022	87,246	86,280	86,502	86,729	991	1,041	1,093	0.98744	0.98804	0.98861	0.01139	0.01196	0.01256	0.01145	0.01204	0.01264	16.5	16.6	16.6
72	85,751	85,981	86,212	85,124	85,359	85,594	1,187	1,245	1,306	0.98481	0.98553	0.98620	0.01380	0.01447	0.01519	0.01390	0.01458	0.01531	15.7	15.8	15.8
73	84,493	84,736	84,977	83,799	84,052	84,296	1,306	1,369	1,436	0.98306	0.98384	0.98459	0.01541	0.01616	0.01694	0.01553	0.01629	0.01709	14.9	15.0	15.1
74	83,102	83,367	83,617	82,355	82,619	82,873	1,427	1,496	1,565	0.98122	0.98207	0.98290	0.01710	0.01793	0.01878	0.01725	0.01809	0.01896	14.2	14.2	14.3
75	81,597	81,871	82,137	80,758	81,039	81,311	1,586	1,663	1,743	0.97870	0.97967	0.98063	0.01937	0.02033	0.02130	0.01956	0.02054	0.02153	13.4	13.5	13.6
76	79,918	80,208	80,490	79,055	79,347	79,631	1,644	1,720	1,796	0.97761	0.97857	0.97951	0.02049	0.02143	0.02239	0.02070	0.02166	0.02265	12.7	12.8	12.8
77	78,185	78,488	78,777	77,259	77,567	77,859	1,761	1,842	1,922	0.97550	0.97654	0.97756	0.02244	0.02346	0.02450	0.02270	0.02374	0.02480	12.0	12.0	12.1
78	76,333	76,646	76,947	75,269	75,587	75,892	2,030	2,119	2,210	0.97116	0.97237	0.97352	0.02648	0.02763	0.02884	0.02684	0.02802	0.02927	11.2	11.3	11.4
79	74,204	74,527	74,842	73,019	73,350	73,666	2,262	2,357	2,458	0.96999	0.96834	0.96967	0.03033	0.03166	0.03301	0.03079	0.03217	0.03356	10.5	10.6	10.7
80	71,825	72,170	72,501	70,510	70,858	71,191	2,516	2,626	2,731	0.96216	0.96365	0.96515	0.03485	0.03635	0.03784	0.03547	0.03703	0.03857	9.9	9.9	10.0
81	69,185	69,544	69,891	67,742	68,105	68,457	2,764	2,877	3,002	0.95682	0.95859	0.96030	0.03970	0.04141	0.04318	0.04051	0.04228	0.04414	9.2	9.3	9.4
82	66,287	66,667	67,027	64,718	65,101	65,468	3,000	3,131	3,256	0.95115	0.95308	0.95502	0.04498	0.04692	0.04885	0.04601	0.04805	0.05007	8.6	8.7	8.7
83	63,137	63,536	63,927	61,461	61,862	62,255	3,222	3,351	3,487	0.94510	0.94724	0.94934	0.05066	0.05276	0.05490	0.05198	0.05419	0.05645	8.0	8.1	8.1
84	59,764	60,185	60,595	57,951	58,371	58,773	3,488	3,628	3,769	0.93732	0.93970	0.94203	0.05797	0.06030	0.06268	0.05970	0.06218	0.06470	7.4	7.5	7.6
85	56,125	56,557	56,977	54,165	54,595	55,006	3,771	3,923	4,067	0.92804	0.93073	0.93332	0.06668	0.06927	0.07196	0.06898	0.07176	0.07465	6.9	6.9	7.0
86	52,194	52,634	53,058	50,092	50,523	50,943	4,078	4,225	4,381	0.91682	0.91969	0.92254	0.07746	0.08031	0.08318	0.08058	0.08367	0.08679	6.4	6.4	6.5
87	47,969	48,409	48,851	45,750	46,181	46,617	4,303	4,459	4,611	0.90478	0.90799	0.91105	0.08895	0.09201	0.09522	0.09309	0.09645	0.09998	5.9	5.9	6.0
88	43,513	43,950	44,399	41,217	41,648	42,087	4,445	4,607	4,772	0.89157	0.89515	0.89868	0.10112	0.10485	0.10843	0.10651	0.11065	0.11464	5.4	5.5	5.6
89	38,902	39,343	39,784	36,581	37,009	37,435	4,511	4,672	4,839	0.87700	0.88119	0.88520	0.11480	0.11881	0.12300	0.12179	0.12632	0.13107	5.0	5.1	5.1
90	34,248	34,671	35,096	31,941	32,350	32,766	4,478	4,642	4,805	0.86156	0.86611	0.87065	0.12935	0.13389	0.13844	0.13829	0.14349	0.14874	4.6	4.7	4.8
91	29,611	30,029	30,447	27,367	27,779	28,179	4,342	4,501	4,669	0.84472	0.85010	0.85524	0.14476	0.14990	0.15528	0.15605	0.16205	0.16836	4.3	4.4	4.4
92	25,115	25,528	25,930	23,007	23,400	23,780	4,098	4,261	4,417	0.82727	0.83317	0.83903	0.16097	0.16683	0.17273	0.17506	0.18202	0.18906	4.0	4.0	4.1
93	20,887	21,267	21,648	18,947	19,307	19,666	3,778	3,924	4,073	0.80893	0.81559	0.82210	0.17790	0.18441	0.19107	0.19527	0.20314	0.21125	3.7	3.7	3.8
94	16,992	17,343	17,705	15,256	15,585	15,924	3,373	3,515	3,665	0.78928	0.79727	0.80465	0.19535	0.20273	0.21072	0.21650	0.22560	0.23553	3.4	3.5	3.5
95	13,505	13,828	14,154	11,995	12,295	12,599	2,934	3,096	3,203	0.76940	0.77833	0.78684	0.21316	0.22167	0.23060	0.23859	0.24930	0.26065	3.2	3.2	3.3
96	10,474	10,762	11,056	9,196	9,465	9,734	2,481	2,596	2,721	0.74877	0.75875	0.76822	0.23178	0.24125	0.25123	0.26216	0.27435	0.28732	2.9	3.0	3.1
97	7,912	8,166	8,424	6,868	7,097	7,334	2,031	2,135	2,245	0.72671	0.73849	0.75009	0.24991	0.26151	0.27329	0.28559	0.30084	0.31655	2.7	2.8	2.9
98	5,806	6,031	6,258	4,978	5,180	5,388	1,608	1,702	1,795	0.70334	0.71773	0.73168	0.26832	0.28227	0.29666	0.30989	0.32866	0.34833	2.5	2.6	2.7
99	4,136	4,329	4,525	3,499	3,672	3,851	1,229	1,315	1,399	0.67886	0.69656	0.71354	0.28646	0.30344	0.32114	0.33435	0.35772	0.38257	2.3	2.4	2.6
100	2,850	3,014	3,187	2,373	2,525	2,684	914	980	1,049	0.65330	0.67498	0.69477	0.30523	0.32502	0.34670	0.36021	0.38808	0.41940	2.2	2.3	2.4
101	1,890	2,034	2,184	1,552	1,681	1,814	652	706	764	0.62842	0.65277	0.67579	0.32421	0.34723	0.37158	0.38693	0.42018	0.45637	2.0	2.1	2.3
102	1,207	1,328	1,454	976	1,082	1,191	446	492	538	0.60191	0.62957	0.65734	0.34266	0.37043	0.39809	0.41351	0.45464	0.49702	1.8	2.0	2.2
103	743	836	935	591	671	759	292	330	368	0.56919	0.60572	0.64146	0.35854	0.39428	0.43081	0.43685	0.49109	0.54909	1.7	1.9	2.2
104	435	506	587	339	400	472	182	212	242	0.53525	0.58097	0.62889	0.37111	0.41903	0.46475	0.45566	0.53010	0.60543	1.5	1.8	2.2
105	240	294	359	364	513	733	240	294	359	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	0.46629	0.57210	0.69563	1.4	1.7	2.1

1. For figues in columns Lx, dx, px, qx, and mx the age interval relates to a 1-year period, except for age 105 which relates to remaining lifespan.
2. The 2.5th to 97.5th percentiles represent a 95% credible interval. We can say there is a 95% chance that the true value lies between these two values.

Values used to calculate Years of Life Lost

Average of the median values for the total male and female populations

Age at death	Male population 50% (Median)	Female population 50% (Median)	male and female populations Average of the median of the male and female total populationa
0	80.0	83.5	81.75
1	79.3	82.8	81.05
2	78.4	81.9	80.15
3	77.4	80.9	79.15
4	76.4	79.9	78.15
5	75.4	78.9	77.15
6	74.4	77.9	76.15
7	73.4	76.9	75.15
8	72.4	75.9	74.15
9	71.5	74.9	73.2
10	70.5	73.9	72.2
11	69.5	72.9	71.2
12	68.5	71.9	70.2
13	67.5	71.0	69.25
14	66.5	70.0	68.25
15	65.5	69.0	67.25
16	64.5	68.0	66.25
17	63.6	67.0	65.3
18	62.6	66.0	64.3
19	61.6	65.1	63.35
20	60.7	64.1	62.4
21	59.7	63.1	61.4
22	58.8	62.1	60.45
23	57.8	61.1	59.45
24	56.9	60.2	58.55
25	55.9	59.2	57.55
26	54.9	58.2	56.55
27	54.0	57.2	55.6
28	53.0	56.3	54.65
29	52.1	55.3	53.7
30	51.1	54.3	52.7
31	50.2	53.3	51.75
32	49.2	52.3	50.75
33	48.2	51.4	49.8
34	47.3	50.4	48.85
35	46.3	49.4	47.85
36	45.4	48.5	46.95
37	44.4	47.5	45.95
38	43.5	46.5	45
39	42.5	45.5	44
40	41.6	44.6	43.1
41	40.6	43.6	42.1
42	39.7	42.6	41.15
43	38.7	41.7	40.2
44	37.8	40.7	39.25
45	36.9	39.8	38.35
46	35.9	38.8	37.35
47	35.0	37.9	36.45
48	34.1	36.9	35.5
49	33.2	36.0	34.6
50	32.2	35.0	33.6

Age at death	Male population 50% (Median)	Female population 50% (Median)	male and female populations Average of the median of the male and female total populationa
51	31.3	34.1	32.7
52	30.4	33.2	31.8
53	29.5	32.3	30.9
54	28.7	31.4	30.05
55	27.8	30.4	29.1
56	26.9	29.5	28.2
57	26.0	28.6	27.3
58	25.2	27.7	26.45
59	24.3	26.8	25.55
60	23.5	25.9	24.7
61	22.6	25.1	23.85
62	21.8	24.2	23
63	21.0	23.3	22.15
64	20.1	22.4	21.25
65	19.3	21.6	20.45
66	18.5	20.7	19.6
67	17.7	19.9	18.8
68	17.0	19.0	18
69	16.2	18.2	17.2
70	15.4	17.4	16.4
71	14.6	16.6	15.6
72	13.9	15.8	14.85
73	13.2	15.0	14.1
74	12.5	14.2	13.35
75	11.8	13.5	12.65
76	11.1	12.8	11.95
77	10.4	12.0	11.2
78	9.8	11.3	10.55
79	9.2	10.6	9.9
80	8.6	9.9	9.25
81	8.0	9.3	8.65
82	7.5	8.7	8.1
83	7.0	8.1	7.55
84	6.5	7.5	7
85	6.0	6.9	6.45
86	5.6	6.4	6
87	5.2	5.9	5.55
88	4.8	5.5	5.15
89	4.4	5.1	4.75
90	4.1	4.7	4.4
91	3.8	4.4	4.1
92	3.6	4.0	3.8
93	3.3	3.7	3.5
94	3.1	3.5	3.3
95	2.9	3.2	3.05
96	2.7	3.0	2.85
97	2.5	2.8	2.65
98	2.4	2.6	2.5
99	2.2	2.4	2.3
100	2.1	2.3	2.2
101	2.0	2.1	2.05
102	1.9	2.0	1.95
103	1.8	1.9	1.85
104	1.7	1.8	1.75
105	1.6	1.7	1.65

Appendix 2: IDI Code for 2019

Code for Quantifying the Years of Life Lost and Years of Life Lost to Disability from Diabetes

MORTALITY

Step 1. Identify the snz_uid and age_death for those who died of DI in 2020

```
--      Base table
select * from IDI_Clean_202403.moh_clean.mortality_registrations

--      Code
        select
        IDI_Clean_202403.moh_clean.mortality_registrations.snz_uid,
        IDI_Clean_202403.moh_clean.mortality_registrations.snz_moh_uid,
        IDI_Clean_202403.moh_clean.mortality_registrations.snz_dia_death_reg_uid,
        IDI_Clean_202403.moh_clean.mortality_registrations.moh_mor_ethnic_grp2_snz_ind as
        m_nm,
        IDI_Clean_202403.moh_clean.mortality_registrations.moh_mor_icd_d_code,
        IDI_Clean_202403.moh_clean.mortality_registrations.moh_mor_birth_year_nbr as year_birth,
        IDI_Clean_202403.moh_clean.mortality_registrations.moh_mor_registration_year_nbr as
        year_death,
        (IDI_Clean_202403.moh_clean.mortality_registrations.moh_mor_registration_year_nbr -
        IDI_Clean_202403.moh_clean.mortality_registrations.moh_mor_birth_year_nbr) as age_death
        into IDI_Sandpit.[DL-MAA2021-57].DI_2020_1
        from IDI_Clean_202403.moh_clean.mortality_registrations
        where moh_mor_registration_year_nbr = 2019 and moh_mor_icd_d_code like 'E11%'
        order by moh_mor_icd_d_code;
```

Step 2. Save a revised version of the NZ Life Table in the Sandpit

Step 3. Join life table to identify YYL for those who died of DI in 2020

```
--      Base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_1;
        select * from IDI_Sandpit.[DL-MAA2021-57].NZ_life_table;

--      Code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_1.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_1.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_1.year_birth,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_1.year_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_1.age_death,
```

```
IDI_Sandpit.[DL-MAA2021-57].NZ_life_table.expected_years as YLL
into IDI_Sandpit.[DL-MAA2021-57].DI_2020_2
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_1
left join IDI_Sandpit.[DL-MAA2021-57].NZ_life_table
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_1.age_death = IDI_Sandpit.[DL-MAA2021-5
7].NZ_life_table.age_death
order by age_death;
```

MORBIDITY

Step 1. Identify year individual diagnosed with chronic disease

```
--      base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_2
        select * from IDI_Clean_202403.moh_clean.chronic_condition

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.year_birth,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.year_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.age_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.YLL,
        year(IDI_Clean_202403.moh_clean.chronic_condition.moh_chr_fir_incidnt_date) as year_diag
        into #temp3 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_2
        join IDI_Clean_202403.moh_clean.chronic_condition
        on IDI_Sandpit.[DL-MAA2021-57].DI_2020_2.snz_uid =
        IDI_Clean_202403.moh_clean.chronic_condition.snz_uid
        where IDI_Clean_202403.moh_clean.chronic_condition.moh_chr_condition_text = 'DIA';
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_3 from #temp3;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_3 order by snz_uid;

--      CALCULATE YLLD FROM HAVING DI WITHOUT A COMPLICATION

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_3;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.year_birth,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.year_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.age_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.YLL,
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.year_diag,
(2020 - IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.year_diag) as years_lived_w_DI,
(2020 - IDI_Sandpit.[DL-MAA2021-57].DI_2020_3.year_diag) * 0.049 as YLLD_no_comp
into #temp4 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_3
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_4 from #temp4;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4;

-- YYL and YLLD_nc

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.YLLD_no_comp as YLL_nc
into #temp11z from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_4_zz from #temp11z;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4_zz;

-- CALCULATE YLLD FROM PUBLIC HOSPITAL DISCHARGES

-- Step 1.Connect event and diagnosis table and identify year/s of event/s

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4;
select * from IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_event;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.year_diag,
IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_event.moh_evt_event_id_nbr,
year(IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_event.moh_evt_evst_date) as
year_event
into #temp5 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4
join IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_event
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.snz_uid =
IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_event.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_5 from #temp5;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_5 order by snz_uid;
```

```
-- Step 2. Identify diagnoses of events

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_5
select * from IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_diag;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.year_event,
IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_diag.moh_dia_clinical_code
into #temp7 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_5
join IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_diag
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_5.moh_evt_event_id_nbr =
IDI_Clean_202403.moh_clean.pub_fund_hosp_discharges_diag.moh_dia_event_id_nbr
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_7 from #temp7;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7 order by snz_uid;

-- Step 3. Remove duplicates

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code
order by
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7
) delete from CTE where CNT>1;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7 order by snz_uid, year_event;

-- Step 4. Find earliest diag year

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event asc
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7
) delete from CTE where CNT>1;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7 order by snz_uid,
moh_dia_clinical_code

-- Step 5. Remove events before DI diagnosis

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7 order by snz_uid

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.snz_uid,
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.moh_dia_clinical_code,
(IDI_Sandpit.[DL-MAA2021-57].DI_2020_7.year_event - IDI_Sandpit.[DL-MAA2021-
57].DI_2020_7.year_diag) as CNT
into #temp10 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_7
order by snz_uid, CNT
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_8 from #temp10;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_8 order by CNT asc;
delete from IDI_Sandpit.[DL-MAA2021-57].DI_2020_8 where CNT<0
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_8 order by CNT asc;

-- Step 6. Identify years lived with condition

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.moh_dia_clinical_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.year_event,
(2020 - IDI_Sandpit.[DL-MAA2021-57].DI_2020_8.year_event) as yrs_w_cond
into #temp11 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_8
order by snz_uid, moh_dia_clinical_code;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_9 from #temp11;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_9
order by snz_uid, moh_dia_clinical_code;

-- Step 7. Shorten non-DI specific codes to three places

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.age_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.moh_dia_clinical_code,
SUBSTRING(moh_dia_clinical_code,1,3) as icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.year_diag,
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_9.yrs_w_cond
into #temp12 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_9
order by snz_uid;
--  save DI_2020_9 as new table = DI_2020_20
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_20 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_9;

--  DW TABLES

--  DI-specific table
select * from IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5;

--  mental health table
select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_5;

--  other table
select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3;

--  Sub-step 1. JOIN WITH DI-SPECIFIC DW TABLE

--  base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_20;
select * from IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5;

--  code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.moh_dia_clinical_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.dw_icd,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.descr,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.dw,
(IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond * IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.dw) as YLLD_DI_spec
into #temp13 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_20
join IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.moh_dia_clinical_code = IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.dw_icd
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_21 from #temp13
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21 order by snz_uid;
```

```
--      Remove duplicates

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21;

--      code
        with CTE as
        (
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.dw_icd as dw_icd_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.descr,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.descr_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.yrs_w_cond,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.dw,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.YLLD_DI_spec,
        row_number() over (partition by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.descr_combined
        order by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.descr_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.yrs_w_cond desc
        ) as CNT
        from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21
        ) delete from CTE where CNT>1;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21 order by snz_uid;

--      sum YLLD from DI_spec pub_hosp diagnoses

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.snz_uid,
        sum(IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.YLLD_DI_spec) as YLLD_DI_spec_total
        into #temp14 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21
        group by snz_uid
        order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_22 from #temp14;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_22;

--      add back in m_nm
```

```
-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_22;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_22.YLLD_DI_spec_total
into #temp15 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_21
join IDI_Sandpit.[DL-MAA2021-57].DI_2020_22
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_21.snz_uid = IDI_Sandpit.[DL-MAA2021-
57].DI_2020_22.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 from #temp15;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 order by snz_uid;

-- remove duplicates

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 order by snz_uid;

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.YLLD_DI_spec_total,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.YLLD_DI_spec_total
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.YLLD_DI_spec_total
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23
) delete from CTE where CNT>1;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 order by snz_uid;

-- DI specific YLLD public

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 order by snz_uid;

-- MENTAL HEALTH DIAGNOSES
```

```
--      base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_20
        select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.moh_dia_clinical_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond as yrs_w_condition,
        DI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.icd_code as dw_icd_code,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.descr,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.descri_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.dw,
        (IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond * IDI_Sandpit.[DL-MAA2021-
        57].FINAL_dw_table_mental_health_6.dw) as YLLD_mental_h
        into #temp16 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_20
        join IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6
        on IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.moh_dia_clinical_code = IDI_Sandpit.[DL-
        MAA2021-57].FINAL_dw_table_mental_health_6.icd_code
        order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_24 from #temp16
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_24 order by snz_uid;

--      remove duplicates

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_24 order by snz_uid;

--      code
        with CTE as
        (
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.dw_icd_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.descr,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.descri_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.yrs_w_cond,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.dw,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.YLLD_mental_h,
        row_number() over (partition by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.descri_combined
        order by
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.descri_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.yrs_w_cond desc
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_24
) delete from CTE where CNT>1;

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_24.YLLD_mental_h
into #temp17 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_24
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_25 from #temp17;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_25;

--      mental health YLLD from public hospital diagnoses

        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_25 order by snz_uid;

--      DI OTHER DIAGNOSES

--      base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_20
        select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.moh_dia_clinical_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond as yrs_w_condition,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.icd_code as dw_icd_code,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.descr,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.descr_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond,
        IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.dw,
        (IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.yrs_w_cond *    IDI_Sandpit.[DL-MAA2021-
        57].FINAL_dw_table_other_3.dw) as YLLD_other
        into #temp18 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_20
        join IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3
        on IDI_Sandpit.[DL-MAA2021-57].DI_2020_20.moh_dia_clinical_code = IDI_Sandpit.[DL-
        MAA2021-57].FINAL_dw_table_other_3.icd_code
        order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_26 from #temp18;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_26 order by snz_uid;
```

```
--      remove duplicates

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_26 order by snz_uid;

--      code
        with CTE as
        (
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.dw_icd_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.descr,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.descr_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.yrs_w_cond,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.dw,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.YLLD_other,
        row_number() over (partition by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.descr_combined
        order by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.descr_combined,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.yrs_w_cond desc
        ) as CNT
        from IDI_Sandpit.[DL-MAA2021-57].DI_2020_26
        ) delete from CTE
        where CNT>1;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_26 order by snz_uid;

--      Sum rows

        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.snz_uid,
        sum(IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.YLLD_other) as YLLD_other
        into #temp19 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_26
        group by snz_uid
        order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_27 from #temp19;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_27 order by snz_uid;

--      add back in m_nm

        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.snz_uid,
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_27.YLLD_other
into #temp20 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_26
join IDI_Sandpit.[DL-MAA2021-57].DI_2020_27
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_26.snz_uid = IDI_Sandpit.[DL-MAA2021-
57].DI_2020_27.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_28 from #temp20;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_28;

-- remove duplicates

with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.YLLD_other,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.m_nm
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.m_nm
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_28
) delete from CTE
where CNT>1;

-- YLLD from Other public hosp diagnoses

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_28 order by snz_uid;

-- CALCULATE YLLD FROM PRIVATE HOSPITAL DISCHARGES

-- Step 1. Identify event year for priv hosp

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4;
select * from IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_event

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.m_nm,
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.year_diag,
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_event.snz_uid as
priv_fund_hosp_snz_uid,
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_event.moh_pri_evt_event_id_nbr,
year(IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_event.moh_pri_evt_start_date
) as year_event
into #temp21 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4
join IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_event
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.snz_uid =
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_event.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_29 from #temp21;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_29 order by snz_uid;

-- Step 2.Identify diag for events

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_29;
select * from IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_diag;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.year_event,
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_diag.moh_pri_diag_event_id_nbr,
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_diag.moh_pri_diag_clinic_sys_code,
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_diag.moh_pri_diag_clinic_code
into #temp22 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_29
join IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_diag
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_29.moh_pri_evt_event_id_nbr =
IDI_Clean_202403.moh_clean.priv_fund_hosp_discharges_diag.moh_pri_diag_event_id_nbr
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_30 from #temp22;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_30 order by snz_uid;

- Step 3. Remove duplicates

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_30
```

```
--      code
        with CTE as
        (
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_birth,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_diag,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_event,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_event_id_nbr,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_clinic_sys_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_clinic_code,
        row_number() over (partition by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_event,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_clinic_code
        order by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_event,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_clinic_code
        ) as CNT
        from IDI_Sandpit.[DL-MAA2021-57].DI_2020_30
        ) delete from CTE where CNT>1;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_30 order by snz_uid;

--      Step 4. Remove events before diag

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_30 order by year_event;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_birth,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_death,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_diag,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_event,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_event_id_nbr,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_clinic_sys_code,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.moh_pri_diag_clinic_code,
        (IDI_Sandpit.[DL-MAA2021-57].DI_2020_30.year_event - IDI_Sandpit.[DL-MAA2021-
        57].DI_2020_30.year_diag) as CNT
        into #temp23 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_30
        order by CNT;
```

```
select * from #temp23;
delete from #temp23 where CNT < 0;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_31 from #temp23;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_31 order by snz_uid;

-- Step 5. Identify years lived with condition

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_31

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.moh_pri_diag_clinic_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.year_event,
(2020 - IDI_Sandpit.[DL-MAA2021-57].DI_2020_31.year_event) as yrs_w_cond
into #temp24 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_31
order by snz_uid, moh_pri_diag_clinic_code;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_32 from #temp24;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_32 order by snz_uid,
moh_pri_diag_clinic_code;

-- Step 6. Shorten non-DI specific codes to three places

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_32;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.moh_pri_diag_clinic_code,
SUBSTRING(moh_pri_diag_clinic_code,1,3) as icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_32.yrs_w_cond
into #temp25 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_32
order by snz_uid, icd_code;
```

```
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_33 from #temp25;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33 order by snz_uid, icd_code;

-- Step 7. Find earlest year of diag / largest YLID

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33;

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.year_birth,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.year_death,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.moh_pri_diag_clinic_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.year_diag,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.yrs_w_cond,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.icd_code
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.year_event,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.icd_code
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33
) delete from CTE where CNT>1;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33 order by snz_uid;

-- dw TABLES .. updated

select * from IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5;
select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_5;
select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3;

-- JOIN WITH DI-SPECIFIC DW TABLE

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33;
select * from IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5;
```

```
-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.moh_pri_diag_clinic_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.yrs_w_cond,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.dw_icd as dw_icd_code,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.descr,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5.dw,
(IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.YRS_W_COND * IDI_Sandpit.[DL-MAA2021-
57].dw_table_DI_spec_19jul_5.dw) as YLLD_DI_spec
into #temp26 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33
join IDI_Sandpit.[DL-MAA2021-57].dw_table_DI_spec_19jul_5
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.moh_pri_diag_clinic_code = IDI_Sandpit.[DL-
MAA2021-57].dw_table_DI_spec_19jul_5.dw_icd;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_34 from #temp26;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_34 order by snz_uid;

-- Remove duplicates

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_34;

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.dw_icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.descr,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.yrs_w_cond,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.dw,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.YLLD_DI_spec,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.descr_combined
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.yrs_w_cond desc
) as CNT
```

```
        from IDI_Sandpit.[DL-MAA2021-57].DI_2020_34
        ) delete from CTE where CNT>1;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_34 order by snz_uid;

--      cut down table -- fewer cols

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_34 order by snz_uid;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_34.YLLD_DI_spec
        into #temp27 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_34
        order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_35 from #temp27
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_35 order by snz_uid

--      Sum YLLD

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_35 order by snz_uid

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_35.snz_uid,
        sum(IDI_Sandpit.[DL-MAA2021-57].DI_2020_35.YLLD_DI_spec) as YLLD_DI_spec_total
        into #temp28 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_35
        group by snz_uid
        order by snz_uid
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_36 from #temp28;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_36 order by snz_uid;

--      add back in m_nm

--      base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_35;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_36;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_35.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_35.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_36.YLLD_DI_spec_total
        into #temp29 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_35
```

```
left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_36
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_35.snz_uid = IDI_Sandpit.[DL-MAA2021-57].DI_2020_36.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_37 from #temp29;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37;

-- remove duplicates

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37;

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.YLLD_DI_spec_total,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.YLLD_DI_spec_total
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.YLLD_DI_spec_total
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37
) delete from CTE where CNT>1;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37 order by snz_uid;

-- DI specific YLLD private diagnoses

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37 order by snz_uid;

-- MENTAL HEALTH

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33;
select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6;

-- join mental health conditions dw_table

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.m_nm,
```

```
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.icd_code as dw_icd_code,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.descr,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.descri_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.yrs_w_cond,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6.dw,
(IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.yrs_w_cond * IDI_Sandpit.[DL-MAA2021-
57].FINAL_dw_table_mental_health_6.dw) as YLLD_mh
into #temp30 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33
join IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_mental_health_6
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.icd_code = IDI_Sandpit.[DL-MAA2021-
57].FINAL_dw_table_mental_health_6.icd_code
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_38 from #temp30;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_38

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_38.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_38.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_38.YLLD_mh
into #temp31a from IDI_Sandpit.[DL-MAA2021-57].DI_2020_38
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_39 from #temp31a;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_39 order by snz_uid;

-- mental health YLLD from private

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_39 order by snz_uid;

-- DI OTHER

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33;
select * from IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.moh_pri_diag_clinic_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.icd_code,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.icd_code as dw_icd_code,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.descr,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.yrs_w_cond,
IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3.dw,
```

```
(IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.yrs_w_cond * IDI_Sandpit.[DL-MAA2021-
57].FINAL_dw_table_other_3.dw) as YLLD_other
into #temp33 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_33
join IDI_Sandpit.[DL-MAA2021-57].FINAL_dw_table_other_3
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_33.moh_pri_diag_clinic_code = IDI_Sandpit.[DL-
MAA2021-57].FINAL_dw_table_other_3.icd_code
order by snz_uid;
 select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_40 from #temp33
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40 order by snz_uid;

-- remove duplicates

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40
order by snz_uid;

-- code
with CTE as
(
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.dw_icd_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.descr,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.yrs_w_cond,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.dw,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.YLLD_other,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.descr_combined
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.descr_combined,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.yrs_w_cond desc
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40
) delete from CTE where CNT>1;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40 order by snz_uid;

-- Sum rows

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40 order by snz_uid
```

```
--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.snz_uid,
        sum(IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.YLLD_other) as YLLD_other
        into #temp34a from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40
        group by snz_uid
        order by snz_uid;

        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_41 from #temp34a;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_41 order by snz_uid;

--      add back in m_nm

--      base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_41;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_41.YLLD_other
        into #temp35a from IDI_Sandpit.[DL-MAA2021-57].DI_2020_40
        join IDI_Sandpit.[DL-MAA2021-57].DI_2020_41
        on IDI_Sandpit.[DL-MAA2021-57].DI_2020_40.snz_uid = IDI_Sandpit.[DL-MAA2021-
        57].DI_2020_41.snz_uid
        order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_42 from #temp35a;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_42;

--      remove duplicates

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_42;

-- code
        with CTE as
        (
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.YLLD_other,
        row_number() over (partition by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.m_nm
        order by
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.m_nm
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_42
) delete from CTE where CNT>1;

DI Other YLLD private
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_42 order by snz_uid;

--      ADD ALL THE YLLD TABLES TOGETHER

--      base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4 -- YLL and YLLD no comps;

--      base public
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 order by snz_uid -- = DI specific YLLD
public
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_25 order by snz_uid -- = mental health Y
LLD public
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_28 order by snz_uid -- = DI other public

-- base private
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37 order by snz_uid -- =    DI specific YLLD
private
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_39 order by snz_uid -- = DI mental health
private
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_42 order by snz_uid -- = DI other private

--      Step 1. Start with YLL and YLLD no comp

--      base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4

--      code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_4.YLLD_no_comp as YLLD_nc
into #temp36 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_4
Select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a from #temp36;
Select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a order by snz_uid;
delete from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a where YLL is NULL;
Select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a order by snz_uid;
```

```
-- Step 2. Add in DI specific (public)

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_23 order by snz_uid

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a.YLLD_nc,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_23.YLLD_DI_spec_total as YYLD_DI_spec_pub
into #temp37 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a
left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_23
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_1a.snz_uid = IDI_Sandpit.[DL-MAA2021-
57].DI_2020_23.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a from #temp37;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a order by snz_uid;

-- Step 3. Add DI mental health (public)

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_25;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a.YLLD_nc,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a.YYLD_DI_spec_pub as YLLD_DI_spec_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_25.YLLD_mental_h as YLLD_mental_pub
into #temp38 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a
left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_25
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_2a.snz_uid = IDI_Sandpit.[DL-MAA2021-
57].DI_2020_25.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a from #temp38;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a order by snz_uid;
```

```
--      remove duplicates

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a;

-- code
        with CTE as
        (
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLL,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLLD_nc,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLLD_DI_spec_pub,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLLD_mental_pub,
        row_number() over (partition by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.m_nm
        order by
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.m_nm
        ) as CNT
        from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a
        ) delete from CTE where CNT>1;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a order by snz_uid;

--      Step 4. Add DI other health (public)

--      base tables
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_28;

--      code
        select
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.snz_uid,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLL,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.m_nm,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLLD_nc,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLLD_DI_spec_pub,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.YLLD_mental_pub,
        IDI_Sandpit.[DL-MAA2021-57].DI_2020_28.YLLD_other as YLLD_other_pub
        into #temp39 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a
        left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_28
        on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_3a.snz_uid = IDI_Sandpit.[DL-MAA2021-
        57].DI_2020_28.snz_uid
        order by snz_uid;
```

```
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a from #temp39;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a order by snz_uid;

-- Step 5. Add DI other (private)

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_42 order by snz_uid;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.YLLD_nc,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.YLLD_DI_spec_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.YLLD_mental_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.YLLD_other_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_42.YLLD_other as YLLD_other_pri
into #temp40 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a
left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_42
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_4a.snz_uid = IDI_Sandpit.[DL-MAA2021-
57].DI_2020_42.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a from #temp40;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a order by snz_uid;

-- Step 6. Add DI mental health (private)

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_39;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.YLLD_nc,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.YLLD_DI_spec_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.YLLD_mental_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.YLLD_other_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.YLLD_other_pri,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_39.YLLD_mh as YLL_mental_pri
into #temp41 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a
left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_39
```

```
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_5a.snz_uid = IDI_Sandpit.[DL-MAA2021-57].DI_2020_39.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a from #temp41;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a order by snz_uid;

-- Step 7. Add DI spec (private)

-- base tables
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_37;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLLD_nc,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLLD_DI_spec_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLLD_mental_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLLD_other_pub,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLLD_other_pri,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.YLL_mental_pri as YLLD_mental_pri,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.YLLD_DI_spec_total as YLLD_DI_spec_pri
into #temp42 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a
left join IDI_Sandpit.[DL-MAA2021-57].DI_2020_37
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_6a.snz_uid = IDI_Sandpit.[DL-MAA2021-57].DI_2020_37.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a from #temp42;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a order by snz_uid;

-- TURN NULLS TO ZERO

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a order by snz_uid;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_nc,
isnull(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_DI_spec_pub,0) as YLLD_DI_spec_public,
```

```
isnull(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_mental_pub, 0) as
YLLD_DI_mental_public,
isnull(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_other_pub, 0) as
YLLD_DI_other_public,
isnull(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_other_pri, 0) as
YLLD_DI_other_private,
isnull(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_mental_pri, 0) as
YLLD_DI_mental_private,
isnull(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a.YLLD_DI_Spec_pri, 0) as
YLLD_DI_spec_private
into #temp43 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_7a
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a from #temp43;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a order by snz_uid;
delete from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a where YLL is NULL;

--      SUM YLLD

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLL,
(IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_nc
+ IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_DI_spec_public
+ IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_DI_mental_public
+ IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_DI_other_public
+ IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_DI_spec_private
+ IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_DI_mental_private
+ IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a.YLLD_DI_other_private) as YLLD
into #temp44 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_8a
select * into  IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a from #temp44;
select * from  IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a order by snz_uid;

--      ESTABLISH YLL QUARTILES

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.YLL,
ntile(4) over(order by IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.YLL) as YLLq
into #temp45 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a
order by YLL asc
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a from #temp45;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a order by YLL;
```

```
-- ESTABLISH YLLD QUARTILES

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.YLLD,
ntile(4) over(order by IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a.YLLD) as YLLDq
into #temp46 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_9a
order by YLLD asc
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_11a from #temp46;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_11a order by snz_uid;

-- join tables

select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a.YLLq,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_11a.YLLD,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_11a.YLLDq
into #temp47 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a
join IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_11a
on IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_10a.snz_uid = IDI_Sandpit.[DL-MAA2021-
57].DI_2020_final_11a.snz_uid
order by snz_uid;
select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a from #temp47;
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a order by snz_uid;

-- ESTABLISH AREA RESULTS

-- base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a order by snz_uid;

-- code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.m_nm,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLL,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLLq,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLLD,
IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLLDq,
case
when IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLLq > IDI_Sandpit.[DL-MAA2021-
57].DI_2020_final_12a.YLLDq
then IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLLq
```

```
        else IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a.YLLDq
        end as Area_result
        into #temp48 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_12a;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a from #temp48;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a order by snz_uid;

--      IDENTIFY MĀORI AND NON-MĀORI AREA RESULTS

--      MĀORI

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a

--      code
        select * into #temp49 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a
        where m_nm = 1 order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori from #temp49;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori;

--      non-MĀORI

--      base table
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a

--      code
        select * into #temp50 from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a
        where m_nm = 0 order by snz_uid;
        select * into IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori from #temp50;
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori;

--      FOR RELEASE

--      MĀORI

--      total number
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori

--      results
        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
        where Area_result = 1

        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
        where Area_result = 2

        select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
        where Area_result = 3
```

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where Area_result = 4

-- Among the best health outcomes
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where Area_result = 1 or Area_result = 2
order by snz_uid;

-- Among the worst health outcomes
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where Area_result = 3 or Area_result = 4
order by snz_uid;

-- YLLq
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLq = 1

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLq = 2

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLq = 3

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLq = 4

-- YLLDq
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLDq = 1

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLDq = 2

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLDq = 3

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
where YLLDq = 4

-- YLL
select
SUM(YLL)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori
```

```
select
avg(YLL)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori

-- YLLD
select
SUM(YLLD)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori

select
avg(YLLD)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_Māori

-- NON-MĀORI

-- total number
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori

-- results
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where Area_result = 1

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where Area_result = 2

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where Area_result = 3

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where Area_result = 4

-- Among the best health outcomes
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where Area_result = 1 or Area_result = 2
order by snz_uid;

-- Among the worst health outcomes
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where Area_result = 3 or Area_result = 4
order by snz_uid;

-- YLLq
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLq = 1
```

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLq = 2

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLq = 3

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLq = 4

-- YLLDq
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLDq = 1

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLDq = 2

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLDq = 3

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
where YLLDq = 4

-- YLL
select
SUM(YLL)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori

select
avg(YLL)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori

-- YLLD
select
SUM(YLLD)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori

select
avg(YLLD)
from IDI_Sandpit.[DL-MAA2021-57].DI_2020_final_13a_non_Māori
```

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3 order by snz_uid;
```

(2) SMOKING

```
code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_smoking_stus_code,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_smoke_ever_ind_code
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
join IDI_Clean_202403.cen_clean.census_individual_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.cen_clean.census_individual_2018.snz_uid
order by snz_uid;

delete from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a
where cen_ind_smoking_stus_code is NULL and cen_ind_smoke_ever_ind_code is NULL;

delete from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a
where cen_ind_smoking_stus_code = 9 and cen_ind_smoke_ever_ind_code = 9
```

Calculations

If person says they never smoked (as smoke ever) then smoke_score = 0
If person says they still smoke (as smoke_beh_now) then smoke_score = 10
If person says they are an ex-smoker (as smoke_beh_now) then smoke_score = 5

```
code
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.cen_ind_smoke_ever_ind_code as
smoke_ever,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.cen_ind_smoking_stus_code as
smoke_beh_now,
case
when IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.cen_ind_smoke_ever_ind_code = 2
then 0
when IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.cen_ind_smoking_stus_code = 1
then 10
when IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a.cen_ind_smoking_stus_code = 2
```

```
then 5
end as smoke_score
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_2a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_1a;
```

Data for spreadsheet

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_2a
where result = 1 or result = 2;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_smoking_2a
where result = 3 or result = 4
order by snz_uid;
```

(3) DEPRIVATION

base tabes

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3;
select * from IDI_Clean_202403.cen_clean.census_individual_2018;
```

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_NZDep2018 as deprivation,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_ur5ya_address_sa1 as address_5yes_ago
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
join IDI_Clean_202403.cen_clean.census_individual_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.cen_clean.census_individual_2018.snz_uid
order by snz_uid;
```

data for spreadsheet

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a.deprivation
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a
where result = 1 or result = 2
order by snz_uid;

select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a.deprivation
```

```
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_dep_1a
where result = 3 or result = 4
order by snz_uid;
```

(4) AVG INCOME

1. identify income / year

base tables

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3;
select * from IDI_Clean_202403.data.apc_time_series;
```

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.data.apc_time_series.apc_income_tot_amt
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
join IDI_Clean_202403.data.apc_time_series
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.data.apc_time_series.snz_uid
order by snz_uid;
```

2. average income / year / individual

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a.snz_uid,
avg(IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a.apc_income_tot_amt) as
avg_income
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_2a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a
group by IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a.snz_uid
order by snz_uid;
```

```
delete from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_2a where avg_income is null;
```

3. join tables to put result back in

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_2a.avg_income
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a
```

```
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a
join IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_2a
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_1a.snz_uid = IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_2a.snz_uid
order by snz_uid;
```

4. remove duplicates

```
with CTE as
 (
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a.avg_income,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a.snz_uid
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a.snz_uid
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a
) delete from CTE where CNT>1;
```

data for spreadsheet

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a
where result = 1 or result = 2
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_avg_income_3a
where result = 3 or result = 4
order by snz_uid;
```

(6) HEALTH LITERACY

base tables

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3;
select * from IDI_Clean_202403.cen_clean.census_individual_2018;
```

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_hst_qual_code as highest_qualification
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_HL_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
```

```
join IDI_Clean_202403.cen_clean.census_individual_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.cen_clean.census_individual_2018.snz_uid
order by snz_uid;

delete from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_HL_1a
where highest_qualification is NULL
or highest_qualification = 97
or highest_qualification = 99;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_HL_1;

data for spreadsheet

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_HL_1a
where result = 1 or result = 2
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_HL_1a
where result = 3 or result = 4
order by snz_uid;
```

(7) CULTURAL IDENTITY

```
base table
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3;
select * from IDI_Clean_202403.cen_clean.iwi_affiliation_census_2018;

scoring
3 pts for knowing iwi
Don't know, response unidentifed = 4444,5555,7777,8888,9999;
iwi_code

3 pts for speaking te reo
--Te reo = 11,21,22,23,31,32,33,41
--remove = 97,98,99
--not te reo = 12,13,24,25,26,34,51
cen_ind_official_language_code

3 pts for Māori beliefs
--Māori = 6
--not Māori = 0,1,2,3,4,5,7,8,9
cen_ind_religion_output_level1
cen_ind_religion_output_level2
```

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Clean_202403.cen_clean.census_individual_2018.snz_cen_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_official_language_code,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_religion_output_level1,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_religion_output_level2
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
join IDI_Clean_202403.cen_clean.census_individual_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.cen_clean.census_individual_2018.snz_uid
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1
order by snz_uid;

delete from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a
where cen_ind_religion_output_level2 = '206;602'
```

include iwi affiliation data

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a.snz_cen_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a.cen_ind_official_language_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a.cen_ind_religion_output_level1,
IDI_Clean_202403.cen_clean.iwi_affiliation_census_2018.iwi_code
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a
join IDI_Clean_202403.cen_clean.iwi_affiliation_census_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_1a.snz_cen_uid =
IDI_Clean_202403.cen_clean.iwi_affiliation_census_2018.snz_cen_uid
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2
order by snz_uid;
```

remove duplicates

code

```
with CTE as
 (
select
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.cen_ind_official_language_code,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.cen_ind_religion_output_level1,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.iwi_code,
row_number() over (partition by
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.snz_uid
order by
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.iwi_code asc
) as CNT
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a
) delete from CTE where CNT>1;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2 order by snz_uid;

delete from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a where
cen_ind_religion_output_level1 = '6;7';

write case for scores

yes 4 te_reo = 11, 21, 22, 23, 31,32, 33, 41
yes 4 beliefs = 6
yes 4 iwi = all but 5555,7777,8888,9999,4444

score for Māori beliefs

select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.cen_ind_official_language_code as te_reo,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.cen_ind_religion_output_level1,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a.iwi_code as iwi,
case
when cen_ind_religion_output_level1 = 6
then 5
else 0
end as mb_score
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_2a;

score for te reo

select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa.result,
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa.cen_ind_religion_output_level1 as beliefs,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa.te_reo,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa.iwi,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa.mb_score,
case
when te_reo = 11
or te_reo = 21
or te_reo = 22
or te_reo = 23
or te_reo = 31
or te_reo = 32
or te_reo = 33
or te_reo = 41
then 5
else 0
end as tr_score
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_3aa;

score for iwi

select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.beliefs,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.te_reo,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.iwi,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.mb_score,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a.tr_score as reo_score,
case
when iwi is NULL
or iwi = 4444
or iwi = 5555
or iwi = 7777
or iwi = 8888
or iwi = 9999
then 0
else 5
end as i_score
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_4a
order by snz_uid;

sum scores

select
```

```
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.result,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.mb_score,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.reo_score,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.i_score,
 (IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.mb_score
+ IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.reo_score
+ IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a.i_score) as CI_score
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_6a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_5a
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_6 order by snz_uid;
```

data for spreadsheet

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_6a
where result = 1 or result = 2
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_CI_6a
where result = 3 or result = 4
order by snz_uid;
```

(9) URBAN / RURAL

base tabes

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3;
select * from IDI_Clean_202403.cen_clean.census_individual_2083;
```

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_ur_address_urbanruralind
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_urban_rural_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
join IDI_Clean_202403.cen_clean.census_individual_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.cen_clean.census_individual_2018.snz_uid
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_urban_rural_1a;
```

data for spreadsheet

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_urban_rural_1a
where result = 1 or result = 2
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_urban_rural_1a
where result = 3 or result = 4
order by snz_uid;
```

(10) GENDER

base tables

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3;
select * from IDI_Clean_202403.cen_clean.census_individual_2018;
```

code

```
select
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid,
IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.result,
IDI_Clean_202403.cen_clean.census_individual_2018.cen_ind_sex_code as gender
into IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_gender_1a
from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3
join IDI_Clean_202403.cen_clean.census_individual_2018
on IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_3.snz_uid =
IDI_Clean_202403.cen_clean.census_individual_2018.snz_uid
order by snz_uid;

select * from  IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_gender_1a;
```

data for spreadsheet

```
select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_gender_1a
where result = 1 or result = 2
order by snz_uid;

select * from IDI_Sandpit.[DL-MAA2021-57].DI_2019_Māori_gender_1a
where result = 3 or result = 4
order by snz_uid;
```

Appendix 3: Disability Weights

GBD 2019-derived disability-weight comparator table for ICD-coded diabetes complications and comorbidities

GBD 2019 disability weights attach to health states (sequelae), not directly to ICD codes. This table maps each ICD description to the closest defensible GBD 2019 health state and applies that state's published disability weight. The mapping is necessarily approximate; where an ICD code has no direct GBD health-state equivalent, the closest defensible comparator is used and flagged as judgement-based. Every weight is traceable to a named GBD 2019 health state. Where GBD publishes only one health state for a condition (for example chronic kidney disease, for which only a stage IV weight of 0·104 exists), that single published weight is applied across severities rather than interpolating values GBD does not publish.

Acute diabetic crises (ketoacidosis, hyperosmolar crisis, and coma) are excluded from this table and from the YLLD calculation. These are transient, self-resolving events rather than persistent health states, and are not suited to duration-based disability accrual; excluding them prevents an acute event from being counted as prevalent disability over the interval to death.

Source of weights: IHME Global Burden of Disease 2019 disability weights, verified against the official health-state list. Weights shown to three places using the middle-dot convention.

ICD code	ICD description	Closest GBD 2019 health state (comparator)	GBD 2019 source health state — verified weight	DW	Rationale
25040	Diabetes with renal manifestations, type II or unspecified type, not stated as uncontrolled	Chronic kidney disease due to diabetes, non-dialysis / moderate CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Renal manifestation codes are better aligned with CKD due to diabetes than diabetic neuropathy or acute diabetic foot states. In absence of CKD stage, 0.072 is a conservative mid-severity CKD comparator and harmonises with E1122/E1129.
25041	Diabetes with renal manifestations, type I [juvenile type], not stated as uncontrolled	Chronic kidney disease due to diabetes, non-dialysis / moderate CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Renal manifestation codes are better aligned with CKD due to diabetes than diabetic neuropathy or acute diabetic foot states. In absence of CKD stage, 0.072 is a conservative mid-severity CKD comparator and harmonises with E1122/E1129.
25042	Diabetes with renal manifestations, type II or unspecified type, uncontrolled	Chronic kidney disease due to diabetes, non-dialysis / moderate CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Renal manifestation codes are better aligned with CKD due to diabetes than diabetic neuropathy or acute diabetic foot states. In absence of CKD stage, 0.072 is a conservative mid-severity CKD comparator and harmonises with E1122/E1129.

25043	Diabetes with renal manifestations, type I [juvenile type], uncontrolled	Chronic kidney disease due to diabetes, non-dialysis / moderate CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Renal manifestation codes are better aligned with CKD due to diabetes than diabetic neuropathy or acute diabetic foot states. In absence of CKD stage, 0.072 is a conservative mid-severity CKD comparator and harmonises with E1122/E1129.
25050	Diabetes with ophthalmic manifestations, type II or unspecified type, not stated as uncontrolled	Diabetes-related moderate vision impairment / diabetic retinopathy comparator	Distance vision, moderate impairment (0·031)	0·031	The ICD-9 ophthalmic category does not specify severity. A moderate vision-loss comparator of 0.031 is defensible as a conservative default unless evidence indicates severe vision loss or blindness.
25051	Diabetes with ophthalmic manifestations, type I [juvenile type], not stated as uncontrolled	Diabetes-related moderate vision impairment / diabetic retinopathy comparator	Distance vision, moderate impairment (0·031)	0·031	The ICD-9 ophthalmic category does not specify severity. A moderate vision-loss comparator of 0.031 is defensible as a conservative default unless evidence indicates severe vision loss or blindness.
25052	Diabetes with ophthalmic manifestations, type II or unspecified type, uncontrolled	Diabetes-related moderate vision impairment / diabetic retinopathy comparator	Distance vision, moderate impairment (0·031)	0·031	The ICD-9 ophthalmic category does not specify severity. A moderate vision-loss comparator of 0.031 is defensible as a conservative default unless evidence indicates severe vision loss or blindness.
25053	Diabetes with ophthalmic manifestations, type I [juvenile type], uncontrolled	Diabetes-related moderate vision impairment / diabetic retinopathy comparator	Distance vision, moderate impairment (0·031)	0·031	The ICD-9 ophthalmic category does not specify severity. A moderate vision-loss comparator of 0.031 is defensible as a conservative default unless evidence indicates severe vision loss or blindness.
25060	Diabetes with neurological manifestations, type II or unspecified type, not stated as uncontrolled	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	The code description directly indicates neurological manifestations. The GBD diabetic neuropathy health-state weight of 0.133 is the closest and most defensible comparator.
25061	Diabetes with neurological manifestations, type I [juvenile type], not stated as uncontrolled	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	The code description directly indicates neurological manifestations. The GBD diabetic neuropathy health-state weight of 0.133 is the closest and most defensible comparator.
25062	Diabetes with neurological manifestations, type II or unspecified type, uncontrolled	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	The code description directly indicates neurological manifestations. The GBD diabetic neuropathy health-state weight of 0.133 is the closest and most defensible comparator.
25063	Diabetes with neurological manifestations, type I [juvenile type], uncontrolled	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	The code description directly indicates neurological manifestations. The GBD diabetic neuropathy health-state weight of 0.133 is the closest and most defensible comparator.

25070	Diabetes with peripheral circulatory disorders, type II or unspecified type, not stated as uncontrolled	Peripheral angiopathy without gangrene / uncomplicated vascular complication	Judgement-based uncomplicated peripheral-vascular comparator	0·049	The closest ICD-10 equivalent is E1151 peripheral angiopathy without gangrene. In the absence of gangrene, ulcer, or amputation, 0.049 is more defensible than the neuropathy weight.
25071	Diabetes with peripheral circulatory disorders, type I [juvenile type], not stated as uncontrolled	Peripheral angiopathy without gangrene / uncomplicated vascular complication	Judgement-based uncomplicated peripheral-vascular comparator	0·049	The closest ICD-10 equivalent is E1151 peripheral angiopathy without gangrene. In the absence of gangrene, ulcer, or amputation, 0.049 is more defensible than the neuropathy weight.
25072	Diabetes with peripheral circulatory disorders, type II or unspecified type, uncontrolled	Peripheral angiopathy without gangrene / uncomplicated vascular complication	Judgement-based uncomplicated peripheral-vascular comparator	0·049	The closest ICD-10 equivalent is E1151 peripheral angiopathy without gangrene. In the absence of gangrene, ulcer, or amputation, 0.049 is more defensible than the neuropathy weight.
25073	Diabetes with peripheral circulatory disorders, type I [juvenile type], uncontrolled	Peripheral angiopathy without gangrene / uncomplicated vascular complication	Judgement-based uncomplicated peripheral-vascular comparator	0·049	The closest ICD-10 equivalent is E1151 peripheral angiopathy without gangrene. In the absence of gangrene, ulcer, or amputation, 0.049 is more defensible than the neuropathy weight.
25080	Diabetes with other specified manifestations, type II or unspecified type, not stated as uncontrolled	Other specified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	The description is non-specific and does not identify neuropathy, CKD stage, severe vision loss, diabetic foot, or amputation. A conservative GBD-derived uncomplicated diabetes comparator is most defensible.
25081	Diabetes with other specified manifestations, type I [juvenile type], not stated as uncontrolled	Other specified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	The description is non-specific and does not identify neuropathy, CKD stage, severe vision loss, diabetic foot, or amputation. A conservative GBD-derived uncomplicated diabetes comparator is most defensible.
25082	Diabetes with other specified manifestations, type II or unspecified type, uncontrolled	Other specified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	The description is non-specific and does not identify neuropathy, CKD stage, severe vision loss, diabetic foot, or amputation. A conservative GBD-derived uncomplicated diabetes comparator is most defensible.
25083	Diabetes with other specified manifestations, type I [juvenile type], uncontrolled	Other specified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	The description is non-specific and does not identify neuropathy, CKD stage, severe vision loss, diabetic foot, or amputation. A conservative GBD-derived uncomplicated diabetes comparator is most defensible.
25090	Diabetes with unspecified	Unspecified diabetes complication; conservative	Uncomplicated diabetes	0·049	Because the ICD description does not identify the

	complication, type II or unspecified type, not stated as uncontrolled	uncomplicated diabetes comparator	comparator (0·049; conservative)		complication type or severity, 0.049 is the most defensible conservative comparator. Higher weights require evidence of a specific sequela.
25091	Diabetes with unspecified complication, type I [juvenile type], not stated as uncontrolled	Unspecified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	Because the ICD description does not identify the complication type or severity, 0.049 is the most defensible conservative comparator. Higher weights require evidence of a specific sequela.
25092	Diabetes with unspecified complication, type II or unspecified type, uncontrolled	Unspecified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	Because the ICD description does not identify the complication type or severity, 0.049 is the most defensible conservative comparator. Higher weights require evidence of a specific sequela.
25093	Diabetes with unspecified complication, type I [juvenile type], uncontrolled	Unspecified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	Because the ICD description does not identify the complication type or severity, 0.049 is the most defensible conservative comparator. Higher weights require evidence of a specific sequela.
E1121	Type 2 diabetes mellitus with diabetic nephropathy	Chronic kidney disease due to diabetes, non-dialysis / moderate CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Nephropathy is renal disease, not neuropathy. Without stage-specific evidence, 0.072 is a defensible CKD comparator and avoids applying the diabetic neuropathy weight to kidney disease.
E1122	Type 2 diabetes mellitus with diabetic chronic kidney disease	Chronic kidney disease due to diabetes, non-dialysis / moderate CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	The code directly identifies diabetic CKD. In the absence of stage, dialysis, or transplant information, 0.072 is a defensible mid-severity CKD comparator.
E1129	Type 2 diabetes mellitus with other diabetic kidney complication	Other diabetic kidney complication / CKD comparator	Chronic kidney disease (stage IV) (0·104)	0·104	The kidney-specific description supports CKD-based mapping. 0.072 is a conservative defensible comparator where CKD stage is not available.
E1131	Type 2 diabetes mellitus with unspecified diabetic retinopathy	Diabetes-related moderate vision impairment / retinopathy comparator	Distance vision, moderate impairment (0·031)	0·031	Unspecified retinopathy does not prove severe vision loss or blindness. A moderate vision impairment comparator of 0.031 is defensible as a default.
E1132	Type 2 diabetes mellitus with mild nonproliferative diabetic retinopathy	Mild vision impairment / mild diabetic retinopathy	Distance vision, mild impairment (0·003)	0·003	Mild nonproliferative retinopathy is best treated as a low-disability visual health state. 0.003 is defensible and conservative.
E1133	Type 2 diabetes mellitus with moderate nonproliferative diabetic retinopathy	Diabetes-related moderate vision impairment	Distance vision, moderate impairment (0·031)	0·031	Moderate nonproliferative retinopathy aligns most closely with moderate vision impairment rather than severe vision loss. 0.031 is defensible.
E1134	Type 2 diabetes mellitus with severe	Diabetes-related severe vision loss	Distance vision, severe impairment (0·184)	0·184	Severe nonproliferative retinopathy is more closely aligned with severe vision-

	nonproliferative diabetic retinopathy				loss sequelae than moderate vision impairment. Use 0.184 if severity is intended to represent severe visual impairment; otherwise document conservative sensitivity analysis.
E1135	Type 2 diabetes mellitus with proliferative diabetic retinopathy	Diabetes-related severe vision loss / pre-blindness comparator	Distance vision, severe impairment (0·184)	0·184	Proliferative retinopathy is a severe sight-threatening state. A severe vision-loss comparator of 0.184 is more defensible than moderate vision impairment unless visual acuity data indicate otherwise.
E1136	Type 2 diabetes mellitus with diabetic cataract	Diabetes-related moderate vision impairment / cataract-associated visual impairment	Distance vision, moderate impairment (0·031)	0·031	Cataract severity is not specified. A moderate vision impairment comparator of 0.031 is defensible unless evidence indicates severe vision loss or blindness.
E1139	Type 2 diabetes mellitus with other diabetic ophthalmic complication	Other diabetic ophthalmic complication / moderate vision impairment comparator	Distance vision, moderate impairment (0·031)	0·031	The ophthalmic complication is not severity-specific. 0.031 is a defensible conservative comparator for moderate visual impairment.
E1140	Type 2 diabetes mellitus with diabetic neuropathy, unspecified	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	Direct mapping to GBD diabetic neuropathy. The code and sequela descriptions align well.
E1141	Type 2 diabetes mellitus with diabetic mononeuropathy	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	Neuropathy is explicitly identified. The GBD diabetic neuropathy weight is the closest comparator.
E1142	Type 2 diabetes mellitus with diabetic polyneuropathy	Diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	Polyneuropathy is a core diabetic neuropathy manifestation. Direct GBD comparator is diabetic neuropathy.
E1143	Type 2 diabetes mellitus with diabetic neuralgia	Painful diabetic neuropathy / diabetic neuropathy	Diabetic neuropathy (0·133)	0·133	Neuralgia indicates painful nerve involvement. The GBD diabetic neuropathy weight is the most defensible diabetes-specific comparator.
E1149	Type 2 diabetes mellitus with other diabetic neurological complication	Other diabetic neurological complication / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Neurological complication is most closely aligned with diabetic neuropathy when no more specific neurological sequela is provided.
E1151	Type 2 diabetes mellitus with diabetic peripheral angiopathy without gangrene	Peripheral angiopathy without gangrene / uncomplicated vascular complication	Judgement-based uncomplicated peripheral-vascular comparator	0·049	The description excludes gangrene. In absence of ulcer/amputation, uncomplicated diabetes/peripheral vascular complication comparator of 0.049 is defensible.
E1152	Type 2 diabetes mellitus with diabetic peripheral angiopathy with gangrene	Diabetic foot / severe lower-extremity complication	Diabetic neuropathy with diabetic foot (0·150)	0·15	Gangrene indicates severe lower-extremity complication. The closest diabetes-specific GBD comparator is diabetic foot. If amputation is documented, an amputation health state should be used instead.
E1159	Type 2 diabetes mellitus with other	Other diabetic circulatory complication; intermediate vascular comparator	Judgement-based; see rationale	0·08	The code is vascular but not specific for gangrene, ulcer, or amputation. 0.080 is a

	circulatory complications				pragmatic intermediate comparator between uncomplicated vascular disease and diabetic foot; it should be flagged as judgement-based.
E1161	Type 2 diabetes mellitus with diabetic arthropathy	Diabetic arthropathy / moderate musculoskeletal impairment comparator	Musculoskeletal problems, lower limbs, moderate (0·079)	0·079	Arthropathy is joint disease, not neuropathy. In the absence of a diabetes-specific GBD arthropathy sequela, a moderate musculoskeletal/functional impairment comparator around 0.072 is more defensible than the neuropathy weight.
E1164	Type 2 diabetes mellitus with hypoglycaemia	Hypoglycaemia / acute metabolic event; conservative uncomplicated diabetes comparator unless severe episode is modelled	Uncomplicated diabetes comparator (0·049; episodic, conservative)	0·049	Hypoglycaemia is not diabetic neuropathy and is usually episodic. For prevalent annual YLD, 0.049 is a conservative comparator; severe events should be modelled by episode duration.
E1165	Type 2 diabetes mellitus with hyperglycaemia	Hyperglycaemia / metabolic dysregulation; conservative uncomplicated diabetes comparator unless acute crisis is modelled	Uncomplicated diabetes comparator (0·049; episodic, conservative)	0·049	Hyperglycaemia alone does not imply neuropathy, CKD, diabetic foot, or severe vision loss. 0.049 is the defensible conservative comparator unless acute crisis severity/duration is explicitly modelled.
E1169	Type 2 diabetes mellitus with other specified complication	Other specified diabetes complication; conservative uncomplicated diabetes comparator	Uncomplicated diabetes comparator (0·049; conservative)	0·049	The complication is specified only as “other” and no high-disability sequela is identified. 0.049 is a defensible conservative GBD-derived comparator.
295	Schizophrenic psychoses	Schizophrenia, residual state	Schizophrenia, residual state (0·588)	0·588	Mapped to the GBD 2019 schizophrenia residual health state because the ICD heading does not specify acute psychosis; residual state is the more conservative chronic comparator.
296	Manic-depressive	Bipolar disorder, depressive/moderate episode	Bipolar disorder, depressive state → MDD moderate (0·396)	0·396	Mapped to the GBD 2019 bipolar depressive/moderate health state; this is a defensible mid-severity comparator where the ICD heading does not specify manic, severe, or psychotic state.
300	Anxiety	Anxiety disorders, moderate	Anxiety disorders, moderate (0·133)	0·133	Mapped to the GBD 2019 moderate anxiety health state, consistent with a symptomatic disorder without evidence of severe anxiety or suicidality.
301	Personality disorder	Severe other mental disorder / severe anxiety-type functional limitation	Anxiety disorders, severe (0·523)	0·523	GBD 2019 does not provide a specific personality-disorder health state in this table; severe other mental disorder is used as the closest functional comparator.
311	Depressive disorder, not elsewhere classified	Major depressive disorder, moderate episode	Major depressive disorder, moderate episode (0·396)	0·396	Mapped to the GBD 2019 moderate depressive episode because the ICD heading is non-specific and

					does not indicate mild or severe depression.
F01	Vascular dementia	Dementia, moderate severity	Dementia, moderate (0·377)	0·377	Mapped to a moderate dementia comparator because the ICD heading does not specify severity; this is a central chronic-state estimate.
F03	Unspecified dementia	Dementia, moderate severity	Dementia, moderate (0·377)	0·377	Mapped to a moderate dementia comparator because the ICD heading does not specify severity; this is a central chronic-state estimate.
F20	Schizophrenia	Schizophrenia, residual state	Schizophrenia, residual state (0·588)	0·588	Mapped to the GBD 2019 schizophrenia residual health state because the ICD heading does not specify acute psychosis; residual state is the more conservative chronic comparator.
F31	Bipolar disorder	Bipolar disorder, depressive/moderate episode	Bipolar disorder, depressive state → MDD moderate (0·396)	0·396	Mapped to the GBD 2019 bipolar depressive/moderate health state; this is a defensible mid-severity comparator where the ICD heading does not specify manic, severe, or psychotic state.
F41	Other anxiety disorders	Anxiety disorders, moderate	Anxiety disorders, moderate (0·133)	0·133	Mapped to the GBD 2019 moderate anxiety health state, consistent with a symptomatic disorder without evidence of severe anxiety or suicidality.
F60	Specific personality disorders	Severe other mental disorder / severe anxiety-type functional limitation	Anxiety disorders, severe (0·523)	0·523	GBD 2019 does not provide a specific personality-disorder health state in this table; severe other mental disorder is used as the closest functional comparator.
C18	Malignant neoplasm of colon	Cancer diagnosis/treatment or controlled phase comparator	Cancer, diagnosis/primary-therapy phase (0·288; generic, judgement-based)	0·288	Mapped to a generic GBD malignant-neoplasm health-state comparator because the ICD heading identifies cancer but not stage or treatment phase.
C44	Other malignant neoplasm of skin	Cancer diagnosis/treatment or controlled phase comparator	Cancer, diagnosis/primary-therapy phase (0·288; generic, judgement-based)	0·288	Mapped to a generic GBD malignant-neoplasm health-state comparator because the ICD heading identifies cancer but not stage or treatment phase.
153	Malignant neoplasm of colon	Cancer diagnosis/treatment or controlled phase comparator	Cancer, diagnosis/primary-therapy phase (0·288; generic, judgement-based)	0·288	Mapped to a generic GBD malignant-neoplasm health-state comparator because the ICD heading identifies cancer but not stage or treatment phase.
173	Other malignant neoplasm of skin	Cancer diagnosis/treatment or controlled phase comparator	Cancer, diagnosis/primary-therapy phase (0·288; generic, judgement-based)	0·288	Mapped to a generic GBD malignant-neoplasm health-state comparator because the ICD heading identifies cancer but not stage or treatment phase.
D50	Iron deficiency anemia	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD

					anaemia comparator is the defensible default.
D52	Folate deficiency anemia	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD anaemia comparator is the defensible default.
D63	Anemia in chronic diseases classified elsewhere	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD anaemia comparator is the defensible default.
D64	Other anemias	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD anaemia comparator is the defensible default.
280	Iron deficiency anemia	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD anaemia comparator is the defensible default.
281	Other deficiency anemia	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD anaemia comparator is the defensible default.
285	Other and unspecified anemias	Mild anaemia	Anaemia, mild (0·004)	0·004	Mapped to mild anaemia; ICD heading does not specify haemoglobin severity, so the lowest symptomatic GBD anaemia comparator is the defensible default.
G45	Transient cerebral ischemic attacks and related syndromes	Transient ischaemic attack / mild cerebrovascular event comparator	Stroke, long-term consequences, mild (proxy for TIA) (0·019)	0·019	Mapped to a mild transient cerebrovascular comparator because the code describes TIA rather than completed stroke.
G47	Sleep disorder	Sleep disorder, mild/moderate functional limitation	No GBD 2019 sleep-disorder health-state; judgement-based low-disability comparator	0·03	Mapped to a mild sleep-disorder comparator because the ICD heading does not specify severe sleep-related disability.
327	Organic sleep disorder	Sleep disorder, mild/moderate functional limitation	No GBD 2019 sleep-disorder health-state; judgement-based low-disability comparator	0·03	Mapped to a mild sleep-disorder comparator because the ICD heading does not specify severe sleep-related disability.
G56	Mononeuropathies of upper limb	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
G57	Mononeuropathies of lower limb	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable

					sensory/functional limitation.
G58	Other mononeuropathies	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
G62	Other and unspecified polyneuropathies	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
G81	Hemiplegia and hemiparesis	Post-stroke motor impairment, mild	Stroke, long-term consequences, mild (0·019)	0·019	Mapped to a mild motor-impairment comparator; the ICD heading does not specify dependence, severity, or stroke phase.
342	Hemiplegia and hemiparesis	Post-stroke motor impairment, mild	Stroke, long-term consequences, mild (0·019)	0·019	Mapped to a mild motor-impairment comparator; the ICD heading does not specify dependence, severity, or stroke phase.
354	Epilepsy and recurrent seizures	Epilepsy, active recurrent seizures	Epilepsy, seizures 1–11 per year (0·263)	0·263	Mapped to an active epilepsy/recurrent-seizure comparator because the code indicates recurrent seizures rather than remote history only.
353	Nerve root and plexus disorders	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
354	Mononeuritis of upper limb and mononeuritis multiplex	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
355	Mononeuritis of lower limb and unspecified site	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
357	Inflammatory and toxic neuropathy	Peripheral neuropathy / diabetic neuropathy comparator	Diabetic neuropathy (0·133)	0·133	Mapped to the GBD diabetic/peripheral neuropathy health state because the code describes neuropathy or mononeuritis with comparable sensory/functional limitation.
H26	Other cataract	Moderate vision loss	Distance vision, moderate impairment (0·031)	0·031	Mapped to moderate vision loss because the code indicates an eye disorder but

					does not specify blindness or severe visual loss.
H35	Other retinal disorders	Moderate vision loss	Distance vision, moderate impairment (0·031)	0·031	Mapped to moderate vision loss because the code indicates an eye disorder but does not specify blindness or severe visual loss.
H54	Blindness and low vision	Severe vision loss	Distance vision, severe impairment (0·184)	0·184	Mapped to severe vision loss because the ICD heading explicitly includes blindness/low vision.
362	Other proliferative retinopathy	Closest GBD chronic symptomatic health-state comparator	Judgement-based; see rationale	0·031	Mapped by description to the closest available GBD 2019 sequela/health state; ICD heading is not directly represented as a GBD sequela.
365	Glaucoma	Moderate vision loss	Distance vision, moderate impairment (0·031)	0·031	Mapped to moderate vision loss because the code indicates an eye disorder but does not specify blindness or severe visual loss.
366	Cataract	Moderate vision loss	Distance vision, moderate impairment (0·031)	0·031	Mapped to moderate vision loss because the code indicates an eye disorder but does not specify blindness or severe visual loss.
368	Visual disturbances	Moderate vision loss	Distance vision, moderate impairment (0·031)	0·031	Mapped to moderate vision loss because the code indicates an eye disorder but does not specify blindness or severe visual loss.
369	Blindness and low vision	Severe vision loss	Distance vision, severe impairment (0·184)	0·184	Mapped to severe vision loss because the ICD heading explicitly includes blindness/low vision.
I10	Essential primary hypertension	Hypertension / cardiopulmonary vascular disease comparator	GBD models hypertension as a risk factor, not a DW health-state; judgement-based comparator	0·072	Mapped to a hypertension or pulmonary vascular disease comparator because the ICD heading does not specify advanced heart failure or dialysis-level disease.
I12	Hypertensive chronic kidney disease	Hypertensive end-organ disease / heart-kidney disease comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to a more severe hypertension-related end-organ damage comparator rather than uncomplicated hypertension.
I20	Angina pectoris	Stable angina pectoris	Angina pectoris, moderate (0·080)	0·08	Mapped to GBD angina health-state comparator because the ICD heading directly identifies angina.
I25	Chronic ischemic heart disease	Chronic ischaemic heart disease / post-myocardial infarction comparator	Acute myocardial infarction, days 3–28 (0·074)	0·074	Mapped to chronic ischaemic heart disease/post-MI comparator rather than acute MI because the ICD heading indicates chronic or old disease.
I27	Other secondary pulmonary hypertension	Hypertension / cardiopulmonary vascular disease comparator	GBD models hypertension as a risk factor, not a DW health-state; judgement-based comparator	0·072	Mapped to a hypertension or pulmonary vascular disease comparator because the ICD heading does not specify advanced heart failure or dialysis-level disease.
I47	Paroxysmal tachycardia	Symptomatic cardiac arrhythmia	Atrial fibrillation and flutter, symptomatic (0·224)	0·224	Mapped to symptomatic arrhythmia comparator because the code describes rhythm/conduction disease.
I48	Atrial fibrillation and flutter	Symptomatic cardiac arrhythmia	Atrial fibrillation and flutter,	0·224	Mapped to symptomatic arrhythmia comparator

			symptomatic (0·224)		because the code describes rhythm/conduction disease.
I49	Other cardiac arrhythmias	Symptomatic cardiac arrhythmia	Atrial fibrillation and flutter, symptomatic (0·224)	0·224	Mapped to symptomatic arrhythmia comparator because the code describes rhythm/conduction disease.
I50	Heart failure	Heart failure, mild/moderate	Heart failure, moderate (0·072)	0·072	Mapped to a heart-failure comparator; severity is unspecified, so the lower/moderate chronic-state weight is used.
I51	Complications and ill-defined descriptions of heart disease	Closest GBD chronic symptomatic health-state comparator	Judgement-based; see rationale	0·049	Mapped by description to the closest available GBD 2019 sequela/health state; ICD heading is not directly represented as a GBD sequela.
I63	Cerebral infarction	Stroke, long-term mild/moderate sequela	Stroke, long-term consequences, mild (0·019)	0·019	Mapped to chronic stroke sequela rather than acute stroke because the table represents prevalent disability weights.
I70	Atherosclerosis	Peripheral arterial disease / vascular disease without gangrene	Judgement-based uncomplicated peripheral-vascular comparator	0·049	Mapped to peripheral vascular disease without gangrene or amputation; this is the closest chronic vascular comparator.
I74	Arterial embolism and thrombosis	Vascular thrombosis/thrombophlebitis comparator	Judgement-based vascular comparator (no exact GBD thrombophlebitis state)	0·114	Mapped to a vascular thrombosis comparator because the code identifies thrombotic vascular disease rather than simple vascular risk.
I80	Phlebitis and thrombophlebitis	Vascular thrombosis/thrombophlebitis comparator	Judgement-based vascular comparator (no exact GBD thrombophlebitis state)	0·049	Mapped to a vascular thrombosis comparator because the code identifies thrombotic vascular disease rather than simple vascular risk.
I95	Hypotension	Symptomatic hypotension/shock-like circulatory state comparator	No GBD hypotension health-state; judgement-based comparator	0·179	Mapped to symptomatic hypotension comparator because the code implies circulatory symptoms rather than hypertension-related risk.
393	Chronic rheumatic pericarditis	Valvular/pericardial heart disease comparator	Judgement-based structural-heart comparator (no single GBD valvular DW)	0·149	Mapped to chronic structural heart disease comparator because the ICD heading identifies valve/pericardial/endocardial disease.
394	Diseases of mitral valve	Valvular/pericardial heart disease comparator	Judgement-based structural-heart comparator (no single GBD valvular DW)	0·049	Mapped to chronic structural heart disease comparator because the ICD heading identifies valve/pericardial/endocardial disease.
395	Diseases of aortic valve	Valvular/pericardial heart disease comparator	Judgement-based structural-heart comparator (no single GBD valvular DW)	0·049	Mapped to chronic structural heart disease comparator because the ICD heading identifies valve/pericardial/endocardial disease.
396	Diseases of mitral and aortic valves	Valvular/pericardial heart disease comparator	Judgement-based structural-heart comparator (no single GBD valvular DW)	0·049	Mapped to chronic structural heart disease comparator because the ICD heading identifies valve/pericardial/endocardial disease.

401	Essential hypertension	Hypertension / cardiopulmonary vascular disease comparator	GBD models hypertension as a risk factor, not a DW health-state; judgement-based comparator	0·072	Mapped to a hypertension or pulmonary vascular disease comparator because the ICD heading does not specify advanced heart failure or dialysis-level disease.
402	Hypertensive heart disease	Hypertensive end-organ disease / heart-kidney disease comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to a more severe hypertension-related end-organ damage comparator rather than uncomplicated hypertension.
403	Hypertensive chronic kidney disease	Hypertensive end-organ disease / heart-kidney disease comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to a more severe hypertension-related end-organ damage comparator rather than uncomplicated hypertension.
404	Hypertensive heart and chronic kidney disease	Hypertensive end-organ disease / heart-kidney disease comparator	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to a more severe hypertension-related end-organ damage comparator rather than uncomplicated hypertension.
405	Secondary hypertension	Hypertension / cardiopulmonary vascular disease comparator	GBD models hypertension as a risk factor, not a DW health-state; judgement-based comparator	0·072	Mapped to a hypertension or pulmonary vascular disease comparator because the ICD heading does not specify advanced heart failure or dialysis-level disease.
412	Old myocardial infarction	Chronic ischaemic heart disease / post-myocardial infarction comparator	Acute myocardial infarction, days 3–28 (0·074)	0·074	Mapped to chronic ischaemic heart disease/post-MI comparator rather than acute MI because the ICD heading indicates chronic or old disease.
413	Angina pectoris	Stable angina pectoris	Angina pectoris, moderate (0·080)	0·08	Mapped to GBD angina health-state comparator because the ICD heading directly identifies angina.
414	Other forms of chronic ischemic heart disease	Chronic ischaemic heart disease / post-myocardial infarction comparator	Acute myocardial infarction, days 3–28 (0·074)	0·074	Mapped to chronic ischaemic heart disease/post-MI comparator rather than acute MI because the ICD heading indicates chronic or old disease.
416	Chronic pulmonary heart disease	Hypertension / cardiopulmonary vascular disease comparator	GBD models hypertension as a risk factor, not a DW health-state; judgement-based comparator	0·072	Mapped to a hypertension or pulmonary vascular disease comparator because the ICD heading does not specify advanced heart failure or dialysis-level disease.
423	Other diseases of pericardium	Valvular/pericardial heart disease comparator	Judgement-based structural-heart comparator (no single GBD valvular DW)	0·071	Mapped to chronic structural heart disease comparator because the ICD heading identifies valve/pericardial/endocardial disease.
424	Other diseases of endocardium	Valvular/pericardial heart disease comparator	Judgement-based structural-heart comparator (no single GBD valvular DW)	0·072	Mapped to chronic structural heart disease comparator because the ICD heading identifies valve/pericardial/endocardial disease.
426	Conduction disorders	Symptomatic cardiac arrhythmia	Atrial fibrillation and flutter, symptomatic (0·224)	0·224	Mapped to symptomatic arrhythmia comparator because the code describes rhythm/conduction disease.
427	Cardiac dysrhythmias	Symptomatic cardiac arrhythmia	Atrial fibrillation and flutter, symptomatic (0·224)	0·224	Mapped to symptomatic arrhythmia comparator because the code describes rhythm/conduction disease.

428	Heart failure	Heart failure, mild/moderate	Heart failure, moderate (0·072)	0·072	Mapped to a heart-failure comparator; severity is unspecified, so the lower/moderate chronic-state weight is used.
440	Atherosclerosis	Peripheral arterial disease / vascular disease without gangrene	Judgement-based uncomplicated peripheral-vascular comparator	0·049	Mapped to peripheral vascular disease without gangrene or amputation; this is the closest chronic vascular comparator.
443	Other peripheral vascular disease	Peripheral arterial disease / vascular disease without gangrene	Judgement-based uncomplicated peripheral-vascular comparator	0·049	Mapped to peripheral vascular disease without gangrene or amputation; this is the closest chronic vascular comparator.
451	Phlebitis and thrombophlebitis	Vascular thrombosis/thrombophlebitis comparator	Judgement-based vascular comparator (no exact GBD thrombophlebitis state)	0·049	Mapped to a vascular thrombosis comparator because the code identifies thrombotic vascular disease rather than simple vascular risk.
452	Portal vein thrombosis	Vascular thrombosis/thrombophlebitis comparator	Judgement-based vascular comparator (no exact GBD thrombophlebitis state)	0·114	Mapped to a vascular thrombosis comparator because the code identifies thrombotic vascular disease rather than simple vascular risk.
458	Hypotension	Symptomatic hypotension/shock-like circulatory state comparator	No GBD hypotension health-state; judgement-based comparator	0·179	Mapped to symptomatic hypotension comparator because the code implies circulatory symptoms rather than hypertension-related risk.
J44	Other chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease, moderate/severe	COPD, moderate (0·225)	0·225	Mapped to symptomatic COPD comparator because the ICD heading identifies chronic obstructive pulmonary disease.
J90	Pleural effusion, not elsewhere classified	Chronic respiratory disease, mild/moderate	Nearest GBD chronic-respiratory state, mild–moderate (judgement)	0·072	Mapped to chronic respiratory disease comparator; severity is not specified.
J98	Other respiratory disorders	Chronic respiratory disease, mild/moderate	Nearest GBD chronic-respiratory state, mild–moderate (judgement)	0·072	Mapped to chronic respiratory disease comparator; severity is not specified.
491	Chronic bronchitis	Chronic respiratory disease, mild/moderate	Nearest GBD chronic-respiratory state, mild–moderate (judgement)	0·072	Mapped to chronic respiratory disease comparator; severity is not specified.
493	Asthma	Asthma, mild/moderate symptomatic	Asthma, partially controlled (0·036)	0·036	Mapped to asthma comparator; unspecified severity supports a mild/moderate chronic-state weight.
K29	Gastritis and duodenitis	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.
K59	Other functional intestinal disorders	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.

K65	Peritonitis	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.
K81	Cholecystitis	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.
K92	Other diseases of digestive system	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.
530	Diseases of esophagus	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.
535	Gastritis and duodenitis	Symptomatic gastrointestinal disorder	No single GBD GI health-state; judgement-based symptomatic-GI comparator	0·114	Mapped to symptomatic gastrointestinal disorder comparator because the ICD heading indicates active digestive disease without severity staging.
L97	Non-pressure chronic ulcer of unspecified heel and midfoot	Diabetic foot / chronic skin ulcer	Diabetic neuropathy with diabetic foot (0·150)	0·15	Mapped to diabetic foot/chronic ulcer comparator because the code identifies a chronic lower-limb or skin ulcer.
707	Chronic ulcer of skin	Diabetic foot / chronic skin ulcer	Diabetic neuropathy with diabetic foot (0·150)	0·15	Mapped to diabetic foot/chronic ulcer comparator because the code identifies a chronic lower-limb or skin ulcer.
N183	Chronic kidney disease stage 3 moderate	Chronic kidney disease, stage 3 or unspecified	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 3/unspecified comparator when severity is stage 3 or absent.
N184	Chronic kidney disease stage 4 severe	Chronic kidney disease, stage 4	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 4 comparator because the ICD heading directly specifies severe CKD.
N185	Chronic kidney disease stage 5	Chronic kidney disease, stage 5	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 5 comparator because the ICD heading directly specifies CKD stage 5.
N186	End stage renal disease chronic kidney disease requiring chronic dialysis	End-stage kidney disease on dialysis	End-stage renal disease, on dialysis (0·571)	0·571	Mapped to GBD end-stage kidney disease requiring dialysis because the ICD heading explicitly identifies dialysis/ESRD.
N189	Chronic kidney disease unspecified	Chronic kidney disease, stage 3 or unspecified	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 3/unspecified comparator when severity is stage 3 or absent.
5853	Chronic kidney disease, Stage III (moderate)	Chronic kidney disease, stage 3 or unspecified	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 3/unspecified comparator when severity is stage 3 or absent.
5854	Chronic kidney disease, Stage IV (severe)	Chronic kidney disease, stage 4	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 4 comparator because the ICD heading directly specifies severe CKD.

5855	Chronic kidney disease, Stage V	Chronic kidney disease, stage 5	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 5 comparator because the ICD heading directly specifies CKD stage 5.
5856	End stage renal disease	End-stage kidney disease on dialysis	End-stage renal disease, on dialysis (0·571)	0·571	Mapped to GBD end-stage kidney disease requiring dialysis because the ICD heading explicitly identifies dialysis/ESRD.
5859	Chronic kidney disease, unspecified	Chronic kidney disease, stage 3 or unspecified	Chronic kidney disease (stage IV) (0·104)	0·104	Mapped to CKD stage 3/unspecified comparator when severity is stage 3 or absent.
Z89.4	Acquired absence of foot and ankle	Lower-limb amputation with prosthesis comparator	Diabetic neuropathy with treated amputation (0·167)	0·167	Mapped to lower-limb amputation comparator; prosthesis status is not specified, so a conservative treated-amputation comparator is used.
Z89.5	Acquired absence of leg below knee	Lower-limb amputation with prosthesis comparator	Diabetic neuropathy with treated amputation (0·167)	0·167	Mapped to lower-limb amputation comparator; prosthesis status is not specified, so a conservative treated-amputation comparator is used.
Z89.6	Acquired absence of leg above knee	Lower-limb amputation with prosthesis comparator	Diabetic neuropathy with treated amputation (0·167)	0·167	Mapped to lower-limb amputation comparator; prosthesis status is not specified, so a conservative treated-amputation comparator is used.
Z89.7	Acquired absence of both lower limbs	Lower-limb amputation with prosthesis comparator	Diabetic neuropathy with treated amputation (0·167)	0·167	Mapped to lower-limb amputation comparator; prosthesis status is not specified, so a conservative treated-amputation comparator is used.
Z99.2	Dependence on renal dialysis	End-stage kidney disease on dialysis	End-stage renal disease, on dialysis (0·571)	0·571	Mapped to GBD end-stage kidney disease requiring dialysis because the ICD heading explicitly identifies dialysis/ESRD.

Appendix 4: Literature Supporting Inclusion of Diagnoses in Disability Weights Tables

Diabetes-related mental health diagnoses

Code	Description	Literature supporting inclusion
295, F20	Schizophrenia	Zhuo, C., Zhang, Q., Wang, L., Ma, X., Li, R., Ping, J., Zhu, J., Tian, H., & Jiang, D. (2024). Insulin resistance/diabetes and schizophrenia: Potential shared genetic factors and implications for better management of patients with schizophrenia. Dong, K., Wang, S., Qu, C., Zheng, K., & Sun, P. (2024). Schizophrenia and type 2 diabetes risk: A systematic review and meta-analysis. Lindekilde, N., Scheuer, S. H., Rutters, F., Knudsen, L., Lasgaard, M., Rubin, K. H., Henriksen, J. E., Kivimäki, M., Andersen, G. S., & Pouwer, F. (2022). Prevalence of type 2 diabetes in psychiatric disorders: An umbrella review with meta-analysis of 245 observational studies from 32 systematic reviews.
296 311, F32	Manic-depressive Depressive disorder	Nouwen, A., Winkley, K., Twisk, J., Lloyd, C. E., Peyrot, M., Ismail, K., & Pouwer, F. (2010). Type 2 diabetes mellitus as a risk factor for the onset of depression: A systematic review and meta-analysis. Beverly, E. A., & Gonzalez, J. S. (2025). The interconnected complexity of diabetes and depression.
300, F41	Anxiety	Smith, K. J., Béland, M., Clyde, M., Gariépy, G., Pagé, V., Badawi, G., Rabasa-Lhoret, R., & Schmitz, N. (2013). Association of diabetes with anxiety: A systematic review and meta-analysis.
F01 F03	Vascular dementia Unspecified dementia	Cao, F., Yang, F., Li, J., Guo, W., Zhang, C., Gao, F., Sun, X., Zhou, Y., & Zhang, W. (2024). The relationship between diabetes and the dementia risk: A meta-analysis. Chatterjee, S., Peters, S. A. E., Woodward, M., Mejia Arango, S., Batty, G. D., Beckett, N., Beiser, A., Borenstein, A. R., Crane, P. K., Haan, M., Hassing, L. B., Hayden, K. M., Kiyohara, Y., Larson, E. B., Li, C.-Y., Ninomiya, T., Ohara, T., Peters, R., Russ, T. C., Seshadri, S., Strand, B. H., Walker, R., Xu, W., & Huxley, R. R. (2016). Type 2 diabetes as a risk factor for dementia in women compared with men: A pooled analysis of 2.3 million people comprising more than 100,000 cases of dementia.

F31	Bipolar disorder	Cannon, A., Jacoby, C., & Hughes, A. S. (2025). Mind in metabolism – A comprehensive literature review on diabetes and its connections to obsessive compulsive disorder, schizophrenia, and bipolar disorder. Liu, S., Leone, M., Ludvigsson, J. F., Lichtenstein, P., Gudbjörnsdottir, S., Landén, M., Bergen, S. E., Taylor, M. J., Larsson, H., Kuja-Halkola, R., & Butwicka, A. (2022). Early-onset type 2 diabetes and mood, anxiety, and stress-related disorders: A genetically informative register-based cohort study.

'Other' diabetes-related diagnoses

Code	Description	Literature supporting inclusion
C18, 153 C44, 173	Malignant neoplasm of colon Other malignant neoplasm of skin	Tsilidis, K. K., Kasimis, J. C., Lopez, D. S., Ntzani, E. E., & Ioannidis, J. P. A. (2015). Type 2 diabetes and cancer: Umbrella review of meta-analyses of observational studies. Bonagiri, P. R., & Shubrook, J. H. (2020). Review of associations between type 2 diabetes and cancer.
D50 D52 D63 D64 280 281 285	Iron deficiency anemia Folate deficiency anemia Anemia in chronic diseases classified elsewhere Other anemias Iron deficiency anemia Other deficiency anemia Other and unspecified anemias	Arkew, M., Asmerom, H., Gemechu, K., & Tesfa, T. (2023). Global prevalence of anemia among type 2 diabetic adult patients: A systematic review and meta-analysis. Mokgalaboni, K., Mabusela, M. S., & Moraba, M. M. (2020). Haematological indices and anaemia in patients with type 2 diabetes mellitus: Systematic review and meta-analysis.
G45	Transient cerebral ischemic attacks and related syndromes	Kaynak, N., Kennel, V., Rackoll, T., Schulze, D., Endres, M., & Nave, A. H. (2024). Impaired glucose metabolism and the risk of vascular events and mortality after ischemic stroke: A systematic review and meta-analysis. Pan, Y., Chen, W., & Wang, Y. (2019). Prediabetes and outcome of ischemic stroke or transient ischemic attack: A systematic review and meta-analysis.
G47 327	Sleep disorder Organic sleep disorder	Khalil, M., Power, N., Graham, E., Deschênes, S. S., & Schmitz, N. (2020). The association between sleep and diabetes outcomes: A systematic review. Andayeshgar, B., Janatolmakan, M., Soroush, A., Azizi, S. M., & Khatony, A. (2022). The prevalence of obstructive sleep apnea in patients with type 2 diabetes: A systematic review and meta-analysis.

G56, 354	Mononeuropathies of upper limb	These codes meet the first criterion for inclusion in the 'Other' disability weights table as they are the same kind of conditions as the following in the specific disability weights table: E1140 to E1149
G57, 355	Mononeuropathies of lower limb	
G58	Other mononeuropathies	
G62	Other and unspecified polyneuropathies	
G81, 342	Hemiplegia and hemiparesis	
353	Nerve root and plexus disorders	
357	Inflammatory and toxic neuropathy	
H26	Other cataract	These codes met the first criterion for inclusion in the 'Other' disability weights table as they are the same as the following ophthalmic codes in the diabetes-specific disability weights table: E1132 – E11.39.
H35	Other retinal disorders	
H54	Blindness and low vision	
362	Other proliferative retinopathy	
365	Glaucoma	
366	Cataract	
368	Visual disturbances	
369	Blindness and low vision	
I10, 401	Essential hypertension	Panchal, K., Lawson, C., Chandramouli, C., Lam, C., Khunti, K., & Zaccardi, F. (2024). Diabetes and risk of heart failure in people with and without cardiovascular disease: A systematic review and meta-analysis. Uthman, O. A., Ayorinde, A., Oyebode, O., Sartori, J., Gill, P., & Lilford, R. J. (2022). Global prevalence and trends in hypertension and type 2 diabetes mellitus among slum residents: A systematic review and meta-analysis. Haile, T. G., Mariye, T., Tadesse, D. B., Gebremeskel, G. G., Asefa, G. G., & Woldemariam, T. G. (2023). Prevalence of hypertension among type 2 diabetes mellitus patients in Ethiopia: A systematic review and meta-analysis. Lopez-Jaramillo, P., Lopez-Lopez, J. P., Lopez-Lopez, C., & Rodriguez-Alvarez, M. I. (2014). The goal of blood pressure in the hypertensive patient with diabetes is defined: Now the challenge is to go from recommendations to practice. Alijla, F., Buttia, C., Reichlin, T., Razvi, S., Minder, B., Wilhelm, M., Muka, T., Franco, O. H., & Bano, A. (2021). Association of diabetes with atrial fibrillation types: A systematic review and meta-analysis. Chase-Vilchez, A. Z., Chan, I. H. Y., Peters, S. A. E., & Woodward, M. (2020). Diabetes as a risk factor for incident peripheral arterial disease in women compared with men: A systematic review and meta-analysis. Deischinger, C., Dervic, E., Nopp, S., Kaleta, M., Klimek, P., & Kautzky-Willer, A. (2022). Diabetes mellitus is associated with a higher relative risk for venous thromboembolism in females than in males.
I12, 403	Hypertensive chronic kidney disease	
I20, 413	Angina pectoris	
I25	Chronic ischemic heart disease	
I27	Other secondary pulmonary hypertension	
I47	Paroxysmal tachycardia	
I48	Atrial fibrillation and flutter	
I49	Cardiac arrhythmias	
I50, 428	Heart failure	
I51	Complications and ill-defined descriptions of heart disease	
I63	Cerebral infarction	
I70, 440	Atherosclerosis	
I74	Arterial embolism and thrombosis	
I80, 451	Phlebitis and thrombophlebitis Hypotension	
I95, 458	Chronic rheumatic pericarditis	
393	Diseases of mitral valve	
394	Diseases of aortic valve	
395	Diseases of mitral and aortic valves	
396	Hypertensive heart disease	
402	Hypertensive heart and chronic kidney disease	
	Secondary hypertension	

404 405 414 416 423 424 426 427 443 452	Other forms of chronic ischemic heart disease Chronic pulmonary heart disease Other diseases of pericardium Other diseases of endocardium Conduction disorders Cardiac dysrhythmias Other peripheral vascular disease Portal vein thrombosis	
J44 J90 J98 491 493	Other chronic obstructive pulmonary disease Pleural effusion, not elsewhere classified Other respiratory disorders Chronic bronchitis Asthma	Peng, Y., Zhong, G.-C., Wang, L., Guan, L., Wang, A., Hu, K., & Shen, J. (2020). Chronic obstructive pulmonary disease, lung function and risk of type 2 diabetes: A systematic review and meta-analysis of cohort studies. Chen, F., Yang, Y., Yu, L., Song, L., Zhang, C., He, Y., Wu, L., Ma, W., & Zhang, B. (2025). The association between type 2 diabetes and asthma incidence: A longitudinal analysis considering genetic susceptibility.
K29, 535 K59 K65 K81 K92 530	Gastritis and duodenitis Other functional intestinal disorders Peritonitis Cholecystitis Other diseases of digestive system Diseases of oesophagus	Chen, J., Yuan, S., Fu, T., Ruan, X., Qiao, J., Wang, X., Li, X., Gill, D., Burgess, S., Giovannucci, E. L., & Larsson, S. C. (2023). Gastrointestinal consequences of type 2 diabetes mellitus and impaired glycemic homeostasis: A Mendelian randomization study. Nabrdalik, K., Skonieczna-Żydecka, K., Irlik, K., Hendel, M., Kwiendacz, H., Łoniewski, I., Januszkiewicz, K., Gumprecht, J., & Lip, G. Y. H. (2022). Gastrointestinal adverse events of metformin treatment in patients with type 2 diabetes mellitus: A systematic review, meta-analysis and meta-regression of randomized controlled trials.
L97 707	Non-pressure chronic ulcer of unspecified heel and midfoot Chronic ulcer of skin	Crawford, F., Inkster, M., Kleijnen, J., & Fahey, T. (2007). Predicting foot ulcers in patients with diabetes: A systematic review and meta-analysis. Lin, C., Tian, J., Zhang, Z., Zheng, C., & Liu, J. (2025). Risk factors associated with the recurrence of diabetic foot ulcers: A meta-analysis.
N183, 5853 N184, 5854	Chronic kidney disease stage 3 moderate	These codes met the first criterion for inclusion in the 'Other' disability weights table as they are used in conjunction with diabetes-specific codes to identify the level of kidney disease for individuals with diabetes.

N185, 5855	Chronic kidney disease stage 4 severe	
N186, 5856	Chronic kidney disease stage 5	
N189, 5859	End stage renal disease chronic kidney disease requiring chronic dialysis	
	Chronic kidney disease unspecified	
Z89.4	Acquired absence of foot and ankle	These codes met the first criterion for inclusion in the 'Other' disability weights table as they are used in conjunction with diabetes-specific codes to identify amputation sites for individuals with diabetes.
Z89.5	Acquired absence of leg below knee	
Z89.6	Acquired absence of leg above knee	
Z89.7	Acquired absence of both lower limbs	
Z99.2	Dependence on renal dialysis	This code met the first criterion for inclusion in the 'Other' disability weights table as it is used in conjunction with the diabetes-specific codes to clarify that an individual is now dependent on dialysis.

Appendix 5: Database-specific search strings

Master search strategy

No	String
1.1	(Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR cardiovascular OR "heart disease" OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions") AND (health OR hauora OR wellbeing OR "well-being") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications OR hospitalisation OR hospitalisations OR hospitalization OR hospitalizations) AND ("best outcomes" OR "best outcome" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor" OR "protective factors" OR protective OR resilience OR "positive deviance" OR outlier OR outliers OR "high performing" OR "high-performing")
1.2	(Māori OR Maori) AND (health OR hauora OR wellbeing OR well-being) AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation*) AND ("best outcome*" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor*" OR protective OR resilience OR "positive deviance" OR outlier* OR "high performing" OR "high-performing")
2.1	(Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation* OR admission*) AND (("within Māori" OR "within-Māori" OR subgroup* OR strata OR stratified OR heterogeneity OR variation OR "risk stratification")) AND (determin* OR factor* OR predictor* OR associated OR correlat* OR "risk factor*" OR protective OR resilience) AND (favourable OR favorable OR "best outcome*" OR "better outcome*" OR optimal OR "low burden" OR "better survival" OR "lower mortality" OR adverse OR poor OR worst OR "high burden" OR "worse outcome*" OR "higher mortality")

2.2	(Māori OR Maori) AND (non-Māori OR non-Maori OR "non Māori" OR "non Maori" OR European OR "non-Indigenous") AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication*) AND (favourable OR favorable OR "best outcome*" OR optimal OR "low burden" OR "better survival" OR "lower mortality")
2.3	(Māori OR Maori) AND (non-Māori OR non-Maori OR "non Māori" OR "non Maori" OR European OR "non-Indigenous") AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication*) AND (adverse OR poor OR worst OR "high burden" OR "worse outcome*" OR "higher mortality")

Scopus Search

No	Strings
1.1	TITLE-ABS-KEY((Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR cardiovascular OR "heart disease" OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions") AND (health OR hauora OR wellbeing OR "well-being") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications OR hospitalisation OR hospitalisations OR hospitalization OR hospitalizations) AND ("best outcomes" OR "best outcome" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor" OR "protective factors" OR protective OR resilience OR "positive deviance" OR outlier OR outliers OR "high performing" OR "high-performing"))
1.2	TITLE-ABS-KEY((Māori OR Maori) AND (health OR hauora OR wellbeing OR "well-being") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications OR hospitalisation OR hospitalisations OR hospitalization OR hospitalizations) AND ("best outcomes" OR "best outcome" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor" OR "protective factors" OR protective OR resilience OR "positive deviance" OR outlier OR outliers OR "high performing" OR "high-performing"))

2.1	TITLE-ABS-KEY((Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications OR hospitalisation OR hospitalisations OR hospitalization OR hospitalizations OR admission OR admissions) AND ("within Māori" OR "within-Māori" OR subgroup OR subgroups OR strata OR stratified OR heterogeneity OR variation OR "risk stratification") AND (determinant OR determinants OR factor OR factors OR predictor OR predictors OR associated OR association OR correlation OR correlate OR correlates OR "risk factor" OR "risk factors" OR protective OR resilience) AND (favourable OR favorable OR "best outcomes" OR "best outcome" OR "better outcomes" OR "better outcome" OR optimal OR "low burden" OR "better survival" OR "lower mortality" OR adverse OR poor OR worst OR "high burden" OR "worse outcomes" OR "worse outcome" OR "higher mortality"))
2.2	TITLE-ABS-KEY((Māori OR Maori) AND ("non-Māori" OR "non Maori" OR "non-Maori" OR non-Māori OR non-Maori OR non Maori OR European OR "non-Indigenous") AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications) AND (favourable OR favorable OR "best outcomes" OR "best outcome" OR optimal OR "low burden" OR "better survival" OR "lower mortality"))
2.3	TITLE-ABS-KEY((Māori OR Maori) AND ("non-Māori" OR "non Maori" OR "non-Maori" OR non-Māori OR non-Maori OR non Maori OR European OR "non-Indigenous") AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications) AND (adverse OR poor OR worst OR "high burden" OR "worse outcomes" OR "worse outcome" OR "higher mortality"))

PubMed Search

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1.1	(Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR cardiovascular OR "heart disease" OR cancer OR "chronic disease" OR "chronic condition" OR "chronic conditions") AND (health OR hauora OR wellbeing OR "well-being") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication OR complications OR hospitalisation OR hospitalisations OR hospitalization OR hospitalizations) AND ("best outcomes" OR "best outcome" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor" OR "protective factors" OR protective OR resilience OR "positive deviance" OR outlier OR outliers OR "high performing" OR "high-performing")
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CINAHL Complete Search

No	String
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1.2	(Māori OR Maori) AND (health OR hauora OR wellbeing OR well-being) AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation*) AND ("best outcome*" OR favourable OR favorable OR optimal OR "low burden" OR "lowest incidence" OR "lower incidence" OR "survival advantage" OR "better survival" OR "lower mortality" OR "protective factor*" OR protective OR resilience OR "positive deviance" OR outlier* OR "high performing" OR "high-performing")

2.1	(Māori OR Maori) AND (diabetes OR "type 2 diabetes" OR T2D OR cardiovascular OR CVD OR "heart disease" OR stroke OR cancer OR "chronic disease" OR "chronic condition*") AND (mortality OR survival OR incidence OR prevalence OR burden OR morbidity OR complication* OR hospitali?ation* OR admission*) AND ("within Māori" OR "within-Māori" OR subgroup* OR strata OR stratified OR heterogeneity OR variation OR "risk stratification") AND (determin* OR factor* OR predictor* OR associated OR correlat* OR "risk factor*" OR protective OR resilience) AND (favourable OR favorable OR "best outcome*" OR "better outcome*" OR optimal OR "low burden" OR "better survival" OR "lower mortality" OR adverse OR poor OR worst OR "high burden" OR "worse outcome*" OR "higher mortality")
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