APPENDIX 1: METHODS

Bridget Robson, Gordon Purdie

Introduction

This appendix provides an overview of the methods and data sources used in the analysis of hospitalisation, cancer registration, and mortality data for *Hauora IV*. It relates to data presented in the mortality, hospitalisations, cancer, and parts of the mental health, cardiovascular disease, diabetes, and respiratory, chapters.

General statistical methods are described, followed by specific details of deaths, hospitalisation and cancer data analysis.

Ethnicity classification

Hauora IV presents statistics on disparities in health between Māori and non-Māori. Accurate ethnicity data is important to enable this comparison. Previously however, official health data have been shown to undercount Māori. This leads to a mismatch between numerators and denominators that can bias results when population census denominator data are used to calculate rates.

For this edition of *Hauora*, population rates for deaths were calculated between 2000–2004 using ethnicity as recorded on death registrations. Anyone recorded as Māori (either alone or in combination with another ethnic group or groups) were classified as Māori. Everyone else was classified as non-Māori. Recording of Māori on death registrations appears to have improved. The latest NZCMS for the period 2001–2004 shows no net undercount of Māori deaths on mortality records compared with matched census numbers (Fawcett et al, in press).

Hospitalisations and cancer registrations continue to undercount Māori. This undercount was estimated by linkage to other datasets with more reliable ethnicity data. From these estimates, Māori adjusters were created and applied to hospital and cancer registration data to 'adjust' for the undercount of Māori in these datasets (see Appendix 3 for further detail).

The adjusters were applied to the number of Māori hospital discharges and cancer registrations (as recorded on these data sets) to estimate Māori numbers. Non-Māori numbers were estimated as the difference between the total number of hospitalisations or cancer registrations and the adjusted Māori numbers. These data were used as numerators in the calculation of population rates and ratios. In addition, confidence intervals on the rates and ratios incorporated the standard error on the adjusters. Hospitalisation rates were calculated for 2003–2005, and cancer incidence for 2000–2004.

Where modelling was used to analyse data (e.g., cancer survival, deprivation modelling) ethnicity data was not adjusted.

Data sources

Numerators

Details on the data obtained, their sources and time periods along with the chapters in which the data are presented are listed in Table A1.1.

Table A1.1: Sources of numerator data

Source (agency or collection)	Data	Period	Chapter/s data presented in
New Zealand Health Information Service	Mortality	2000–2004	mortality, cancer, mental health CVD, diabetes, respiratory diseases
	Public hospital discharges	2000–2005	hospitalisations, mental health CVD, diabetes, respiratory diseases
New Zealand Cancer Registry	Cancer registrations	2000–2004	cancer
Statistics New Zealand	Population census	2001, 2006	population, socioeconomic indicators

The mortality, hospital discharge and cancer registration datasets were coded according to the International Classifications of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) classification and the Tenth Revision of the International Classifications of Diseases, Australian Modification (ICD-10-AM). These classifications organise causes of death or hospital admission into chapters, subgroups and specific causes. For example, Circulatory System disease is a chapter heading, and ischaemic heart disease is a subgroup of this chapter. Appendix 2 lists all ICD-9-CM and ICD-10-AM codes used in Section II. The diseases were grouped according to the ICD-10-AM classification scheme.

Denominators

Age-sex-ethnicity-specific population estimates for each year from 2000 to 2005 served as denominators for mortality, hospitalisation or cancer registration rates. They were obtained from Statistics New Zealand's revised estimates of the mid-year resident Māori ethnic group population[1] and total New Zealand population. Denominators for the non-Māori rates were constructed by subtracting the Māori population estimates from the total New Zealand population estimates for each year.

Area deprivation

NZDep2001 is an area-based index of socioeconomic deprivation, which ranks small areas from the least deprived (decile 1) to the most deprived (decile 10). The index combines nine variables from the 2001 Census (see table A1.2), reflecting eight domains of deprivation (Salmond & Crampton 2002). Each variable was calculated as the proportion of people with the specified deprivation characteristic in each meshblock in New Zealand. Meshblocks are geographical units defined by Statistics New Zealand

[1] These estimates include adjustments for: missing responses to the ethnicity question; the estimated net undercount at the 2001 Census as measured by the 2001 Post-enumeration Survey; the estimated number of Māori residents temporarily overseas on census night; and estimated external migration, births and deaths.

containing a median of 90 people (approximately 60 households). Each proportion is age-standardised and where necessary adjusted for household composition.

Table A1.2: Variables included in NZDep2001 index

Variable	Proportions in small areas in order of decreasing weight in the index
Income	People aged 18–59 receiving a means- tested benefit
Employment	People aged 18–59 unemployed
Income	People living in households with equivalised income below an income threshold
Communication	People with no access to a telephone
Transport	People with no access to a car
Support	People aged <60 living in a single-parent family
Qualifications	People aged 18–59 without any qualifications
Living space	People living in households below equivalised bedroom occupancy threshold
Owned home	People not living in own home

Source: Salmond & Crampton 2002

A deprivation score for census area units, rather than meshblocks, was used. The score, from 1, which is the least deprived, to 10 the most deprived, is derived from the distribution of the population weighted average NZDep2001 meshblock first principal component scores. Where the domicile code corresponds to a census area unit that was not in use in the 2001 Census, the area was assigned a score from the above distribution using the population weighted average NZDep2001 meshblock first principal component scores for meshblocks in the area that were in use in the 2001 Census.

Mortality rate

The mortality rate is the number of deaths in a specified population during a year, usually expressed as the number of deaths per 100,000 per year. That is:

mortality rate = (deaths/population) x 100,000

For example, a Māori mortality rate of 27 per 100,000 for 2000–2004 represents the yearly risk of death in the Māori population each year, i.e., out of 100,000 Māori, on average, we would expect 27 to die each year.

The *numerator* of the mortality rate is the number of deaths. The *denominator* of the mortality rate is the size of the population. Because the mortality rate is a rate, and not a proportion, the population size is the estimated mid-year population (Beaglehole et al 1993).

Incidence rate

The cancer incidence rate (for example) is the number of newly diagnosed cancers of a specific site/type registered in a specified population during a year, usually expressed as the number of cancers (registrations) per 100,000 per year. That is:

incidence rate = (new cancers/population) x 100,000

The *numerator* of the incidence rate is the number of new cancers; the *denominator* of the incidence rate is the size of the population. As for the mortality rate, the mid-year

population is used for the denominator. The population used depends on the rate to be calculated. For example, for cancer sites that occur in only one sex (e.g., cervical cancer), the sex-specific population is used (i.e., females). The number of new cancers may include multiple primary cancers occurring in one patient.

Age-standardised rates

Differences in the age structure of the Māori population (relatively young) and the non-Māori population (relatively old) make it necessary to adjust for age when comparing health outcomes. Rates have been age-standardised using direct standardisation, which applies age-specific rates to a standard population structure. The age-standardised rate is the rate that would be expected for the group if it had the same age distribution as the standard population. It is a weighted average of the age-specific incidence or mortality rates, where the weights are the proportions of persons in the corresponding age groups of a standard population. The results are affected by the age distribution of events (e.g., deaths) in each population and the relative differences across age groups (the age-specific rate ratios). If these vary between the populations being compared, the selection of standard population can affect the magnitude of rates and ratios, relative ranking of causes, and trends in rates and ratios.

In the main body of *Hauora IV* rates were standardised to the 2001 Māori population (males and females combined) using five-year age groups up to 84, then 85+. Using this standard, sex-specific comparisons between Māori and non-Māori are age-standardised and combined sex comparisons between Māori and non-Māori are age-sex-standardised. Use of a Māori population standard creates rates that are a close approximation of the crude overall rates for Māori and thus better reflect the experience of the Māori population. Mortality rates standardised to Segi's world population or the World Health Organization (WHO) population are generally higher (because these standard populations are older and place greater weight on events at older ages). In some instances the rate ratios also differ (Robson et al 2007). Tables of mortality, hospital discharge and cancer registration rates age-standardised to Segi's world and WHO world populations, will be available on the *Hauora IV* website (www.hauora.maori.nz). Details of the standard populations can be found in Appendix 4.

There were a very small number of records with missing values where sex was not recorded. Therefore, numbers used in crude and age-sex standardised rates may not correspond exactly.

Crude rates are reported within each age group presented in tables except for the 65+ age group. Because this group includes all ages 65 and above, there is a marked discrepancy in ages within this group between Māori and non-Māori, with Māori being mainly in the early part of this age range. Therefore, results for this age group were age-standardised as described above.

Appendix One

Rate ratios

Rate ratios (or relative risks) are used as a measure of disparities between Māori and non-Māori. In this book rate ratios were calculated by dividing the Māori rate by the non-Māori rate:

Rate ratio = Māori rate per 100,000/non-Māori rate per 100,000

A rate ratio higher than 1 signifies that Māori have a higher risk than non-Māori. If the rate is less than 1, the risk is lower among Māori than non-Māori. For example, if the rate ratio for deaths from cancer was 1.80, Māori would have an 80% (or 1.8 times) higher chance of dying from cancer than non-Māori. If it was 0.90, Māori would be 10% less likely than non-Māori to die from the disease.

Rate differences (absolute differences)

Rate differences (sometimes called absolute differences) are another measure of disparities. They measure how many deaths (or cases of cancer, for example) per 100,000 population (or person-years) would need to be prevented to eliminate the disparity. In this book, they were calculated by subtracting the non-Māori rate from the Māori rate:

Rate difference =
(Māori mortality rate per 100,000) – (non-Māori mortality rate per 100,000)

For example, if the Māori death rate from cancer was 120 per 100,000 and the non-Māori rate was 80 per 100,000, the rate difference would be 40 deaths per 100,000.

If rate differences are calculated from age-standardised rates, the population standard used to calculate the rate will make a difference to the rate difference. In this book we have standardised rates to the Māori population, which generally produces smaller rates than Segi's or the WHO standard, and thus smaller rate differences.

Rate differences provide information on the size of the problem, as well as the inequality. A rate ratio, on the other hand, may be very large but only involve a few deaths. We have used rate differences to estimate the contribution of specific causes to the overall disparity between Māori and non-Māori in mortality or hospitalisations. For example, the rate difference for a specific cause was divided by the rate difference for all-cause mortality or hospitalisations, and expressed as a percentage.

Confidence intervals and p-values

Estimates of rates and ratios have a degree of uncertainty. Confidence intervals can be calculated to give an indication of this. A 95% confidence interval around an estimate is the range of values that have a 95% probability of including the true population value (Beaglehole et al 1993).

When comparing rates of two groups, such as Māori and non-Māori, the 95% confidence intervals can indicate whether the difference is statistically significant. If the

95% confidence intervals do not overlap, the difference between the estimates is considered statistically significant at the 5% level. This means that the probability that the difference is due to chance is less than 5% or 1 in 20. However differences between estimates can be statistically significant when there is some overlap of their confidence intervals which is why tests of significance are also carried out.

An alternative to looking at differences in rates is to calculate rate ratios. A 95% confidence interval around a rate ratio that does not include 1 indicates that the ratio is statistically significant from 1 at the 5% level. This means that the two rates are significantly different.

P-values can also be used to test for statistical significance or the role of chance. In most epidemiological research, a p-value less than 0.05 is considered statistically significant (a 1 in 20 probability that the result is due to chance). In this book, p-values are used to test for significant differences between groups as well as significant trends in data.

In this book, 95% confidence intervals for crude and age-standardised rates and rate ratios were calculated using the log-transformation method (Clayton and Hills 1993). Where adjusters were used to estimate Māori and non-Māori hospitalisation and cancer registration numbers, standard errors on the adjusters were incorporated into the standard error of the adjusted numbers using formulas for linear function and product of variables to calculate confidence intervals on rates and ratios (Armitage et al 2002).

Time trends

Poisson regression (Dobson 1990) was used to model trends in rates over time (2000–2004 for deaths and cancers; 2000–2005 for hospitalisations), using the GENMOD procedure of SAS version 9. Males and females were modelled separately for sex specific variables, otherwise they were combined. The log of the rates were modelled as a function of ethnicity (Māori or non-Māori); gender (where appropriate); age (five-year age groups and age 85 years and above as a categorical variable); year (as a continuous variable); and an interaction term (ethnicity x year). The poisson errors in the model were assumed to have autoregressive correlations between years, within ethnic-sex-age groups. We report on selected statistically significant time trends in deaths and cancers.

Deaths data

The mortality chapter presents the number and rate of Māori and non-Māori deaths registered in the years 2000–2004. The number of Māori deaths registered each year is comparatively small when presented by age-group and specific causes. To overcome the yearly fluctuation in rates that can occur when numbers are small, all deaths in the five-year period were combined. The numbers of deaths shown in tables are, therefore, the total number of deaths for the five-year period 2000–2004. The rates are the number of deaths per 100,000 person-years.

Analysis by deprivation

Poisson regression (Dobson 1990) was used to model the association between mortality and area deprivation, using the GENMOD procedure of SAS version 9. Males and females were modelled separately. The log of the mortality rate was modelled as a function of ethnicity (Māori or non-Māori); age (five-year age groups and age 85 years and above as a categorical variable); and area deprivation (NZDep2001 decile as a continuous variable). For each model the range of age groups was restricted to those between the minimum and maximum age. Where there were five-year age groups within a range with no deaths, they were grouped with adjacent age groups.

Two estimates were used: the first adjusted for age alone and the second adjusted for age and deprivation combined. The difference between the two estimates indicates the proportion of the mortality disparity that could be attributed to the higher proportion of Māori living in more deprived areas.

To test if the deprivation gradient was different for Māori and non-Māori and to estimate these gradients, an interaction term (ethnicity by NZDep2001) was added to the models. Note that the gradient is the multiplier which applies when going from one deprivation level to another. For example if it was 1.05 that would mean that the rate of deprivation level 10 was 1.05 times that for level 9 and similarly for any adjacent pair of levels. Because Poisson regression models the log of the rate, the association between mortality and area deprivation is multiplicative, not linear, and hence we report the ratio of the gradients to express the interaction.

Hospital data

The chapter on hospitalisations includes data on publicly-funded hospital discharges only. Privately funded hospital data was not available. Public hospital discharges were summed for the three years (2003–2005) and divided by the sum of the three years of population data (2003–2005).

These data report rates of admissions per 100,000 person years, not rates of individuals admitted. With the exception of external causes, rates of hospitalisation are reported for principal diagnosis of admission only. Secondary diagnoses are not included. The unit of analysis is the number of discharges (episodes of care). Therefore, each readmission of a patient for the same condition is counted as a separate episode of care and patients transferred to another public hospital are counted twice. A smaller proportion of Māori admissions were coded as transfers from another hospital than non-Māori patients (4.47% compared to 6.71%) during our period of analysis. Patients dying in hospital are also included.

In some instances we calculated the number and rate of Māori and non-Māori individuals admitted to hospital one or more times during the 3 year period or during the year 2005. These rates were calculated using the encrypted NHI identifier.

Hospital procedures

Hospital procedures are recorded in a different way from principal and secondary diagnoses. There can be multiple procedures reported for one admission. We report

rates of procedure per 100,000 person years, not rates of individuals admitted for a procedure, nor rates of admission for a procedure. The ICD codes for procedures are listed in Appendix 2.

External causes and injury data

The ICD classification includes injury codes which record the type of injury (e.g., head injury, burns), and codes for external causes (e-codes) which record the cause of the injury (e.g., falls, poisoning, motor vehicle accidents). E-codes are classified as intentional (e.g., assault, intentional self-harm), unintentional, or undetermined.

E-codes were analysed for admissions where injury was the principle diagnosis. Hospital discharge records can include multiple e-codes.

When death is the result of an injury, mortality data records the e-code (external cause) as the cause of death. Rates of death from external causes were calculated from the underlying cause of death coded on the death registration.

The ICD codes for injuries and external causes are listed in Appendix 2.

Cancer data

New Zealand has a national cancer registry, the New Zealand Cancer Registry (NZCR), which collects information on all new primary malignant cancer cases. The NZCR includes information on each cancer registration (such as site, stage and pathology), as well as demographic information such as age, gender and ethnicity. This information is gathered from laboratory reports, discharge reports from public and private hospitals, death certificates and autopsy reports (Ministry of Health 2002).

We calculated Māori and non-Māori cancer incidence (from adjusted cancer registrations) and cancer mortality (from death registrations). We also present data on stage at diagnosis (see below) and on cancer survival (see below). Only incidence rates were adjusted for undercounting of Māori in cancer registrations to minimise the numerator / denominator mismatch when using population data to calculate incidence rates. Stage of disease and survival analyses used ethnicity as coded on the NZCR.

Data inclusions and exclusions

Data on cancer registrations in *Hauora IV* were obtained from the NZCR and were restricted to invasive or malignant neoplasms (*in situ* tumours are not included). Cancer registrations flagged as 'multiple' were excluded. Multiple registrations are defined as a second cancer record for the same person where the site (place in the body) and morphological type are the same. Data on cancer deaths were obtained from the NZHIS mortality data set.

For the cancer survival analysis (see section on survival analysis below), where there was more than one registration for a person within a site or site group, the first was included and subsequent registrations were excluded.

Appendix One

Stage of disease at diagnosis

Cancer stage describes the extent of cancer spread from the site of origin at the time of initial diagnosis (Ries et al 2003). Information on the extent of disease up to four months after diagnosis is used to determine the stage at diagnosis.

The summary staging classification

The localised-regional-distant summary staging scheme is used in descriptive and statistical analyses of cancer registry data, and is defined as follows.

- ***In situ* cancer** is early cancer that is present only in the layer of cells in which it began.
- **Localised cancer** is cancer that is limited to the organ in which it began, without evidence of spread.
- **Regional cancer** is cancer that has spread beyond the original (primary) site to nearby lymph nodes or organs and tissues.
- **Distant cancer** is cancer that has spread from the primary site to distant organs or distant lymph nodes.
- **Unstaged cancer** is cancer for which there is not enough information to indicate a stage (SEER 2005).

Table A1.3 presents the staging classification used by NZCR (prior to 1999 and from 1999 on) and how we have classified stage of cancer disease in *Hauora IV*. Data are presented on invasive neoplasms only. *In situ* tumours are not included. The staging classification is not applicable to lymphomas (Hodgkin's disease and non-Hodgkin's lymphoma), myeloma or leukaemias.

Table A1.3: Stage classification (extent of disease)

New Zealand Cancer Registry prior to 1999	New Zealand Cancer Registry 1999 onwards	Hauora IV
In situ	*In situ*	
Localised	Localised to organ of origin	Localised
Regional or node involvement	Invasion of adjacent tissue or organ Regional lymph nodes involvement	Regional
Remote or diffuse metastases	Distant	Distant
Not stated	Not known	Unknown
Not applicable	Not applicable	Not applicable

The stage distribution of new cases (percentage of cases diagnosed at localised, regional, distant and stage unknown) was calculated for Māori and non-Māori. Logistic regression analysis was used to compare the odds of being registered with unknown stage at diagnosis for Māori compared with non-Māori, adjusted for age at diagnosis as a continuous variable. The odds of being diagnosed at localised or distant stage among Māori and non-Māori staged cancers were compared, adjusted for age at diagnosis. Odds ratios were calculated using the logistic procedure of SAS version 9.1 (SAS Institute Inc, Cary, NC).

Survival analyses

There are several techniques for conducting survival analyses. Each can produce slightly different results, and each has its own strengths and limitations (Platel & Semmens 2004). In *Hauora IV* we calculated hazard ratios (see below) for the years 2000–2004 to estimate the relative risk of cancer-specific death after diagnosis, for Māori compared with non-Māori, adjusted for sex and age. To estimate the contribution of differential stage at diagnosis to differences in survival, hazard ratios were also calculated adjusted for sex, age and stage at diagnosis. The percentage change in hazard ratios after adjusting for stage indicates potential reductions in disparities if both populations had the same distribution of disease spread at diagnosis.

The hazard function estimates for each time interval following cancer diagnosis (in this case days), the risk of death among those who have survived up to the start of that time (Lee 1980). Proportional hazards regression (Bland 1995) was used to estimate hazard ratios – the *relative* risk of dying from the cancer once diagnosed, for Māori compared with non-Māori, adjusted for sex and age at diagnosis.

Cancers where the date of diagnosis was the date of death did not contribute to the hazard ratio. Those who died of causes other than the diagnosed cancer were considered censored as of the date of death. This was under the assumption that any misclassification of cause of death was non-differential between Māori and non-Māori. Those with no death record were assumed alive and were censored at 31 December 2004. This allowed us to compare Māori and non-Māori survival without regard to competing causes of death.

Cancer-specific hazard ratios and confidence intervals were calculated using the proportional hazards procedure (PHREG) of SAS version 9.1. The proportional hazards model assumes the relative risk of death between Māori and non-Māori remains constant over time. The assumption of proportionality and linear relationship with age were checked using the graphical and numerical methods of Lin et al (1993).

Māori to non-Māori hazard ratios were calculated for selected cancer sites, adjusted for sex and age at diagnosis (as a categorical variable). Because the assumption of linearity did not hold when age was treated as a continuous variable, age categories were used. The age categories were constructed separately for each cancer by dividing the total number of registrations for that cancer site into quintiles with equal numbers of registrations. However, the method of age adjustment made very little difference to the resulting hazard ratios.

To estimate the contribution of stage at diagnosis to the disparities in survival outcomes between Māori and non-Māori, we calculated hazard ratios also adjusted for stage at diagnosis. These were calculated in two ways: first, including registrations with unknown stage at diagnosis as a stage category, and secondly, restricted to staged cancers only. The estimates for each gender and each stage were estimated from models with interaction terms.

Appendix One

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APPENDIX 2: ICD CODES

Table A2.1: ICD codes for diseases and health-related problems

Description	ICD-10-AM codes used	ICD-9-CM codes used
I: Certain infectious and parasitic diseases	**A00–B99**	**001–139, 771.3 790.7, 790.8, V09 excluding 034.0, 040.2, 099.3, 099.40, 099.49, 135, 136.0, 136.1**
Intestinal infectious diseases	A00–A09	001–009
Tuberculosis (including late effects)	A15–A19, B90	010–018, 137
Meningococcal infection	A39	036
Infections, sexual transmission	A50–A64	054.1, 078.11, 090–099, 131 excluding 099.3, 099.56
Viral hepatitis	B15–B19	070
HIV	B20–B24	042, 079.53
Viral infection, unspecified, of unspecified site	B34.9	079.99, 790.8
II: Neoplasms (cancer)	**C00–D48**	**140–239, 258.0, 273.1, 273.3 excluding 237.7**
Malignant neoplasms	C00–C97	140–208, 238.6, 273.3
Lip, oral cavity and pharynx	C00–C14	140–149
Digestive organs	C15–C26	150–157, 159
• Oesophagus	C15	150 excluding 150.8
• Cancer of stomach	C16	151
• Colorectal	C18–C21	153–154
• Cancer of colon	C18	153
• Rectum, rectosigmoid junction and anus	C19–C21	154
• Liver and intrahepatic bile ducts	C22	155
• Gallbladder, other and unspecified parts of biliary tract	C23–C24	156
• Pancreas	C25	157
• Other digestive organs	C17, C26	150.8, 152, 159
Respiratory and intrathoracic organs	C30–C39	160–162, 163,[1*] 164–165
• Larynx	C32	161
• Trachea, bronchus and lung	C33–C34	162
• Other respiratory and intrathoracic organs	C30–C31, C37–C39	160, 163,* 164–165
Bone and articular cartilage	C40–C41	170
Skin	C43–C44	172–173
• Melanoma of skin	C43	172
• Other malignant neoplasms of skin	C44	173
Mesothelial and soft tissue	C45–C49	158, 163,* 171, 176
Breast: female	C50 & female	174
Breast: male	C50 & male	175
Female genital organs	C51–C58	179–184
• Cervix uteri	C53	180
• Uterus	C54–C55	179, 182
• Ovary	C56	183.0
• Other female genital organs	C51–C52, C57–C58	181, 183.2–183.9, 184

Note: * If the cancer registration is coded as C45.0, then deaths and hospitalisations are coded as mesothelial and soft tissue cancers. Otherwise they are coded as respiratory and intrathoracic organ cancers.

Appendix Two

Description	ICD-10-AM codes used	ICD-9-CM codes used
Male genital organs	C60–C63	185–187
• Prostate	C61	185
• Testis	C62	186
• Other male genital organs	C60, C63	187
Urinary tract	C64–C68	188–189
• Kidney, except renal pelvis	C64	189.0
• Bladder	C67	188
• Other urinary tract	C65–C66, C68	189.1–189.9
Eye and other central nervous system	C69–C72	190–192
• Brain	C71	191
• Other central nervous system	C69–C70, C72	190, 192
Thyroid and other endocrine glands	C73–C75	193–194
• Thyroid gland	C73	193
• Other endocrine glands	C74–C75	194
Malignant neoplasm of ill-defined, secondary and unspecified sites	C76–C80	195–199
Lymphoma	C81–C85	200–202.2, 202.8
• Hodgkin's disease	C81	201
• Non-Hodgkin's lymphoma	C82–C85	200, 202.0–202.2, 202.8
Multiple myeloma and other malignant immunoproliferative diseases and malignant plasma cell neoplasms	C88, C90	203, 238.6, 273.3
Leukaemias	C91–C95	202.4, 204–208
• Lymphoid leukaemia	C91	202.4, 204
• Myeloid leukaemia	C92	205
• Acute myeloid leukaemia	C92.0, C92.4, C92.5	205.0
• Other myeloid leukaemia	C92.1–C92.3, C92.8–C92.9	205.1–205.9
• Other leukaemias	C93–C95	206–208
Other and unspecified malignant neoplasms of lymphoid, hematopoietic, and related tissue	C96	202.3, 202.5–202.6, 202.9
Malignant neoplasm of independent (primary) multiple sites	C97	
In situ neoplasms	D00–D09	230–234
• Melanoma in situ	D03	232
• Carcinoma in situ of breast	D05	233.0
• Carcinoma in situ of cervix uteri	D06	233.1
• Other in situ neoplasms	D00–D02, D04, D07–D09	230–231, 233.2–234
Benign neoplasms	D10–D36	210–229
Neoplasms of uncertain or unknown behaviour	D37–D48	235–239, 258.0, 273.1 excluding 237.7, 238.6
III: Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	**D50–D89**	**135, 273.0, 273.2, 279.0–279.3, 279.8–279.9, 280–289 excluding 289.1–289.3**
IV: Endocrine, nutritional and metabolic diseases	**E00–E90**	**240–278, 330.0–330.2 excluding 258.0, 268.2, 273.0–273.3, 274**
Disorders of thyroid gland	E00–E07	240–246 excluding 244.0 244.1
Diabetes mellitus	E10–E14	250
• IDDM (type 1)	E10	250 with 5th digit 1 or 3
• NIDDM (type 2)	E11–E14	250 with 5th digit 0 or 2
Obesity	E66	278.0

Description	ICD-10-AM codes used	ICD-9-CM codes used
V: Mental and behavioural disorders	**F00–F99**	**290–319, V40.1, V40.3**
Organic, including symptomatic, mental disorder	F00–F09	290, 293, 294, 310
• Dementia, vascular and unspecified	F01, F03	290
• Personality and behavioural disorders due to brain disease, damage, and dysfunction	F07	310
Mental and behavioural disorders due to psychoactive substance use	F10–F19	291, 292, 303–305.7
• Alcohol	F10	291, 303, 305.0
• Opioids	F11	304.0, 304.7, 305.5292 – with other relevant diagnosis: 304.0, 304.7, 305.5 or E850.0–E850.2, E935.0–E935.2
• Cannabinoids	F12	304.3, 305.2, 292 – with other relevant diagnosis: 304.3, 305.2
Schizophrenia, schizotypal and delusional disorders	F20–F29	295, 297, 298.3–298.9, 301.22
• Schizophrenia	F20	295.0–295.3, 295.6, 295.8–295.9
• Schizoaffective disorders	F25	295.7
Mood (affective) disorders	F30–F39	296, 298.0–298.1, 300.4, 301.1, 311
• Manic episode and bipolar affective disorder	F30–F31	296.0–296.1, 296.4–296.81, 296.89, 298.1
• Manic episode	F30	296.0–296.1, 298.1
• Bipolar affective disorder	F31	296.4–296.81, 296.89
• Depressive episode and recurrent, and persistent mood [affective] disorders	F32–F34	296.2, 296.3, 296.82, 298.0, 300.4, 301.1, 311
• Depressive episode	F32	296.2, 296.82, 298.0, 311
• Recurrent depressive disorder	F33	296.3
• Persistent mood [affective] disorders	F34	300.4, 301.1
Neurotic, stress-related and somatoform disorders	F40–F48	298.2, 300, 306, 307.53, 307.8, 308, 309 excluding 300.4, 306.3, 306.51, 306.6, 309.21, 309.22
Eating disorders	F50	307.1, 307.5 excluding 307.53
Disorders of adult personality and behaviour	F60–F69	301, 302, 312.3 excluding 301.1, 301.22, 302.7, 302.89
Mental retardation	F70–F79	317–319
VI: Diseases of the nervous system	**G00–G99**	**320–359, 388.61, 435, 437.7, 780.5, 997.0 excluding 330.0–330.2, 337.2, 349.1**
Bacterial meningitis, not elsewhere classified	G00	320
Parkinson's disease, secondary Parkinsonism	G20–G21	332, 333.92
Alzheimer's disease	G30	331.0
Epilepsy, status epilepticus	G40–G41	345
Migraine	G43	346
Transient cerebral ischemic attacks and related syndromes	G45	435, 437.7
Mononeuropathies of upper limb	G56	354 excluding 354.5
Infantile cerebral palsy	G80	343
VII: Diseases of the eye and adnexa	**H00–H59**	**360–379, V41.0, V41.1 excluding 377.23, 365.14, 376.41**
Disorders of lens	H25–H28	366, 379.3
Glaucoma	H40–H42	364.22, 365 excluding 365.14

Appendix Two

Description	ICD-10-AM codes used	ICD-9-CM codes used
VIII: Diseases of the ear and mastoid process	**H60–H95**	**380–389, V41.2, V41.3 excluding 388.61**
Diseases of middle ear and mastoid	H65–H75	381–385 excluding 383.3
• Non-suppurative otitis media	H65	381.0–381.4
• Suppurative and unspecified otitis media	H66	382 excluding 382.02
• Perforation of tympanic membrane	H72	384.2
Hearing loss	H90–H91	388.01, 388.2, 389, V41.2
IX: Diseases of the circulatory system	**I00–I99**	**289.1–289.3, 390–459, 997.1, 997.2, 997.91 excluding 435, 437.7, 446, 459.0**
Acute rheumatic fever	I00–I02	390–392
• Acute rheumatic heart disease	I01, I02.0	391, 392.0
Chronic rheumatic heart disease	I05–I09	393–398
Hypertensive diseases	I10–I15	401–405
Ischemic heart disease	I20–I25	410–414, 429.2, 429.7
• Angina pectoris	I20	411.1, 413
• Acute myocardial infarction	I21	410
• Chronic ischemic heart disease	I25	412, 414, 429.2
Pulmonary circulation	I26–I28	415–417
Other forms of heart disease	I30–I52	420–429.1, 429.3, 429.5, 429.6, 429.8, 429.9
• Atrial fibrillation and flutter	I48	427.3
• Heart failure	I50	428
Cerebrovascular diseases	I60–I69	430–434, 436–437.6, 437.8–438
• Subarachnoid haemorrhage	I60	430
• Intracerebral haemorrhage, other nontraumatic intracranial haemorrhage	I61–I62	431–432
• Cerebral infarction, stroke, not specified as haemorrhage or infarction	I63–I64	433 or 434, with 5th digit 1, 436
Other diseases of the circulatory system	I70–I99	289.1–289.3, 429.4, 440–444, 447–458, 459.1–459.9, 997.1, 997.2, 997.91
• Atherosclerosis	I70	440
• Varicose veins of lower extremities	I83	454
X: Diseases of the respiratory system	**J00–J99**	**034.0, 460–519, 997.3 excluding 511.0, 518.82**
Acute upper respiratory infections	J00–J06	034.0, 460–465
Pneumonia	J12–J18	480–486
Acute bronchitis and bronchiolitis	J20–J22	466
Chronic diseases of tonsils and adenoids	*J35*	*474*
Chronic obstructive respiratory disease	J40–J44	490–492, 496
Asthma	J45–J46	493
Bronchiectasis	J47	494
XI: Diseases of the digestive system	**K00–K93**	**040.2, 520–579, 997.4 excluding 536.2, 568.82**
Teeth and gums	K00–K08	520–525
• Disorders of tooth development and eruption, embedded and impacted teeth	K00–K01	520
• Dental caries	K02	521.0
• Diseases of pulp and periapical tissues	K04	522
• Periodontal diseases	K05–K06	523, excluding 523.6

Description	ICD-10-AM codes used	ICD-9-CM codes used
Diseases of oesophagus, stomach and duodenum	K20–K31	530–537 excluding 536.2
• Diseases of oesophagus	K20–K22	530
• Gastric, duodenal, peptic gastrojejunal ulcers, gastritis duodenitis	K25–K29	531–535
Diseases of appendix	K35–K38	540–543
Hernia	K40–K46	550–553
• Inguinal hernia	K40	550
Non-infective gastroenteritis and colitis	K50–K52	555–556, 558
Other diseases of intestines and diseases of peritoneum	K55–K67	557, 560–569 excluding 564.2–564.4, 568.82
Diseases of liver	K70–K77	570–573
• Alcoholic liver disease	K70	571.0–571.3
Diseases of gallbladder, biliary tract and pancreas	K80–K87	574–577 excluding 576.0
• Cholelithiasis	K80	574
• Acute pancreatitis	K85	577.0
• Other diseases of pancreas	K86	577.1–577.9
Haematemesis, melaena and gastrointestinal haemorrhage, unspecified	K92.0–K92.2	578
XII: Diseases of the skin and subcutaneous tissue	**L00–L99**	**136.0, 680–709 excluding 706.3**
Infections of skin and subcutaneous tissue	L00–L08	680–686.0, 686.8–686.9, 695.81
XIII: Diseases of the musculoskeletal system and connective tissue	**M00–M99**	**099.3, 136.1, 268.2, 274, 279.4, 337.2, 446, 710–739, V48.6, V48.7 excluding 728.85, 729.82, 719.7**
Gout	M10	274
Arthrosis (osteoarthritis)	M15–M19	715
Other dorsopathies	M50–M54	722–724 excluding 723.0, 723.5, 724.0, 722.8
XIV: Diseases of the genitourinary system	**N00–N99**	**099.40, 099.49, 580–629, 788.0, 788.31–788.35, 788.37, 788.39, 997.5 excluding 599.7**
Glomerular diseases	N00–N08	580–583
Tubulo-interstitial nephritis	N10–N12	590.0, 590.1, 590.8
Renal failure	N17–N19	584–586
Urolithiasis	N20–N23	592, 594, 788.0
Urinary tract infection, site not specified	N39.0	599.0
Stress incontinence and other specified urinary incontinence	N39.3, N39.4	625.6, 788.31–788.35, 788.37, 788.39
• Stress incontinence	N39.3	625.6
Disorders of male genital organs	N40–N51	600–608
• Hyperplasia of prostate	N40	600
Inflammatory disorders of breast	N61	611.0
Inflammatory diseases of female pelvic organs	N70–N77	614–616
Non-inflammatory disorders of female genital tract	N80–N98	617–629 excluding 618.5, 625.6
• Endometriosis	N80	617
• Female genital prolapse	N81	618 excluding 618.5
• Dysplasia of cervix uteri	N87	622.1
• Excessive and frequent menstruation	N92.0, N92.1	626.2, 626.6
• Menopausal and other perimenopausal disorders	N95	627.1–627.9

Appendix Two

Description	ICD-10-AM codes used	ICD-9-CM codes used
XV: Pregnancy, childbirth and the puerperium	**O00–O99**	**630–677, 792.3, V23.6 excluding 659.4–659.6**
Abscess of breast associated with childbirth	O91.1	675.1
XVI: Certain conditions originating in the perinatal period	**P00–P96**	**760–779 excluding 771.3**
Slow fetal growth and fetal malnutrition and premature	P05–P07	764–765
• Slow fetal growth and fetal malnutrition	P05	764
• Premature	P07.2–P07.3	765
Birth trauma	P10–P15	767
Respiratory and cardiovascular disorders specific to the perinatal period	P20–P29	768.2–770
• Birth asphyxia	P21	768.5–768.9
• Respiratory distress of newborn	P22	769, 770.6
Infection specific to the perinatal period	P35–P39	771 excluding 771.3
XVII: Congenital malformations, deformations, and chromosomal abnormalities	**Q00–Q99**	**237.7, 365.14, 376.41, 377.23, 740–759**
XVIII: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified[1]	**R00–R99**	**459.0, 511.0, 518.82, 536.2, 568.82, 599.7, 706.3, 719.7, 728.85, 729.82, 780–799, V41.4–V41.6 excluding 780.5, 788.0, 788.31–788.35, 788.37, 788.39, 790.7, 790.8, 792.3**
Symptoms and signs involving the circulatory and respiratory systems	R00–R09	511.0, 518.82, 784.1, 784.7–784.9, 785.0–785.4, 785.9, 786, 796.2–796.3, 799.0–799.1
Symptoms and signs involving the digestive system and abdomen	R10–R19	536.2, 568.82, 782.4, 787, 789, 792.1, V41.6
Symptoms and signs involving the urinary system	R30–R39	599.7, 788 excluding 788.0, 788.31–788.35, 788.37, 788.39
General symptoms and signs	R50–R69	459.0, 780.2–780.3, 780.6–780.9, 781.5, 782.3, 783, 784.0, 785.5–785.6, 797, 799.3–799.4, 799.8–799.9 if not a death
Ill-defined and unknown causes of mortality	R95–R99	798, 799.8–799.9
• Sudden infant death syndrome	R95	798.0

1 The conditions and signs or symptoms included in categories R00–R99 consist of:

a. cases for which no more specific diagnosis can be made even after all the facts bearing on the case have been investigated;

b. signs or symptoms existing at the time of initial encounter that proved to be transient and whose causes could not be determined;

c. provisional diagnoses in a patient who failed to return for further investigation or care;

d. cases referred elsewhere for investigation or treatment before the diagnosis was made;

e. cases in which a more precise diagnosis was not available for any other reason;

f. certain symptoms, for which supplementary information is provided, that represent important problems in medical care in their own right. (ICD-10 version 7; see http://www.who.int/classifications/apps/icd/icd10online/).

Description	ICD-10-AM codes used	ICD-9-CM codes used
XIX: Injury, poisoning and certain other consequences of external causes	**S00–T98**	**349.1, 800–999, excluding 997.0–997.5, 997.91**
Injuries to the head	S00–S09	800–804, 830, 848.0, 848.1, 850–854, 870–873, 910, 918, 920–921, 925.1, 950–951, 957.0
Other injuries	S10–T14	805–829, 831–847, 848.2–848.9, 860–869, 874–904, 911–917, 919, 922–924, 925.2–929, 952–956, 957.1–957.9, 959
Burns	T20–T31	940–949
Poisoning by drugs, medicaments and biological substances	T36–T50	960–979, excluding 961.2
Complications of surgical and medical care, not elsewhere classified	T80–T88	349.1, 995.2, 995.4, 996–999, excluding 997.0–997.5, 997.91
XX: External causes of morbidity and mortality	**V01–Y98**	**E800–E999**
Accidents	V01-V99, W00-X59, Y85, Y86	E800-E848, E850-E869, E880-E929 excluding E904.0
Transport accidents	V01–V99, Y85	E800–E848, E929.0, E929.1
• Pedestrian	V01–V09	E800–E807 with 4th digit 2, E810–E825 with 4th digit 7, E826–E829 with 4th digit 0
• Pedal cyclist	V10–V19	E800–E807 with 4th digit 3, E810–E825 with 4th digit 6, E826–E829 with 4th digit 1
• Other land transport (occupant of motorcycle, three-wheeled motor vehicle, car, pickup truck or van)	V20–V59, Y85.0	E800-E807 with 4th digit not 2 or 3, E810-E825 with 4th digit not 6 or 7, E826-E829 with 4th digit not 0 or 1, E929.0
• Other transport	V90-V99, Y85.1	E830-E848, E929.1
Other external causes of accidental injury	W00–X59, Y86	E850–E869, E880–E928, E929.2–E929.9 excluding E904.0
• Falls	W00–W19	E880–E888, E929.3
• Exposure to mechanical forces	W20-W64	E906, E914-E923, E928.1, E928.2
• Exposure to inanimate mechanical forces	W20–W49	E914–E923, E928.1, E928.2 excluding E917.1
• Exposure to animate mechanical forces	W50–W64	E906, E917.1
• Drowning and submersion (non transport)	W65–W74	E910
• Fires	X00–X09	E890–E899, E929.4
• Accidental poisoning by and exposure to noxious substances	X40–X49	E850–E869, E924.1
• Accidental threats to breathing	W75-84	E9111-E913
o Accidental suffocation or strangulation in bed	W75	E913.0
Intentional self-harm (suicide)	X60–X84, Y87.0	E950–959
Assault (homicide)	X85–Y09, Y87.1	E904.0, E960–E969
Event of undetermined intent	Y10–Y34, Y87.2	E980–E989
Legal intervention	Y35, Y89.0	E970–E978
Complications of medical and surgical care	Y40–Y84, Y88	E870–E879, E930–E949
• Drugs, medicaments and biological substances causing adverse effects in therapeutic use	Y40–Y59, Y88.0	E930–E949
• Misadventure to patients during surgical and medical care	Y60–Y69, Y88.1	E870–E876
• Medical devices associated with adverse incidents, surgical and medical procedures as the cause of abnormal reaction, without mention of misadventure at the time of the procedure	Y70–Y84, Y88.2, Y88.3	E878–E879

Appendix Two

Description	ICD-10-AM codes used	ICD-9-CM codes used
XXI: Factors influencing health status and contact with health services	**Z00–Z99**	**659.4–659.6, V01–V82 excluding V09, V23.6, V40.1, V40.3, V41.0–V41.6, V48.6, V48.7**
Persons encountering health services for examination and investigation	Z00–Z13	V20.2, V21, V29, V67, V68.0, V68.2, V68.89, V68.9, V70–V82 excluding V72.4
Persons with potential health hazards related to communicable diseases	Z20–Z29	V01–V08, V64.0 excluding V07.1
Persons encountering health services in circumstances related to reproduction	Z30–Z39	659.4–659.6, V22–V28, V30–V39, V72.4 excluding V23.6
• Outcome of delivery	Z37	V27
• Liveborn infants	Z38	V30–V39
Persons encountering health services for specific procedures and health care	Z40–Z54	V07.1, V50–V59, V62.6, V64.1–V64.3, V66
• Care involving dialysis	Z49	V56.0, V56.8
• Care involving rehabilitation	Z50	V57
Persons with potential health hazards related to socioeconomic and psychosocial circumstances	Z55–Z65	V40.0, V60–V62 excluding V60.4, V60.5, V62.6
Persons encountering health services in other circumstances	Z70–Z76	V20.0, V20.1, V41.7–V41.9, V60.4, V60.5, V63, V65, V68.1, V68.81, V69
Persons with potential health hazards related to family and personal history and certain conditions influencing health status	Z80–Z99	V10–V19, V40.2, V40.9, V42–V49 excluding V48.6, V48.7

Table A2.2: Guide to abbreviations of cancer sites

Cancer site	ICD-10-AM	Abbreviation
Bone and articular cartilage	C40-C41	Bone
Cervix uteri	C53	Cervix
Gallbladder, other and unspecified parts of biliary tract	C23-C24	Gallbladder
Kidney, except renal pelvis	C64	Kidney
Liver and intrahepatic bile ducts	C22	Liver
Trachea, bronchus and lung	C33-C34	Lung
Malignant neoplasm of ill-defined, secondary and unspecified sites	C76–C80	Ill-defined sites
Multiple myeloma and other immunoproliferative diseases and plasma cell neoplasms	C88, C90	Multiple myeloma
Lip, oral cavity and pharynx	C00-C14	Oral cancers
Rectum, rectosigmoid junction and anus	C19-C21	Rectum

Table A2.3: ICD-9-CM codes for procedures

Procedure	ICD-9-CM codes used
Myringotomy (grommets)	20.0
Myringoplasty (repair of eardrum)	19.4–19.5
Mastoidectomy	20.4
Tonsillectomy and adenoidectomy	28.2, 28.3, 28.6
Angiography	88.5
Heart valve replacement	35.2
Angioplasty	36.0
Coronary artery bypass and graft	36.1
Endarterectomy	38.1
Stripping of varicose veins	38.4
Hemodialysis	39.95
Peritoneal dialysis	54.98
Kidney transplant	55.6
Amputation of lower limb	84.1
Cataract surgery	13.1–13.6
Cholecystectomy (removal of gallbladder)	51.1
Hernia repair	53.0–53.3
Total hip replacement	81.51
Partial hip replacement	81.52
Mastectomy	85.4
Total reconstruction of breast	85.7
Prostatectomy	60.2–60.6
Diagnostic procedures on cervix	67.1
Conisation of cervix	67.2
Other excision of lesion of cervix	67.3
Diagnostic procedures on uterus	68.1
Total abdominal hysterectomy	68.4
Vaginal hysterectomy	68.5
Tubal ligation (female sterilisation)	66.2, 66.3
Insertion of intrauterine contraceptive device	69.7
Vasectomy (male sterilisation)	63.7
Caesarean section	74.0–74.2, 74.4
Pacemaker procedure	37.8

APPENDIX 3: ESTIMATING MĀORI HOSPITALISATIONS AND CANCER REGISTRATIONS

Ricci Harris, Gordon Purdie, Bridget Robson, Craig Wright, Jane Zhang, Michael Baker

Abstract

Background

Official health data have been shown to undercount Māori. This appendix reports on our estimates of the undercount of Māori in hospital discharge and cancer registration data used for this edition of *Hauora*. It also reports on the method to develop adjusters for the undercount of Māori in these datasets.

Method

Hospital discharge and cancer registration data were linked to datasets with more reliable ethnicity. These were death registrations (2000–2004) and Housing New Zealand Corporation (HNZC) tenant data (2003–2005). Among the linked records, the numbers of Māori hospitalisations (or cancer registrations) using ethnicity as recorded, were compared to the numbers using ethnicity on the linked dataset.

Adjusters were created for cancer register data and hospital discharge data by calculating a weighted average of the HNZC linkage and mortality linkage ratios in five-year age groups. These ratios were smoothed to create adjusters using local regression. We then applied these ratios to hospital and cancer registration data to 'adjust' for the undercount of Māori in these datasets.

Results

Linkage of hospital discharges and cancer registrations to both death and HNZC datasets suggested an undercount of Māori in hospital and cancer registrations that varied by age.

Adjusters for hospital and cancer registrations both showed a relatively low undercount across the younger age groups that increased in the older. These adjusters suggested that Māori hospital numbers should be approximately 5 to 15% higher depending on age, and Māori cancer registrations 2 to 15% higher.

Conclusion

There is ongoing undercounting of Māori in hospital discharge and cancer registration data. The application of adjusters attempts to minimise this undercount and allow more accurate calculation and comparability of population rates and ratios by

ethnicity. Ongoing effort to improve ethnicity data collection in these datasets is still required.

Background

Official health data have been shown to undercount Māori cancer registrations, hospital admissions and deaths (Ajwani et al 2003a,b; Te Rōpū Rangahau Hauora a Eru Pōmare 2000). Previously, the 'ever Māori' method of ethnicity classification has been used to adjust for undercounting of Māori in health data sets (Cormack et al 2005; Robson et al 2006; Ministry of Health 2006; Curtis et al 2005). This method counts as Māori anyone ever recorded as Māori in any cancer registration, hospital admission or death registration, or on the National Health Index (usually over a specified period). In analyses of earlier periods (1996–2001), the 'ever Māori' method appeared to produce reasonable estimates of deaths and cancers (Robson et al 2006; Curtis et al 2005). However, ethnicity data requires review over time as data quality may change.

This edition of *Hauora* uses more recent data: 2000–2004 deaths, 2000–2004 cancer registrations, 2003–2005 hospital discharges. The 'ever Māori' method of ethnicity classification appeared to overcount Māori when applied to these years of analysis. Potential reasons for this may have included the use of additional years of data (ie 1996 to 2004/5 to assign ethnicity) and the use of improved mortality data.

Mortality data

For the 1996–1999 period the New Zealand Census-Mortality Study (NZCMS), which probabilistically matched death registrations and census data, showed that Māori deaths were undercounted by 7% on mortality records (Ajwani et al 2003a,b). However, data from the extension of the NZCMS for the period 2001-2004, shows no net difference between census and mortality counts for Māori (using the prioritised definition) i.e., there was no net under-count of Māori deaths on mortality records compared with matched census numbers during this period (Fawcett et al in press). Similar results were found by sex and age.

Given the findings of the NZCMS for 2001–2004, death registration ethnicity was used to analyse Māori and non-Māori mortality data for *Hauora IV*.

Hospital discharges and cancer registrations

To assess the potential undercount of Māori hospital discharges and cancer registrations, these databases were linked to other datasets with more reliable ethnicity to compare the effect of using different ethnicity data sources.

Method

Estimating Māori hospitalisation and cancer registration undercounts

Hospitalisation rates for *Hauora IV* were calculated for the period 2003–2005, using New Zealand Health Information Service (NZHIS) public hospital discharge data.

Appendix Three

Cancer incidence rates were calculated for the period 2000–2004 using NZHIS cancer registration data. To estimate potential undercounting of Māori in these databases, they were linked to death registration data, Housing New Zealand Corporation (HNZC) tenant data and Ministry of Health national survey data. Among the linked records, the numbers of Māori hospitalisations (or cancer registrations) using ethnicity as recorded, were compared to the numbers using ethnicity on the linked dataset.

The linkage and comparison datasets are described below.

Linkage to death registration ethnicity

Given the latest findings of the NZCMS for 2001–2004, death registration ethnicity was assumed to be a reliable count of Māori ethnicity data.

Using encrypted NHI numbers, hospital event records were linked to death registrations among those people who had both died and had a hospital discharge between 2000 and 2004.

Using encrypted NHI numbers, cancer registrations were linked to death registrations among those people who had both died and had a cancer registration between 2000–2004.

Linkage to Housing New Zealand Corporation (HNZC) tenant ethnicity

The *Social Housing Outcomes Worth (SHOW) s*tudy aims to investigate the relationship between housing conditions, such as crowding levels, and hospitalisation rates in a large cohort of Housing New Zealand Corporation (HNZC) applicant and tenant households. Housing tenants complete an annual Income Related Rent (IRR) application form which includes the 2001 census ethnicity question (Baker et al 2004). For this study, HNZC data were linked by the NZHIS to their encrypted national health index number (NHI) and then anonymised. The overall match rate to NHI was 92% (Baker et al 2006).

Characteristics of HNZC tenants differ from the total population. They are younger with half less than 20 years old. Māori and Pacific people make up 70.4% of HNZC tenant households, and 75% of the tenants have an income of $353 or less per week (Baker et al 2006). These characteristics made this a particularly useful comparison dataset to assess ethnicity in hospitalisation and cancer data, especially for younger age groups.

Data from the *SHOW* study was used to compare the number of Māori hospitalisations based on hospital event record ethnicity with tenant ethnicity among linked records. Tenant information and matched hospitalisation data were available for May 2003 to December 2005. Only records with a tenant ethnicity recorded were used in the analysis presented here.

Ethnicity data on the Cancer Register are primarily taken from the NHI database with some also taken from hospital discharge information and the mortality collection (S Hanna, personal communication, 10 August 2007). HNZC data was not linked to cancer registrations but was linked to NHI ethnicity on hospitalisations. As cancer registration ethnicity tends to reflect NHI ethnicity, linkage of HNZC data to NHI was

used as a proxy measure to estimate undercounting of Māori on cancer registrations. The number of Māori hospitalisations using NHI ethnicity was compared to the number of Māori hospitalisations using HNZC tenant ethnicity.

Linkage to Ministry of Health national survey ethnicity

For further validation, the 2002 National Children's Nutrition Survey (Ministry of Health 2003) and the 2002/2003 New Zealand Health Survey (Ministry of Health 2004) were linked to hospital data to compare the number of Māori hospitalisations using hospital event record ethnicity and survey ethnicity.

Survey data were probabilistically[1] linked to hospital discharges between 2002–2006. The linkage rate for the CNS was 67% and 18% for the NZHS.[2] Results were used as a check against the other linkage studies and showed a net undercount of Māori across all age groups. However, because of small numbers and linkage only to hospital discharges, these data were not used to estimate the final adjusters. Therefore, the results are not presented here.

Development of ethnicity adjusters for hospitalisations and cancer registrations

The undercounting of Māori hospitalisations and cancer registrations leads to a numerator/denominator mismatch that creates a bias when rates are calculated using population census data for denominators. To minimise this bias, adjusters were created for cancer register data and hospital discharge data. This was done by calculating a weighted average of the HNZC linkage and mortality linkage ratios in five-year age groups. These ratios were smoothed to create adjusters and standard errors that were estimated using local regression with the Loess procedure in SAS (version 9.1, SAS Institute Inc, Cary NC).

Results

Undercount of Māori hospitalisations

Table A3.1 shows the results of the linkage between hospital data with both death registrations and HNZC data. The linked hospital and mortality data shows the number of hospitalisations recorded as Māori using hospital event ethnicity compared to the number of hospitalisations recorded as Māori using death record ethnicity, among linked records. Similarly, the linked hospital and HNZC data show the number of hospitalisations recorded as Māori using hospital event ethnicity compared to the number of hospitalisations recorded as Māori using self identified HNZC tenant ethnicity, among linked records.

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1 Variables used to probabilistically link data: year of birth, gender, meshblock for NZHS 2002/03; date of birth, gender, meshblock for CNS.

2 Linkage of NZHS 2002/03 to hospital discharge data was lower as only year of birth was available rather than date of birth in the CNS.

Ratios of hospitalisations (linked dataset ethnicity/hospital event ethnicity) by age are also provided. A ratio over 1 indicates an increase in Māori hospitalisations using the alternative ethnicity data source and suggests an undercount of Māori in the hospital data. For example, in the linked hospital and HNZC data, for the 0–4 year age group, there were 8,163 hospitalisations recorded as Māori using the ethnicity on the hospital event record compared with 8,473 using the ethnicity on the HNZC tenant database. This is a ratio of 1.038 or a 3.8% increase in Māori hospitalisations in this age group when the HNZC ethnicity is used.

Linkage to both death and HNZC datasets indicates an undercount of Māori in hospital data across all ages as represented by increased Māori hospitalisations using the linked data ethnicity. This undercount varies by age.

The mortality data linkage shows undercounting of Māori across almost all ages with higher undercounting in the younger and older age groups (as represented by higher ratios in these groups). The HNZC linkage also shows undercounting across almost all age groups that increases in the older ages. It is important to note that the mortality linkage has smaller numbers in the younger age groups and the HNZC linkage has smaller numbers in the older age groups. Ratios based on data with smaller numbers may be less reliable. However, this effect is taken into account in the calculation of adjusters for hospital data.

Table A3.1 also shows the age-specific smoothed hospital adjusters (and their standard errors) by age group. These were estimated by calculating a weighted average of the ratios from the mortality linkage and HNZC linkage and then smoothed as described above. The adjusters are therefore weighted more towards the HNZC linkage in the younger ages and the mortality linkage in the older ages where there are more numbers in each age band. As can be seen, the ratios are all above 1 and increase in the older ages where the level of Māori undercounting appeared largest.

Table A3.1: Number of Māori hospitalisations and smoothed Māori hospital adjusters using linked hospital, death and HNZC data

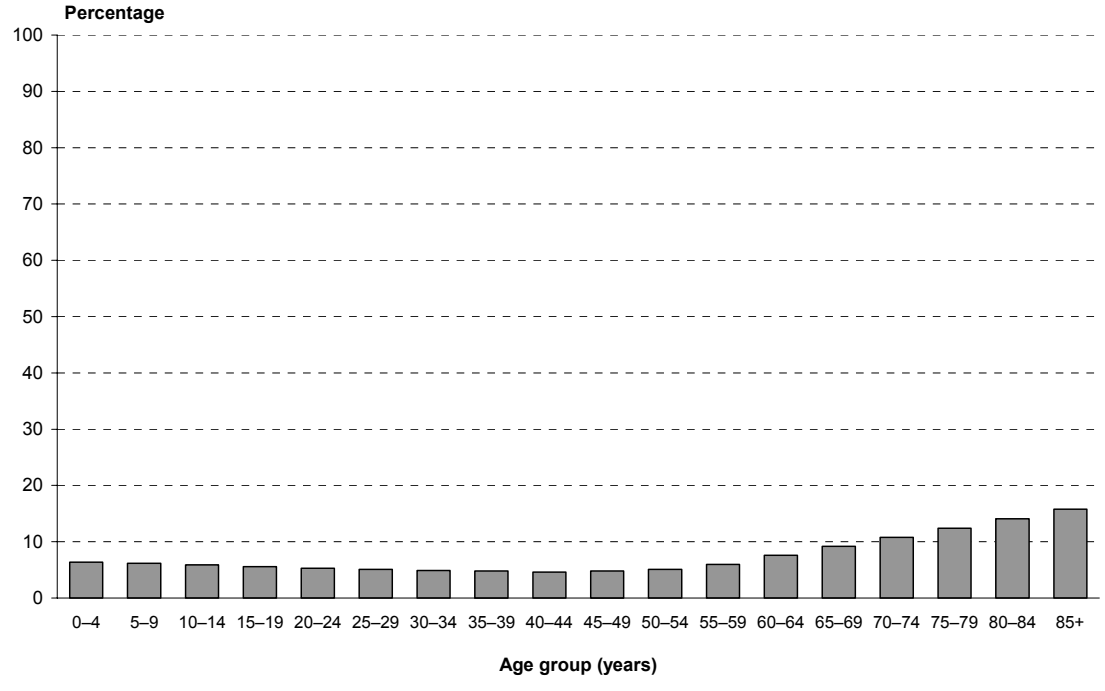
Age group (years)	Linked hospital and mortality data (2000–2004)			Linked hospital and HNZC tenant data (May 2003–December 2005)			Smoothed Māori hospital adjusters*	Standard error
	Number of Māori hospital admissions		Ratio of hospital admissions	Number of Māori hospital admissions		Ratio of hospital admissions		
	On hospital event ethnicity	On death registration ethnicity	Death/ hospital ethnicity	On hospital event ethnicity	On HNZC tenant ethnicity	HNZC/ hospital ethnicity		
0–4	1,323	1,514	1.144	8,163	8,473	1.038	1.064	0.01704
5–9	273	296	1.084	3,026	3,115	1.029	1.062	0.01451
10–14	363	475	1.309	2,281	2,406	1.055	1.059	0.01233
15–19	510	608	1.192	4,089	4,181	1.022	1.056	0.01059
20–24	931	1,054	1.132	3,712	3,921	1.056	1.053	0.00944
25-29	711	830	1.167	3,273	3,489	1.066	1.051	0.00902
30–34	1,088	1,152	1.059	3,547	3,646	1.028	1.049	0.00943
35–39	1,912	1,910	0.999	3,289	3,411	1.037	1.048	0.00915
40–44	3,448	3,478	1.009	3,566	3,478	0.975	1.046	0.00943
45–49	4,607	4,994	1.084	3,742	3,891	1.040	1.048	0.00915
50–54	5,739	6,129	1.068	4,730	4,822	1.019	1.051	0.00943
55–59	6,073	6,367	1.048	3,709	4,042	1.090	1.060	0.00943
60–64	8,732	9,136	1.046	3,363	3,671	1.092	1.076	0.00902
65–69	9,743	10,135	1.040	3,610	3,593	0.995	1.092	0.00944
70–74	6,084	6,842	1.125	1,297	1,410	1.087	1.108	0.01059
75–79	4,168	4,737	1.137	614	650	1.059	1.124	0.01233
80–84	2,181	2,515	1.153	212	261	1.231	1.141	0.01453
85+	1,556	1,807	1.161	105	134	1.276	1.158	0.01704

Sources: NZHIS public hospital discharges and death registrations; SHOW Study.

*Rounded to three decimal places.

A graphical representation of the hospital adjusters is presented in Figure A3.1, where the ratios are shown as the percentage increase in Māori hospital numbers that the adjusters represent. As can be seen, Māori hospital numbers should be increased by 6.4% in the 0–4 year age group, rising to 15.8% in the 85+ age group.

Figure A3.1: Smoothed Māori hospital adjusters (percentage increase)



Undercount of Māori cancer registrations

Table A3.2 shows the results of the linkage between cancer registrations and death registrations, and hospital data (using NHI ethnicity) and HNZC tenant data. The linked cancer registration and mortality data show the number of Māori cancer registrations using cancer register ethnicity compared to the number of Māori cancer registrations using death registration ethnicity, among linked records. Similarly, the linked hospital and HNZC data show the number of hospitalisations recorded as Māori using NHI ethnicity compared to the number of hospitalisations recorded as Māori using self identified HNZC tenant ethnicity among linked records.

Linkage of the two different ethnicity data sources on Māori cancer registrations and hospitalisations using NHI ethnicity both suggest an undercount of Māori in cancer registrations and NHI records (which are used here as a proxy measure to estimate cancer registration undercounting of Māori). This is demonstrated by increasing Māori numbers when the linked data source ethnicity is used and ratios above 1. Undercounting varies by age group.

Age specific smoothed cancer adjusters (and their standard errors) by age group are also presented in Table A3.2. The adjusters are weighted more towards the HNZC linkage where the numbers are larger, particularly in the younger age groups. As can be seen, the ratios are all above 1 and increase in the older ages, representing an undercount of Māori in cancer registrations across all ages that increases in the older age groups. This is shown graphically in Figure A3.2, where the ratios are presented as the percentage increase in Māori cancer registration numbers that the adjusters will achieve. Māori cancer registration numbers should increase by 1.6% in the 0–4 year age group to 15.8% in the 85+ age group. The cancer adjusters also suggest a relatively low undercount across the younger age groups that increases in the older.

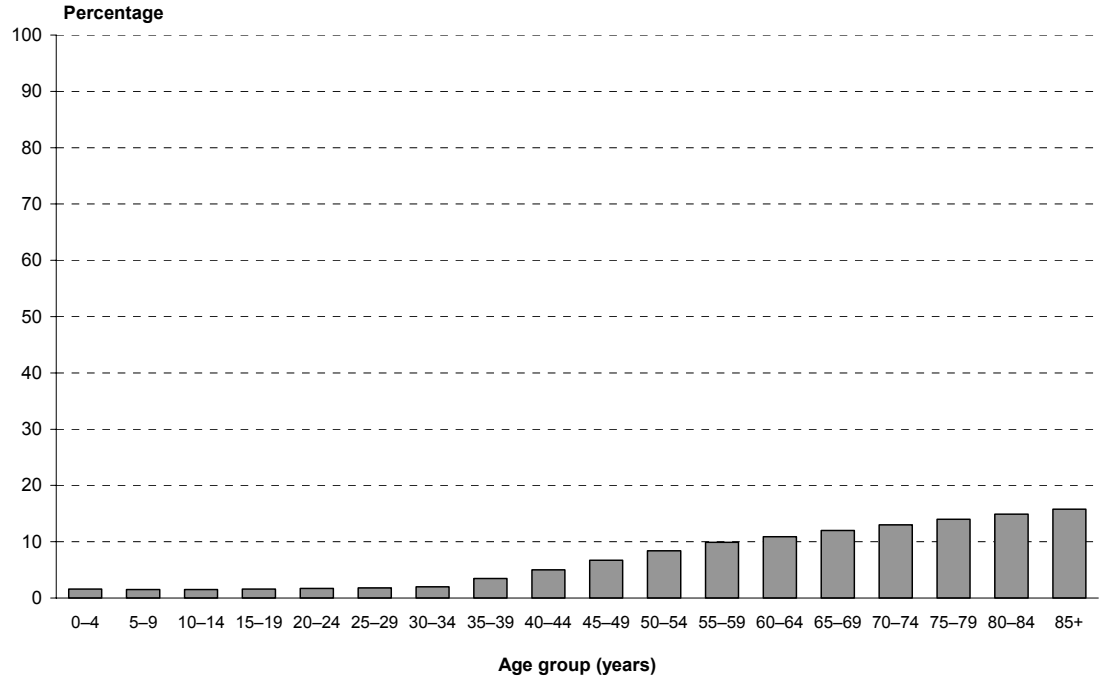
Table A3.2: Number of Māori cancer registrations using linked cancer register and death data, number of Māori hospitalisations (by NHI) using linked hospital and HNZC data

Age group (years)	Linked cancer register and mortality data (2000–2004)			Linked hospital and NZHC tenant data (May 2003–December 2005)			Smoothed Māori cancer adjusters*	Standard error
	Number of Māori cancer registrations		Ratio of cancer registrations	Number of Māori hospital admissions		Ratio of hospital admissions		
	On cancer register ethnicity	On death registration ethnicity	Death/ cancer register ethnicity	On NHI ethnicity	On HNZC tenant ethnicity	HNZC/NHI ethnicity		
0–4	8	8	1.000	8,312	8,473	1.019	1.016	0.02455
5–9	7	8	1.143	3,030	3,115	1.028	1.015	0.02063
10–14	8	10	1.250	2,353	2,406	1.023	1.015	0.01731
15–19	6	11	1.833	4,147	4,181	1.008	1.016	0.01478
20–24	20	22	1.100	3,940	3,921	0.995	1.017	0.01335
25–29	23	24	1.043	3,476	3,489	1.004	1.018	0.01311
30–34	55	60	1.091	3,586	3,646	1.017	1.020	0.01420
35–39	80	79	0.988	3,346	3,411	1.019	1.035	0.01364
40–44	148	155	1.047	3,476	3,478	1.001	1.050	0.01420
45–49	200	219	1.095	3,659	3,891	1.063	1.067	0.01364
50–54	254	277	1.091	4,519	4,822	1.067	1.084	0.01420
55–59	347	369	1.063	3,315	4,042	1.219	1.099	0.01420
60–64	443	462	1.043	3,312	3,671	1.108	1.109	0.01311
65–69	460	493	1.072	3,212	3,593	1.119	1.120	0.01335
70–74	392	430	1.097	1,181	1,410	1.194	1.130	0.01478
75–79	249	273	1.096	627	650	1.037	1.140	0.01731
80–84	114	120	1.053	213	261	1.225	1.149	0.02067
85+	83	85	1.024	104	134	1.288	1.158	0.02455

Sources: NZHIS public hospitalisations, cancer registrations, mortality; SHOW Study.

*Rounded to three decimal places.

Figure A3.2: Smoothed Māori cancer adjusters (percentage increase)



Using adjusters to estimate Māori and non-Māori hospitalisations and cancer registrations

For the calculation of population rates, the adjusters were applied to the number of Māori hospitalisations and cancer registrations (as recorded on these data sets) to take into account the undercount of Māori at each age group. Non-Māori numbers were estimated as the difference between the total number of hospitalisations or cancer registrations and the adjusted Māori numbers. These data were used as numerators in the calculation of population rates and ratios. In addition, confidence intervals on the rates and ratios incorporated the standard error on the adjusters. Age-sex-ethnicity-specific population estimates for corresponding years served as denominators for the calculation of population rates.

Adjusters were applied to the calculation of any hospitalisation or cancer registration rates between 2000–2005, either by year or for aggregated years.

Conclusion

Latest data from the extension of the NZCMS for the period 2001–2004 show no net difference between census and mortality counts for Māori. Therefore, in this edition of *Hauora*, where mortality or death data is analysed for the period 2000–2004, death registration ethnicity has been used in the calculation of population mortality rates for Māori and non-Māori.

For hospital and cancer register data, linkage to other datasets with more reliable ethnicity shows that these datasets continue to undercount Māori and that the level of undercount varies by age, increasing in the elderly. Our results suggest that Māori hospital numbers should be approximately 5 to 15% higher depending on age, and

Māori cancer registrations 2 to 15% higher. Undercounting of Māori as estimated here is less than that found in some earlier studies where 20–25% net undercounts of Māori in hospital records have been shown (Harris et al 1997, Te Rōpū Rangahau Hauora a Eru Pōmare 1996). These findings may suggest that the quality of ethnicity data recording is improving across all of these health datasets.

The undercounting of Māori hospitalisation and cancer registrations leads to a numerator/denominator mismatch that creates a bias when rates using population census data for denominators are calculated. The application of adjusters aims to minimise this bias producing more accurate estimates of Māori hospital discharge and cancer registration numbers and the subsequent calculation of more accurate population rates by ethnicity. As these adjustors are age-specific, they also allow the calculation of more accurate age-specific and age-standardised rates. Finally, because they attempt to minimise the numerator/denominator mismatch, they also enable a better comparison of rates and, in particular, ratios across hospital, cancer and mortality data sets.

It is important to note that the adjusters were calculated using linkages close to the main time period of analysis. They are best designed for the data and time periods of linkage and may not be applicable to other time periods or datasets.

The ongoing problems with the quality of ethnicity data and the undercounting of Māori in routinely collected health data requires urgent action. It impedes our ability to monitor Māori health and inequalities, particularly over time. As data quality (hopefully) improves, the development of other adjusters may be needed but ideally adjusters should not be required at all.

Further research would be useful to investigate the reasons for the continuing undercounting of Māori in hospitalisation and cancer data. Such research could specifically investigate the process used by hospitals to assign ethnicity to the records they submit to NZHIS and also the processes used to update NHI ethnicity fields.

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APPENDIX 4: STANDARD POPULATIONS

Differences in the age structure of the Māori population (relatively young) and the non-Māori population (relatively old) make it necessary to adjust for age when comparing health outcomes. Direct standardisation applies age-specific rates to a standard population structure. The results are affected by the age distribution of events (e.g., deaths) in each population and the relative differences across age groups (the age-specific rate ratios). If these vary between the populations being compared, the selection of a standard population can affect the magnitude of rates and ratios, relative ranking of causes, and trends in rates and ratios.

In the main body of *Hauora IV* age-standardised rates are standardised to the 2001 Māori population.[1] On the *Hauora IV* website (www.hauora.maori.nz) we will also report rates standardised to Segi's world population and the WHO world population.

The age distributions of the three standard populations are presented in Table A4.1.

Table A4.1: Percentage of 2001 Māori, Segi's world and WHO world populations in each age group

Age group (years)	2001 Māori population	Segi's world population	WHO world population
0–4	12.84	12.00	8.86
5–9	12.56	10.00	8.69
10–14	11.93	9.00	8.60
15–19	9.41	9.00	8.47
20–24	8.00	8.00	8.22
25–29	7.63	8.00	7.93
30–34	7.46	6.00	7.61
35–39	7.28	6.00	7.15
40–44	6.24	6.00	6.59
45–49	4.77	6.00	6.04
50–54	3.70	5.00	5.37
55–59	2.63	4.00	4.55
60–64	2.19	4.00	3.72
65–69	1.51	3.00	2.96
70–74	0.96	2.00	2.21
75–79	0.51	1.00	1.52
80–84	0.23	0.50	0.91
85 +	0.14	0.50	0.63
Total	100.00	100.00	100.00

Note: The WHO standard has proportions delineated for five-year age groups up to the age of 100+, which have been grouped together.

[1] 2001 Census usually resident population. Table 3. URL: http://www.stats.govt.nz/census/2001-census-data/2001-maori/default.htm. Accessed online 3 September 2007.

APPENDIX 5: TE TIRITI O WAITANGI[1]

The Māori version

Te Tiriti o Waitangi

Ko Wikitoria te Kuini o Ingarangi i tana mahara atawai ki nga Rangatira me nga Hapu o Nu Tirani i tana hiahia hoki kia tohungia ki a ratou o ratou rangatiratanga me to ratou wenua, a kia mau tonu hoki te Rongo ki a ratou me te Atanoho hoki kua whakaaro ia he mea tika kia tukua mai tetahi Rangatira – hei kai wakarite ki nga Tangata Māori o Nu Tirani – kia whakaaetia e nga Rangatira Māori te Kawanatanga o te Kuini ki nga wahikatoa o te Wenua nei me nga Motu – na te mea hoki he tokomaha ke nga tangata o tona lwi Kua noho ki tenei wenua, a e haere mai nei.

Na ko te Kuini e hiahia ana kia wakaritea te Kawanatanga kia kaua ai nga kino e puta mai ki te tangata Māori ki te Pākehā e noho ture kore ana.

Na, kua pai te Kuini kia tukua a hau a Wiremu Hopihona he Kapitana i te Roiara Nawi hei Kawana mo nga wahi katoa o Nu Tirani e tukua aianei, amua atu ki te Kuini, e mea atu ana ia ki nga Rangatira o te wakaminenga o nga hapu o Nu Tirani me era Rangatira atu enei ture ka korerotia nei.

Ko Te Tuatahi

Ko nga Rangatira o te wakaminenga me nga Rangatira katoa hoki ki hai i uru ki taua wakaminenga ka tuku rawa atu ki te Kuini o Ingarani ake tonu atu – te Kawanatanga katoa o o ratou Wenua.

Ko Te Tuarua

Ko te Kuini o Ingarani ka wakarite ka wakaae ki nga Rangatira ki nga hapu – ki nga tangata katoa o Nu Tirani te tino rangatiratanga o o ratou wenua o ratou kainga me o ratou taonga katoa. Otiia ko nga Rangatira o te wakaminenga me nga Rangatira katoa atu ka tuku ki te Kuini te hokonga o era wahi wenua e pai ai te tangata nona te Wenua – ki te ritenga o te utu e wakaritea ai e ratou ko kai hoko e meatia nei e te Kuini hei kai hoko mona.

Ko Te Tuatoru

Hei wakaritenga mai hoki tenei mo te wakaaetanga ki te Kawanatanga o te Kuini – Ka tiakina e te Kuini o Ingarani nga tangata Māori katoa o Nu Tirani ka tukua ki a ratou nga tikanga katoa rite tahi ki ana mea ki nga tangata o Ingarani.

[Signed] William Hobson Consul and Lieutenant Governor

Na ko matou ko nga Rangatira o te Wakaminenga o nga hapu o Nu Tirani ka huihui nei ki Waitangi ko matou hoki ko nga Rangatira o Nu Tirani ka kite nei i te ritenga o

[1] This appendix is based on the translation and notes outlined in IH Kawharu (ed), *Waitangi: Māori and Pākehā Perspectives on the Treaty of Waitangi*. Auckland: Oxford University Press, 1989.

enei kupu, ka tangohia ka wakaaetia katoatia e matou, koia ka tohungia ai o matou ingoa o matou tohu.

Ka meatia tenei ki Waitangi i te ono o nga ra o Pepueri i te tau kotahi mano, e waru rau e wa te kau o to tatou Ariki.

The English translation of the Māori version[i]

The Treaty of Waitangi

Victoria, the Queen of England, in her concern to protect the chiefs and the sub-tribes of New Zealand and in her desire to preserve their chieftainship[ii] and their lands to them and to maintain peace[iii] and good order considers it just to appoint an administrator[iv] one who will negotiate with the people of New Zealand to the end that their chiefs will agree to the Queen's Government being established over all parts of this land and (adjoining) islands[v] and also because there are many of her subjects already living on this land and others yet to come. So the Queen desires to establish a government so that no evil will come to Māori and European living in a state of lawlessness. So the Queen has appointed me, William Hobson a Captain in the Royal Navy to be Governor for all parts of New Zealand (both those) shortly to be received by the Queen and (those) to be received hereafter and presents[vi] to the chiefs of the Confederation chiefs of the subtribes of New Zealand and other chiefs these laws set out here.

The first

The Chiefs of the Confederation and all the chiefs who have not joined that Confederation give absolutely to the Queen of England for ever the complete government[vii] over their land.

The second

The Queen of England agrees to protect the chiefs, the subtribes and all the people of New Zealand in the unqualified exercise[viii] of their chieftainship over their lands, villages and all their treasures.[ix] But on the other hand the Chiefs of the Confederation and all the Chiefs will sell[x] land to the Queen at a price agreed to by the person owning it and by the person buying it (the latter being) appointed by the Queen as her purchase agent.

The third

For this agreed arrangement therefore concerning the Government of the Queen, the Queen of England will protect all the ordinary people of New Zealand and will give them the same rights and duties[xi] of citizenship as the people of England.[xii]

[Signed] William Hobson Consul and Lieutenant-Governor

So we, the Chiefs of the Confederation of the subtribes of New Zealand meeting here at Waitangi have seen the shape of these words which we accept and agree to record our names and our marks thus. Was done at Waitangi on the sixth of February in the year of our Lord 1840.

Appendix Five

The English version

The Treaty of Waitangi

Her Majesty Victoria Queen of the United Kingdom of Great Britain and Ireland regarding with Her Royal Favour the native chiefs and tribes of New Zealand and anxious to protect their just rights and property and to secure to them the enjoyment of peace and good order has deemed it necessary in consequence of the great number of Her Majesty's Subjects who have already settled in New Zealand and the rapid extension of emigration both from Europe and Australia which is still in progress to constitute and appoint a functionary properly authorised to treat with the Aborigines of New Zealand for the recognition of Her Majesty's sovereign authority over the whole or any part of those islands.

Her Majesty therefore being desirous to establish a settled form of civil Government with a view to avert the evil consequences which must result from the absence of the necessary laws and institutions alike to the native population and to Her subjects has been graciously pleased to empower and to authorise 'me William Hobson a Captain' in Her Majesty's Royal Navy Consul and Lieutenant Governor of such parts of New Zealand as may be or hereafter shall be ceded to Her Majesty to invite the confederated and independent chiefs of New Zealand to concur in the following articles and conditions.

Article the first

The Chiefs of the Confederation of the United Tribes of New Zealand and the separate and independent chiefs who have not become members of the Confederation cede to Her Majesty the Queen of England absolutely and without reservation all the rights and powers of sovereignty which the said Confederation or individual chiefs respectively exercise or possess, or may be supposed to exercise or to possess, over their respective territories as the sole sovereigns thereof.

Article the second

Her Majesty the Queen of England confirms and guarantees to the chiefs and tribes of New Zealand and to the respective families and individuals thereof the full exclusive and undisturbed possession of their lands and estates forests fisheries and other properties which they may collectively or individually possess so long as it is their wish and desire to retain the same in their possession; but the Chiefs of the United Tribes and the individual chiefs yield to Her Majesty the exclusive right of pre-emption over such lands as the proprietors thereof may be disposed to alienate at such prices as may be agreed upon between the respective proprietors and persons appointed by Her Majesty to treat with them in that behalf.

Article the third

In consideration thereof Her Majesty the Queen of England extends to the natives of New Zealand Her royal protection and imparts to them all the rights and privileges of British subjects.

[Signed] W Hobson Lieutenant Governor

Now therefore we the Chiefs of the Confederation of the united tribes of New Zealand being assembled in Congress at Victoria in Waitangi and we the separate and independent chiefs of New Zealand claiming authority over the tribes and territories which are specified after our respective names, having been made fully to understand the provisions of the foregoing Treaty, accept and enter into the same in the full spirit and meaning thereof in witness of which we have attached our signatures or marks at the places and the dates respectively specified.

Done at Waitangi this sixth day of February in the year of Our Lord one thousand eight hundred and forty.

Notes

[i] An attempt at a reconstruction of the literal translation.

[ii] 'Chieftainship': this concept has to be understood in the context of Māori social and politicalorganisation as at 1840. The accepted approximation today is 'trusteeship'; see New Zealand Māori Council Kaupapa 1983.

[iii] 'Rongo': 'Peace', seemingly a missionary usage (rongo – to hear, ie, hear the 'Word' – the 'message' of peace and goodwill, etc).

[iv] 'Chief' ('Rangatira') here is of course ambiguous. Clearly a European could not be a Māori, but the word could well have implied a trustee-like role, rather than that of a mere 'functionary'. Māori speeches at Waitangi in 1840 refer to Hobson being or becoming a 'father' for the Māori people. Certainly this attitude has been held towards the person of the Crown down to the present day – hence the continued expectations and commitments entailed in the Treaty.

[v] 'Islands', ie. neighbouring, not of the Pacific.

[vi] 'Making', ie. 'offering' or '*saying*' but *not* 'inviting to concur' (cf English version).

[vii] 'Government': 'kawanatanga'. There could be no possibility of the Māori signatories having any understanding of government in the sense of 'sovereignty', ie. any understanding on the basis of experience or cultural precedent.

[viii] 'Unqualified exercise' of the chieftainship: this would emphasise to a chief the Queen's intention to give them complete control according to *their* customs 'Tino' has the connotation of 'quinessential'.

[ix] 'Treasures': 'taonga'. As submissions to the Waitangi Tribunal concerning file Māori language have made clear, 'taonga' refers to all dimensions of a tribal group's estate, material and non-material – heirlooms and wahi tapu (sacred places), ancestral lore and whakapapa (genealogies), etc.

[x] 'Sale and purchase': 'hokonga'. Hoko means to buy or sell.

[xi] 'Rights and duties': Māori 'tikanga'. While tika means right, correct, (eg, 'e tika hoki' means 'that is right'), 'tikanga' most commonly refers to custom(s), for example of the marae (ritual forum); and custom(s) clearly includes the notion of duty and obligation.

[xii] There is, however, a more profound problem about 'tikanga'. There is a real sense here of the Queen 'protecting' (ie, allowing the preservation of) the Māori people's tikanga (ie, customs), since no Māori could have had any understanding whatever of *British* tikanga (ie, rights and duties of British subjects). This, then, reinforces the guarantees in Article 2.

NOTES ON AUTHORS

Papaarangi Reid initiated the project and developed the conceptual and analytical framework, and the book structure. Fiona Cram coordinated the project and managed the book and website production. Gordon Purdie carried out the statistical analyses. Donna Cormack contributed to the final production of the book. Bridget Robson and Ricci Harris edited the book. Individual authors are named on the chapters they wrote and are listed below.

Dr Joanne Baxter (Kai Tahu, Kati Mamoe, Waitaha, Ngati Apa) is a mother of two girls and is a Māori health and mental health researcher and lecturer based in Te Rōpū Rakahau Hauora Māori a Kai Tahu, in the Dunedin School of Medicine. Joanne trained in medicine in Auckland and has a background in psychiatry and public health. She has research interests in Māori mental health and in understanding and addressing health disparities e.g., the impact of racism on health. Joanne's research includes working on Te Rau Hinengaro (the New Zealand Mental Health Survey) and investigating ethnicity and health in the Dunedin Multidisciplinary Health and Development Research Unit.

Dr Julia Carr is a public health physician with an interest in Māori health, politics of health, primary health care and prison health. She is a Pākehā New Zealander, currently working in Planning and Funding at District Health Board level. Julia was educated at University of Otago and through life and work in Wellington, Zimbabwe and by Ngāti Porou on the East Coast.

Donna Cormack, Waitaha, Kāti Mamoe, Kai Tahu, is a mother to Te Manaia and a Māori health researcher with Te Rōpū Rangahau Hauora a Eru Pōmare at the Wellington School of Medicine and Health Sciences. Donna has been involved in work on the collection and classification of ethnicity data in Aotearoa/New Zealand, particularly as it relates to measuring and monitoring disparities. Most recently, Donna has been focused on work examining disparities in cancer outcomes and access to cancer services for Māori. Donna has a particular interest in discourses of 'race', ethnicity and health, and the ways in which these discourses work to maintain or challenge taken-for-granted knowledge in Aotearoa. She is currently completing her PhD investigating the ways in which elite discourses, such as those of the media and politicians represent social groups and social relations in Aotearoa.

Dr Fiona Cram, Ngāti Kahungunu, mother of one son, PhD (University of Otago: Social and Developmental Psychology), is the Director of a small research, evaluation and training company, Katoa Ltd. Previously, Fiona was variously in the Departments of Psychology and Education at the University of Auckland; and a Senior Research Fellow in the International Research Institute for Māori and Indigenous Peoples (IRI), University of Auckland. Fiona's research interests are wide-ranging and include Māori health (including whānau violence, health service provision, and genetics), Māori and community development, and social service provision.

Dr Sue Crengle is from the Waitaha, Kati Mamoe and Kāi Tahu tribes in Aotearoa/New Zealand. She graduated with her medical and Master of Public Health degrees

from the Faculty of Medicine and Health Sciences at Auckland University. She holds specialty qualifications in general practice and public health medicine. She was a recipient of the Harkness Fellowship in Health Policy 1999–2000, spending time at Johns Hopkins School of Public Health, Baltimore, USA. On her return from the US she spent a year working as a Senior Advisor in the Ministry of Health. She is currently a Senior Lecturer in Te Kupenga Hauora Māori, and Director of Tōmaiora Māori Health Research Centre, Faculty of Medicine and Heath Sciences, University of Auckland. Her current research interests include health services research, quality of care, and surveys about youth and Māori men's health.

Dr Elana Taipapaki Curtis (Ngāti Rongomai, Ngāti Pikiao, Te Arawa) is a public health physician currently working as Senior Lecturer Medical at Te Kupenga Hauora Māori, University of Auckland. She is Kaiārahi of Hikitia Te Ora – Certificate in Health Sciences, a pre-degree programme aimed at increasing the number of Māori and Pacific students entering into Medicine, Pharmacy, Nursing and Health Sciences. In 2004–2005, Elana was a Harkness Fellow in Healthcare Policy based at the University of California – San Francisco investigating ethnic disparities in breast cancer mortality and survival. Prior to this, Elana worked at the National Screening Unit, Ministry of Health in Wellington where she investigated Māori/non-Māori disparities in breast cancer epidemiology and at Te Rōpū Rangahau Hauora a Eru Pōmare at the University of Otago investigating ethnic disparities in access to invasive cardiovascular procedures/caesarean sections and the relationship between disparities and deprivation. She is a member of the Māori Cardiovascular Advisory Group, Independent Monitoring Group for Cervical Cancer Screening and has been actively involved in developing Te Ohu Rata o Aotearoa – Māori Medical Practitioners Association (Te ORA). Her research interests include investigating ethnic inequalities in health using a Kaupapa Māori Research framework in order to eliminate existing disparities.

Dr Ricci Harris (Ngāti Kahungunu, Ngāti Raukawa, Ngāi Tahu) is a public health physician at Te Rōpū Rangahau Hauora a Eru Pōmare, Wellington School of Medicine and Health Sciences. Ricci has a particular in interest in Māori health research, epidemiology and the investigation of ethnic inequalities in Aotearoa/New Zealand. This has included research into sleep disorders, the classification of ethnicity, ethnic disparities in caesarean sections and cardiovascular procedures, the impact of socioeconomic position on ethnic inequalities in mortality, and the impact of racism on health and ethnic inequalities. Ricci is also a member of the Māori advisory group for the National Screening Unit.

Dr Matire Harwood (Ngā Puhi) studied at the Auckland School of Medicine and now works as a GP and Māori health researcher in Wellington. She is currently involved in a number of research projects including a study that aims to improve stroke recovery for Māori and their whānau and the Health Inequalities Research Project (Unequal Treatment for Māori with Ischaemic Heart Disease). She also provides commentary for the Māori Health Research Review, an e journal for providers and researchers. Other work interests include Māori and ethics, asthma management and protection of the

environment (as member of Ngā Kaihautu Tikanga Taiao). Outside of work Matire is mum to Te Rangiura and a keen waka ama paddler!

Vera Keefe-Ormsby, Ngāti Pāhauwera, Ngāti Raukawa, Rongomaiwahine, is Mum to one son, Jayden. Vera worked as a school dental nurse in the Hawkes Bay region from the mid 1970s to the mid 1980s. She then moved to Wellington and worked in the Māori Health Policy section of the Department of Health. In 1993 she joined Te Pūmanawa Hauora ki Te Whanganui a Tara, later known as Te Rōpū Rangahau Hauora a Eru Pōmare. Vera was involved in a number of research projects, with one particular study, 'Mauri Tangata' investigating the effects of job loss on health amongst redundant freezing workers in the Hawkes' Bay region, being her 'baby'. Other research interests included oral health, Māori health providers, kaupapa Māori research, ethnicity data quality, and eliminating inequalities. A strong advocate for the Treaty of Waitangi and for Māori communities, Vera was also heavily involved in iwi, hapū and whānau health care including the Hawkes Bay DHB, Wairoa PHO and the Ngāti Pāhauwera Hauora Society. Sadly Vera passed away 26 August 2005, but her contribution to Māori health development continues. Tātai whetū ki te rangi, mau tonu, mau tonu; tātai tangata ki te whenua, ngaro noa, ngaro noa.

Pauline Koopu, Te Whanau-a-Apanui, Ngāti Konohi, Ngāti Kahu. Pauline graduated as a dentist in 1996 (BDS, Otago) and has worked in Wellington Hospital dental department for most of her career. In 2005, she was the first Māori woman to attain a Masters in community dentistry (MCommDent, Otago) and her thesis research looked at Māori oral health service utilisation and Māori oral health outcomes. Pauline has worked as a research fellow for Te Rōpū Rangahau Hauora a Eru Pōmare and as a senior oral health advisor for the Ministry of Health.

Dr Kara Mihaere, Rangitāne, Ngāti Kahungunu, Ngāti Maniapoto, PhD (Massey University: Public Health), is an Intern Clinical Psychologist at Rangataua Mauriora, Tu Te Wehi – Primary Mental Health Service, Porirua. Previously, Kara has worked as a Postdoctoral Research Fellow at the Sleep/Wake Research Centre, Massey University and Te Rōpū Rangahau a Eru Pōmare, Wellington School of Medicine & Health Sciences.

Dr Sarah-Jane Paine (Tūhoe) was raised in Wairoa, Hawkes Bay and is currently based at the Sleep/Wake Research Centre at Massey University in Wellington. Her PhD thesis focused on whether individual differences in the timing of human sleep are related to differences in the circadian biological clock or driven by societal demands, such as work patterns and family commitments. Sarah-Jane is also committed to carrying out research that is beneficial for Māori, and continues to develop her understanding of kaupapa Māori research methodologies and she is particularly interested in the ethical implications of genetic research for Māori communities.

Suzanne Pitama (nee Meihana), Ngati Kahungunu, co- founded and is Co-Director of the Māori/Indigenous Health Institute (MIHI), University of Otago – Christchurch. Over the last five years she has led development and evaluation of the Hauora Māori medical curriculum, both at the Christchurch School and a University level. She has previously worked clinically with ante-natal and post-natal adolescents before specialising in working with children (5–17 years) with severe and challenging

behaviours. She currently practises in a part-time capacity in the Department of Paediatrics, Christchurch Hospital. Suzanne has engaged in Māori health research for more than 12 years and is currently leading a major study of cardiovascular disease in the Māori community.

Dr Ramon Pink (Te Aupouri, Te Rarawa) is a public health physician, married with three children. He is currently employed by the Canterbury District Health Board as a Medical Officer of Health. His responsibilities include Māori Health and Communicable Diseases. Previously Ramon worked as a general practitioner in Otara, South Auckland, and then for the Counties Manukau District Health Board, focusing on improved access to primary care services for Māori. His research interest in bronchiectasis is generated from the impact of this disease on whānau, and from his clinical experiences in general practice.

Gordon Purdie works as a statistician in the Department of Public Health, University of Otago, Wellington. He is part of a team providing statistical consulting to health researchers and works with Te Rōpū Rangahau Hauora a Eru Pōmare on several research projects. His concerns include discrimination and inequalities.

Dr Mihi Ratima PhD, Whakatohea and Ngāti Awa, is a Commonwealth Fund Harkness Fellow in Health Care Policy with a joint appointment at the Harvard School of Public Health and Brigham and Women's Hospital, Boston, US. In late 2007 she will return to her role as associate professor and director of Taupua Waiora Centre for Māori Health Research, AUT University. Her research interests are in the areas of health promotion, health workforce development, and reducing ethnic health disparities. She was formerly a World Health Organization analyst, a Fulbright scholar, a researcher with Te Pūmanawa Hauora and the Centre for Public Health Research, Massey University and a diplomat.

Dr Keri Huia Ratima MB ChB M Med Sci DPH FRNZCGP., Whakatohea and Ngāti Awa, is the Tumuaki Whakangungu Māori (Māori Director of Training) at the Royal New Zealand College of General Practitioners (RNZCGP). She and Mihi are sisters, and she has two wonderful sons Taako and Heremia. She has previously worked in general practice in Opotiki, in Māori health research at Massey University, and in healthcare policy in the National Health Committee in Wellington. Her research interests mirror her sister's.

Dr Papaarangi Reid, Te Rarawa, is a public health physician with a research interest in equity and monitoring Crown action to eliminate ethnic inequalities in health between Māori and non-Māori New Zealanders. A leading advocate for Māori health issues, she has worked in health promotion, tobacco control, the determinants of health, workforce development and kaupapa Māori research. Formerly director of Te Rōpū Rangahau Hauora a Eru Pōmare, she is currently the Tumuaki in the Faculty of Medical and Health Sciences, University of Auckland.

Dr Tania Te Akau Riddell, Ngāti Porou and Te Aitanga a Mahaki, Public Health Specialist and Senior Research Fellow at the School of Population Health, University of Auckland. Tania has a background as a general practitioner and lives with her whānau in Auckland. She is currently working on a cardiovascular risk assessment and management project at the Section of Epidemiology and Biostatistics, University of

Auckland. Her other research interests include the social determinants of health inequalities and the effects of racism on health.

Bridget Robson, Ngāti Raukawa, is a senior research fellow and director of Te Rōpū Rangahau Hauora a Eru Pōmare at the School of Medicine and Health Sciences, University of Otago, Wellington. Her research interests are in the areas of the social and economic determinants of health, inequitable treatment in the health system, the impact of racism on health and the development of a kaupapa Māori epidemiology. Bridget was an author on *Hauora: Standards of Health III*. She is currently working on the Mauri Tangata project on unemployment and health, is leading the Unequal Treatment research project on disparities in health care, is involved in several projects on Māori cancer outcomes, including the *Unequal Impact* series, and is active in providing Tackling Inequalities workshops for the health sector.

Carey Robson, Ngāti Raukawa, is from Wellington. She has worked at Wellington Hospital and at Te Rōpū Rangahau Hauora a Eru Pōmare, and conducted a study of discourses on Māori health in the media. She has an MA from Auckland University, in which she studied Māori health history.

Dr David Tipene-Leach is a Ngāti Kere from Porangahau in the Hawkes Bay. He is presently a GP for Te Taiwhenua o Heretaunga. With postgraduate qualifications in public health he has interests in the prevention of diabetes and the prevention of SIDS in the Māori community. He has served in the past on the Advisory Committee on Primary Care, ALAC, and the national Child and Youth Mortality Review Committee. He was Senior Lecturer in Māori Health at the University of Auckland and was the foundation Chair of Te Ora, the Māori Medical Practitioners Association before returning to general practice in 2001.

Kataraina Pipi with her namesake Tu Te Kiha Kataraina Ahorangi Penehira-Hawke *Photo by Sharon Hawke*

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