

Unlocking the Numerator-Denominator Bias for the 1980s and 1990s

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**UNLOCKING THE NUMERATOR-
DENOMINATOR
BIAS FOR THE
1980s AND 1990s**

NZCMS Technical Report No. 4

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Statistic New Zealand's Security Statement

The New Zealand Census-Mortality Study was initiated by Dr Tony Blakely and his co-researchers from the Wellington School of Medicine, University of Otago. It was approved by the Government Statistician as a Data Laboratory project under the Microdata Access Protocols.

Requirements of the Statistics Act

Under the Statistics Act 1975 the Government Statistician has legal authority to collect and hold information about people, households and businesses, as well as the responsibility of protecting individual information and limits to the use to which such information can be put. The obligations of the Statistics Act 1975 on data collected under the Act are summarised below.

1. Information collected under the Statistics Act 1975 can be used only for statistical purposes.
2. No information contained in any individual schedule is to be separately published or disclosed to any person who is not an employee of Statistics New Zealand, except as permitted by sections 21(3B), 37A, 37B and 37C of the Act.
3. This project was carried out under section 21(3B). Under Section 21(3B) the Government Statistician requires an independent contractor under contract to Statistics New Zealand, and any employee of the contractor, to make a statutory declaration of secrecy similar to that required of Statistics New Zealand employees where they will have access to information collected under the Act. For the purposes of implementing the confidentiality provisions of the Act, such contractors are deemed to be employees of Statistics New Zealand.
4. Statistical information published by Statistics New Zealand, and its contracted researchers, shall be arranged in such a manner as to prevent any individual information from being identifiable by any person (other than the person who supplied the information), unless the person owning the information has consented to the publication in such manner, or the publication of information in that manner could not reasonably have been foreseen.
5. The Government Statistician is to make office rules to prevent the unauthorised disclosure of individual information in published statistics.
6. Information provided under the Act is privileged. Except for a prosecution under the Act, no information that is provided under the Act can be disclosed or used in any proceedings. Furthermore no person who has completed a statutory declaration of secrecy under section 21 can be compelled in any proceedings to give oral testimony regarding individual information or produce a document with respect to any information obtained in the course of administering the Act, except as provided for in the Act.

Census data

The Population Census is the most important stocktake of the population that is carried out. The statistics that are produced provide a regular picture of society. Results are used widely in making decisions affecting every neighbourhood. They are used in planning essential local services, and they also help to monitor social programmes ranging from housing to health.

Traditionally census data is published by Statistics New Zealand in aggregated tables and graphs for use throughout schools, business and homes. Recently Statistics New Zealand has sought to increase the benefits that can be obtained from its data by providing access to approved researchers to carry out research projects. Microdata access is provided, at the discretion of the Government Statistician, to allow authoritative statistical research of benefit to the public of New Zealand.

This project used anonymous census data and mortality data, which were integrated using a probabilistic linking methodology to create a single data-set that allows the researchers to undertake a statistical study of the association of mortality and socio-economic factors. This is the first time that the census has been linked to an administrative data-set for purposes apart from improving the quality of Statistics New Zealand surveys. The project has been closely monitored to ensure it complies with Statistics New Zealand's strict confidentiality requirements.

Further information

For further information about confidentiality matters in regard to this study please contact either:

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Chapter 1: Introduction

This technical report subsumes the earlier report on the numerator-denominator analyses for the 1991-94 census-mortality records (Blakely and Atkinson 2001) and presents analyses for all four (1981-84, 1986-89, 1991-94, and 1996-99) census-mortality cohorts. This report uses 'age at death' (instead of 'age at census' used in the previous report) as the age variable and a somewhat different method for weighting, which may alter some of the adjustment ratios published earlier for the 1991 census-mortality cohort.

Routinely published mortality rates use census data for the denominator, and mortality data (obtained from death registration form usually completed by the funeral director) for the numerator. There are two major problems affecting routinely calculated and published **ethnic-specific** mortality rates:

1. the use of different ethnicity questions on census and mortality data (see Figure 19 to Figure 24, page 109 to page 111), and
2. the use of different data collection methods between the death registration form and the census, e.g. funeral director versus self-identified, or missing data defaulted to non-Māori non-Pacific versus actually identified as missing.

There has been significant undercounting of Māori (or Pacific) deaths compared to census data (at least prior to 1996). This gives rise to a 'numerator-denominator bias' when calculating ethnic specific mortality rates (Blakely et al. 2002). The anonymous and probabilistic record linkage of census and mortality records in the New Zealand Census-mortality Study (NZCMS) allows us to quantify this numerator-denominator bias. The details of linking the census and mortality records for the four census years (1981, 1986, 1991, and 1996) in the NZCMS are described elsewhere (Blakely 2002; Hill et al. 2002). Briefly, each of the four censuses were linked to three subsequent years of mortality data for people aged 0-74 years on census night. This linking allowed a direct comparison of the ethnic group on the mortality data with that on the preceding census for what were highly likely to be the same individuals. That is, we could quantify (or "unlock") the numerator-denominator bias affecting ethnic-specific mortality rates.

However, not all the mortality records were linked to a census record. Further not all linked census-mortality records could be used in the analyses of numerator-denominator bias. Therefore, a subset of the linked census-mortality records with a very high likelihood of being correct links was selected to form the 'Highly Probable Links' (HPL) data-set'. This data-set was "weighted up" to represent all eligible mortality records to allow the analyses of numerator-denominator bias.

This Report:

- describes the weighting of the HPL data-set
- discusses the possibility of misclassification bias and residual systemic bias in the analyses
- provides an extensive list of tables of adjustment ratios for all 4 census-mortality cohorts
- provides guidance and advice on how to use the results of this report.

Chapter 2: Methods

2.1 Ethnicity

2.1.1 Census

The censuses collected data on ‘ethnic origin’ in 1981 and 1986, and ‘ethnic group’ in 1991 and 1996. Each census allowed for multiple groups to be self-identified hence, each ethnic group could be categorised into ‘*Sole*’ and ‘*Prioritised*’. The ethnicity question on the 1996 census was modified to include extra categories, and encouraged multi-ethnic responses. Consequently the 1996 *Sole* groups became smaller and the *Prioritised* groups became larger compared to the 1991 census.

Sole ethnic group was assigned as Māori if only one ethnic group was self-identified, and that was Māori (or $\frac{1}{2}$ or more Māori ethnic origin in the 1981 census). The sole group was assigned as Pacific if the census form stated only one self-identified ethnic group, and that was Pacific (or more than $\frac{1}{2}$ Pacific ethnic origin in the 1981 census). The remainder were assigned as non-Māori non-Pacific.

Prioritised ethnic group was assigned as Māori if one of the three possible self-identified ethnicity responses on the 1986, 1991 and the 1996 census was Māori. Therefore, for Māori, the prioritised ethnic group represented the Total Māori Ethnic Group (MEG). For those not allocated as Māori, the prioritised ethnic group was assigned as Pacific if one of the self-identified ethnic groups was Pacific. The remainder were assigned as non-Māori non-Pacific. Note the Pacific prioritised ethnic group did not represent the total number of census respondents who identified one ethnic group as Pacific – some of these people also self-identified as Māori and were therefore categorized as Prioritised Māori. *In this report, those who recorded any degree of Māori ethnic origin in the 1981 census were categorised as prioritised Māori (or MEG). Of the rest, those who recorded any degree of Pacific ethnic origin in the 1981 census were categorised as prioritised Pacific.*

Although the 1981 sole group is based on ethnic origin, it is similar in number to the sole group of the 1986 and 1991 censuses. The 1981 prioritised group although not identical to the 1986 and 1991 censuses, is similar enough to form a series.

Census data includes the following ethnic/Island groups as Pacific: Samoan, Cook Island Māori, Aitutaki Islander, Atiu Islander, Mangaia Islander, Manihiki Islander, Mauke Islander, Mitiaro Islander, Palmerston Islander, Penrhyn Islander, Pukapuka Islander, Rarotongan Islander, Tongan, Niuean, Tokelauan, Fijian, Admiralty Islander, Australian Aboriginal, Austral Islander, Belau/Palau Islander, Bismark Archipelago, Bougainvillean, Caroline Islander, Easter Islander, Gambier Islander, Guadalcanian, Guam Islander, Hawaiian, Kanaka/Kanak, Kiribati/ Gilbertese, Malaitian, Manus Islander, Mariana Islander, Marquesas Islander, Marshall Islander, Nauru Islander, New Britain Islander, New Georgian, New Irelander, Papuan/ New Guinean/ Irian Jayan,

Phoenix Islander, Pitcairn Islander, Rotuman, Santa Cruz Islander, Society Islander (including Tahitian), Solomon, Torres Strait Islander/ Thursday Islander, Tuamotu Islander, Tuvalu Islander/Ellice Islander, Vanuata Islander/ New Hebridean, Wake Islander, Wallis Islander, Yap Islander, and 'Other Pacific Peoples'.

2.1.2 Mortality

Until September 1995, the recording of ethnicity on the death certificate was different from the census. The definition was based on biological race and was collected only for Māori and Pacific ethnic groups. The standard enumeration of Māori (or Pacific) on the mortality records was 'Māori (or Pacific) blood greater than half'. The degree of Māori (or Pacific) blood was based on question in the death registration form about the ethnicity of the *parents* of the deceased rather than the decedent him- or herself. In September 1995, the ethnicity question on the death registration form changed from a focus on descent to that of ethnicity using the same question as the 1996 Census.

The ethnicity question on the National Health Index (NHI – the index file at NZHIS linking all hospitalisations and birth/death records for the same person) file did not change until mid-1996. The NHI ethnicity is that (supposedly) entered by hospital clerks at the last hospitalisation before death. Thus, the NHI ethnicity is collected independently of the death registration form ethnicity, unless there was no preceding hospitalisation event in which case the death registration form is used to construct the NHI file. (The death registration form is used as the basis of the death event on National Minimum Data-Set (NMDS) at New Zealand Health Information Services (NZHIS). In this report, therefore, we often refer to the death registration ethnicity as the NMDS ethnicity. Prior to the NHI file being introduced in 1988, there was no NMDS. Instead, mortality records made up the Historical Mortality Data-Set (HMDS).

For the 1996-99 census-mortality cohort we assigned four different ethnic groups– Māori, Pacific, Asian, and non-Māori non-Pacific non-Asian. For the other three census-mortality cohorts (1981-84, 1986-89, 1991-94) only three ethnic groups were assigned: Māori, Pacific and non-Māori non-Pacific. All the ethnic groups were constructed as both prioritised and sole for both mortality (NMDS or death registration form and NHI) and census data.

2.2 Selection of the Highly Probable Links (HPL) data-set for numerator-denominator analyses

In order to investigate the numerator-denominator bias, the mortality data had to be linked to the census data. For 1981-84 census-mortality cohorts, 31,741 (71%), for 1986-89 census-mortality cohort, 32,837 (74%), for 1991-94 census-mortality cohort, 31,635 (77%), and for 1996-99 census-mortality cohort, 30,889 (78%) mortality records were anonymously and probabilistically linked to the respective census years (Hill et al. 2002). However, only very likely links where ethnicity played no part in the linkage process could be used in the analyses of the numerator-denominator bias. A subset of these linked census-mortality records that agreed exactly on sex, date of birth, and country of birth

formed the HPL data-set, and were used for the analyses of the numerator-denominator bias.

For the 1991-94 data-set, Meshblock (MB) / Area Unit (AU) codes were recorded in 1991-base. For the remaining data-sets, all MB/AU codes were in 1996-base. The NZDep score, rurality status and RHA for the 1981-84 and 1986-89 census-mortality cohorts are assigned based on the 1996 MB/AU codes. In the 1991-94 numerator-denominator bias analyses reported previously, the HPL data-set was restricted to records with agreement on meshblock (Blakely and Atkinson 2001). This time, however, we also included links without agreement on meshblock (but agreement on area unit) in the HPL data-sets of all 4 census-mortality cohorts.

Each mortality record was given an MB flag value of 0 or 1. If the mortality record was linked to the census record on a MB pass, then MB flag = 1. Those links with MB flag = 1 had a positive predictive value (PPV) > 99%, whereas those with MB flag = 0 were linked at the area unit (AU) level and had a PPV of 85%-90% (Hill et al. 2002). Decedents living in rural or more deprived areas were less likely to be assigned a meshblock and, therefore, more likely to be linked at the area unit level.

The reason for the inclusion of census-mortality links formed at the AU-level was to increase the representativeness of our analytical data-set for all mortality records – particularly for rural decedents that seldom had a meshblock assigned. But as the PPV was lower for these links, there was the risk of greater misclassification bias in our analyses. Sensitivity analyses presented later in this Report suggests that this misclassification bias was insubstantial (Section 2.5, page 26). Consequently, all results presented in this Report are based on the larger MB and AU-linked data-sets.

Information on census ethnicity was available only for those included in the HPL data-set. But there was near complete information on age at death, sex, mortality record ethnicity, Regional Health Authority (RHA), rurality, and NZDep, for *all eligible mortality records*. So it was possible to weight the HPL data-set to be representative of all eligible mortality records using these demographic variables.

For example, say there were 30 records on the mortality data-set of 45-64 year-old Māori males living in Midland RHA. Of these, 20 were included in the HPL data-set. So each of these 20 records would receive a weight of 1.5 (30/20) to make them representative of all eligible mortality records. (The weighted and the unweighted numbers by [sex] by [age at death] by [mortality record ethnicity] are shown in Table 39 to Table 42).

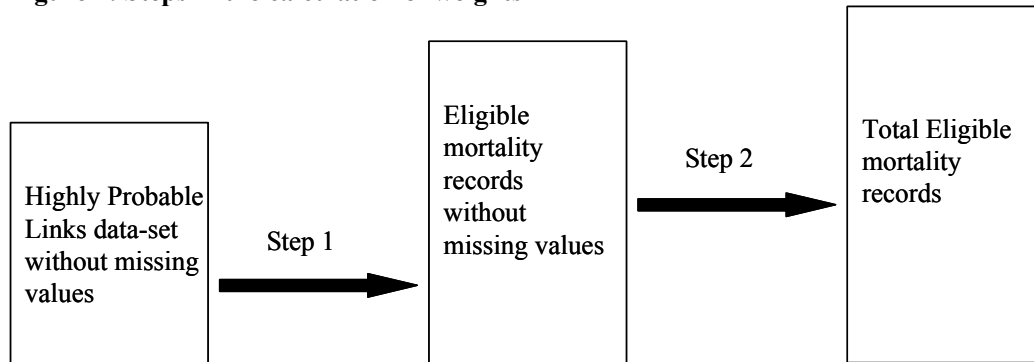
2.3 Weighting

In principle, to calculate the adjustment ratios for the numerator-denominator bias, all that was required was to cross-classify the mortality data ethnicity (NMDS Sole/Prioritised or NHI Sole/Prioritised) with census ethnicity (Sole/Prioritised) in the HPL data-set. However, there was varying percentage inclusion by ethnicity in the HPL data-sets, and simple cross-classification would have been severely biased. Therefore, the HPL data-sets were ‘weighted up’ to the eligible mortality record numbers.

The key assumption for the validity of all the adjustment ratios in this Report is that *within each strata* of mortality record [ethnicity] by [sex] by [age at death] by [RHA] by [NZDep] by [rurality] the distribution of census self-identified ethnicity was the same for those included in the HPL data-set as it was for all eligible mortality records in the given strata.

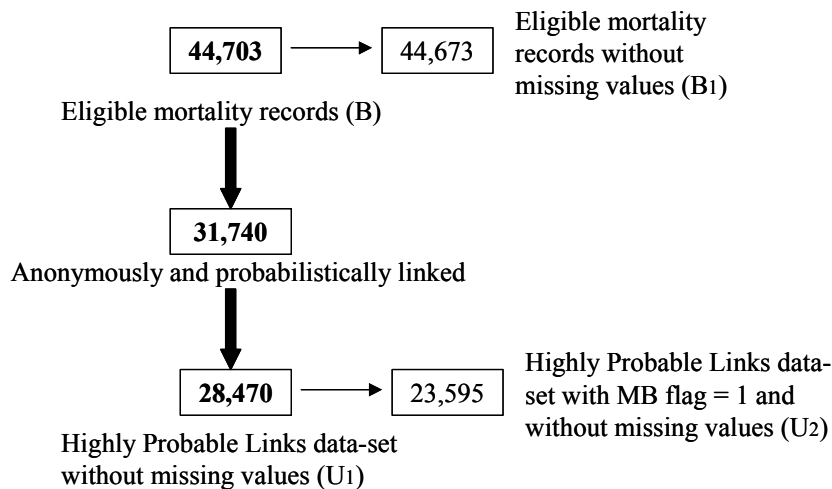
Thus, we assume that any biases regarding individual’s self-identified ethnicity on the census between HPL and mortality data-sets are controlled by the “strata” used for weighting. For all 4 cohorts, weights were calculated in the following two steps.

Figure 1: Steps in the calculation of weights



2.3.1 Weighting for 1981-84 deaths

Figure 2: Data-set selection for 1981-84 analyses



Of the 44,703 eligible mortality records (B), 44,673 records had an NZDep96 value (B₁) (obtained from the mortality records). In total, 28,470 records had no missing RHA or NZDep96 values (obtained from the census records) and were included in the Highly Probable Links (HPL) data-set (U₁) (Figure 2). Records of the HPL data-set linked only

at the meshblock level (MB flag = 1) (n = 23,595) were used to define the strata for calculation of the weights (U₂) (Figure 2).

2.3.1.1 Step1: Weighting n = 28,470 (U₁) and n = 23,595 (U₂) data-sets by n = 44,673 (B₁) data-set (i.e. NZDep96 scores non missing)

In order to calculate the weights, the two HPL data-sets (U₁ and U₂) and the mortality data-set (B₁) were stratified by the demographic variables. The number of decedents in each stratum determined the stratification for each of the three ethnic groups, the minimum cell size preferred being 3.

Figure 3 to Figure 5 diagrammatically show the strata used for each ethnic group (where ethnic group is that on the mortality data).

Figure 3: Diagrammatic representation of strata for non-Māori non-Pacific (1981-84)

a: Urban

		NON MĀORI NON PACIFIC - URBAN																			
		0-14 years				15-24 years				25-44 years				45-64 years				65-77 years			
		Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Northern RHA	Males																				
	Females																				
Midland RHA	Males																				
	Females																				
Central RHA	Males																				
	Females																				
Southern RHA	Males																				
	Females																				

b: Rural

		NON MĀORI NON PACIFIC - RURAL													
		0-14 years		15-24 years		25-44 years		45-64 years				65-77 years			
		Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Males	Northern and Midland RHA														
	Central and Southern RHA														
Females	Northern and Midland RHA														
	Central and Southern RHA														

For urban non-Māori non-Pacific decedents, there were 160 strata formed by cross classifying age at death (5 groups) by NZDep96 (4 groups) by RHA (4 groups) by sex (2 groups), i.e. $5 \times 4 \times 4 \times 2 = 160$ (Figure 3a). For rural non-Māori non-Pacific decedents, however, it was not possible to stratify this thinly because the numbers in many strata would have been too small (< 3) making it unstable. To ensure that no strata had less than three decedents, the categories were aggregated and this group, therefore, had 48 strata (Figure 3b). Likewise, similar aggregations were required for Māori and Pacific decedents (according to mortality records ethnicity). Rurality could not be included for either Māori or Pacific. Note that as most decedents assigned as Māori or Pacific on the mortality data (i.e. Figure 4 & Figure 5) were also Māori or Pacific on the census data, the numerator-denominator bias analyses were more sensitive to the non- Māori non-Pacific mortality records (i.e. Figure 3a).

Figure 4: Diagrammatic representation of strata for Māori (1981-84)

		MĀORI												
		0-14 years		15-24 years		25-44 years			45-64 years			65-77 years		
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10
Males	Northern RHA													
	Midland RHA													
	Central and Southern RHA													
Females	Northern RHA													
	Midland RHA													
	Central and Southern RHA													

For Māori, 70 strata were created (Figure 4).

Figure 5: Diagrammatic representation of strata for Pacific people (1981-84)

		PACIFIC PEOPLE				
		0-14 years	15-24 years	25-44 years	45-64 years	65-77 years
Deciles 1-8						
Deciles 9-10	Males					
	Females					

For Pacific people only 15 strata could be created (Figure 5).

In total, 293 strata were created in all the 3 data-sets [the 2 HPL (U_1, U_2) and the mortality (B_1) data-set]. The stratum specific weight was calculated by dividing the number of deaths in each stratum of B_1 ($n = 44,673$) by the number of deaths in the corresponding stratum of U_1 ($n = 28,470$) and U_2 ($n = 23,595$).

Hence, for any stratum i , the weight $W_{U_1}^i = N_{B_1}^i / N_{U_1}^i$, and $W_{U_2}^i = N_{B_1}^i / N_{U_2}^i$.

2.3.1.2 Step 2: Weighting $n=44,673$ (B_1) data-set by $n=44,703$ (B) data-set (i.e. NZDep96 scores missing)

A second weight was calculated for the demographic (age at death, sex and death registration form ethnicity) distribution in the full eligible mortality data (B , $n = 44,703$)

compared to the eligible mortality data with an NZDep96 (and RHA) value (B_1 , $n = 44,673$). A total of **30** strata were formed ($5 \times 2 \times 3$). The second weight was calculated by dividing number of deaths in each stratum of B by the number of deaths in corresponding stratum of B_1 .

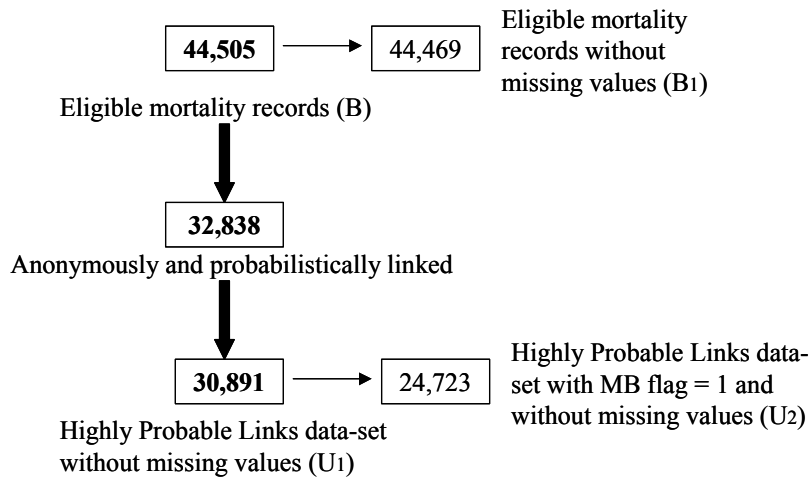
Hence, for any stratum i , the weight $W_B^i = N_B^i / N_{B_1}^i$.

The total weight was product of the above two weights, i.e. $W_1^i = W_{U_1}^i \cdot W_B^i$, or $W_2^i = W_{U_2}^i \cdot W_B^i$.

The weight W_1^i was then assigned to each mortality record in the U_1 data-set ($n = 28,470$) or W_2^i to each mortality record in the U_2 data-set ($n = 23,595$). Note that the weighted frequencies of age at death, sex and ethnicity (death registration form) on the HPL data-set gave the same frequency distribution as the unweighted for all eligible mortality records. However, the weighted distribution by RHA, NZDep96, or rurality was not quite identical due to aggregation of these variables in some instances during the weighting algorithms.

2.3.2 Weighting for 1986-89 deaths

Figure 6: Data-set selection for 1986-89 analyses



In the 1986-89 census-mortality cohort, the definition of Māori (or Pacific) on the census was of self-identified ethnic origin but not in terms of quantum. As a result the Māori (or Pacific) ethnic group were broadly divided into two groups: *Sole* and *Prioritised*. The definition on the death registration form, however, was still based on ‘blood’ quantum (half or more Māori blood). The mortality records, for the 1986-89 census-mortality cohort, were obtained from the National Minimum Data-set (NMDS). The selection of eligible mortality data-sets (B and B_1) and the 2 HPL data-sets (U_1 and U_2) is shown in Figure 6.

3.2.1 Step1: Weighting n = 30,891 (U₁) and n = 24,723 (U₂) data-sets by n = 44,469 (B₁) data-set (i.e. NZDep96 scores non missing)

In order to calculate the weights, the two HPL data-sets (U₁ and U₂) and the mortality data-set (B₁) were stratified by the demographic variables. The number of decedents in each stratum determined the stratification for each of the three ethnic groups, the minimum cell size allowed being 3. Figure 7 to Figure 9 diagrammatically show the strata used for each ethnic group (according to NMDS ethnicity).

**Figure 7: Diagrammatic representation of strata for non-Māori non-Pacific (1986-89)
a: Urban**

		NON MĀORI NON PACIFIC - URBAN																			
		0-14 years				15-24 years				25-44 years				45-64 years				65-77 years			
		Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Northern RHA	Males																				
	Females																				
Midland RHA	Males																				
	Females																				
Central RHA	Males																				
	Females																				
Southern RHA	Males																				
	Females																				

b: Rural

		NON MĀORI NON PACIFIC - RURAL															
		0-14 years		15-24 years		25-44 years			45-64 years			65-77 years					
		Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-4	Dec 5-6	Dec 7-10	Dec 1-4	Dec 5-6	Dec 7-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10		
Males	Northern RHA																
	Midland RHA																
	Central RHA																
	Southern RHA																
Females	Northern RHA																
	Midland RHA																
	Central RHA																
	Southern RHA																

For urban non-Māori non-Pacific decedents, 160 strata (Figure 7a) and for rural, 76 strata (Figure 7b) were created using the 4 demographic variables (age at death, NZDep96, RHA and sex).

Figure 8: Diagrammatic representation of strata for Māori (1986-89)

		MĀORI												
		0-14 years		15-24 years		25-44 years		45-64 years				65-77 years		
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10
Males	Northern and Midland RHA													
	Central and Southern RHA													
Females	Northern and Midland RHA													
	Central and Southern RHA													

For Māori, 44 strata were created (Figure 8).

Figure 9: Diagrammatic representation of strata for Pacific people (1986-89)

		PACIFIC PEOPLE									
		0-14 years		15-24 years		25-44 years		45-64 years		65-77 years	
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10
Males	Northern RHA										
	Midland, Central and Southern RHA										
Females	Midland, Central and Southern RHA										
	Northern RHA										

For Pacific people 30 strata were created (Figure 9).

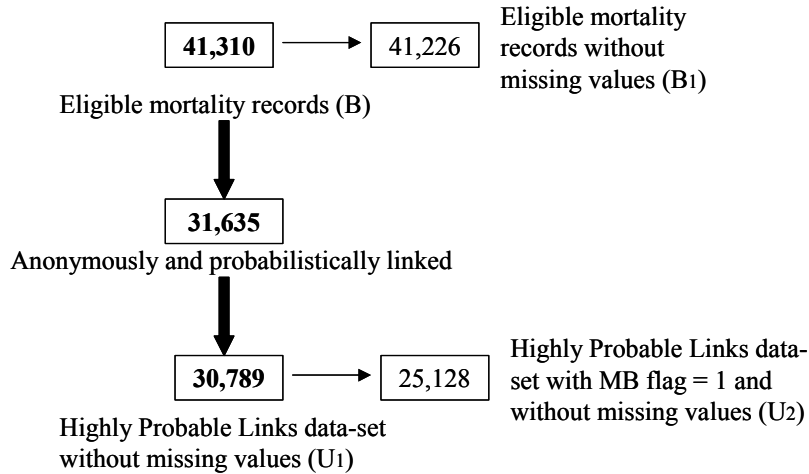
In total, 310 strata were created in all the 3 data-sets [the 2 HPL (U_1, U_2) and the mortality (B_1) data-set]. As in 1981-84 census-mortality cohorts, the stratum specific weights, $W_{U_1}^i = N_{B_1}^i / N_{U_1}^i$ and $W_{U_2}^i = N_{B_1}^i / N_{U_2}^i$.

2.3.2.1 Step 2: Weighting n=44,469 (B₁) data-set by n=44,505 (B) data-set (i.e. NZDep96 scores missing)

See section 2.3.1.2.

2.3.3 Weighting for 1991-94 deaths

Figure 10: Data-set selection for 1991-94 analyses



In the 1991-94 census-mortality cohort, the definition of Māori (or Pacific) on the census was the same as in 1986 census (*Sole and Prioritised*), though the wordings of the question changed slightly from ethnic “origin” to ethnic “group” (see *Appendix 3*: , Figure 21, page 110). The definition on the death registration form was based on the half or more Māori blood concept. For the 1991-94 census-mortality cohort, the mortality data was obtained from both the NMDS and National Health Index (NHI) file. The selection of eligible mortality data-sets (B and B₁) and the 2 HPL data-sets (U₁ and U₂) is shown in Figure 10.

2.3.3.1 Step1: Weighting $n = 30,789$ (U₁) and $n = 25,128$ (U₂) data-sets by $n = 41,226$ (B₁) data-set (i.e. NZDep91 scores non missing)

See section 2.3.1.1.

Figure 11: Diagrammatic representation of strata for non-Māori non-Pacific (1991-94)
a: Urban

		NON MĀORI NON PACIFIC - URBAN																			
		0-14 years				15-24 years				25-44 years				45-64 years				65-77 years			
		Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Northern RHA	Males																				
	Females																				
Midland RHA	Males																				
	Females																				
Central RHA	Males																				
	Females																				
Southern RHA	Males																				
	Females																				

b: Rural

		NON MĀORI NON PACIFIC - RURAL															
		0-14 years		15-24 years		25-44 years				45-64 years				65-77 years			
		Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Males	Northern RHA																
	Midland RHA																
	Central RHA																
	Southern RHA																
Females	Northern RHA																
	Midland RHA																
	Central RHA																
	Southern RHA																

For urban non-Māori non-Pacific decedents, 160 strata (Figure 11a) and for rural, 104 strata (Figure 11b) were created using the 4 demographic variables.

**Figure 12: Diagrammatic representation of strata for Māori (1991-94)
a: Urban**

		MĀORI - URBAN													
		0-14 years		15-24 years		25-44 years			45-64 years				65-77 years		
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8
Males	Northern RHA														
	Midland RHA														
	Central and Southern RHA														
Females	Northern RHA														
	Midland RHA														
	Central and Southern RHA														

b: Rural

		MĀORI - RURAL										
		0-14 years		15-24 years		25-44 years			45-64 years		65-77 years	
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10
Males	Northern and Midland RHA											
	Central and Southern RHA											
Females	Northern and Midland RHA											
	Central and Southern RHA											

For Māori, stratification by rurality was possible. For urban Māori, 80 strata (Figure 12a) and for rural, 28 strata (Figure 12b) were created.

Figure 13: Diagrammatic representation of strata for Pacific people (1991-94)

		PACIFIC PEOPLE										
		0-14 years		15-24 years		25-44 years		45-64 years			65-77 years	
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-8	Dec 9-10
Males	Northern RHA											
	Midland, Central and Southern RHA											
Females	Midland, Central and Southern RHA											
	Northern RHA											

For Pacific people 34 strata were created (Figure 13).

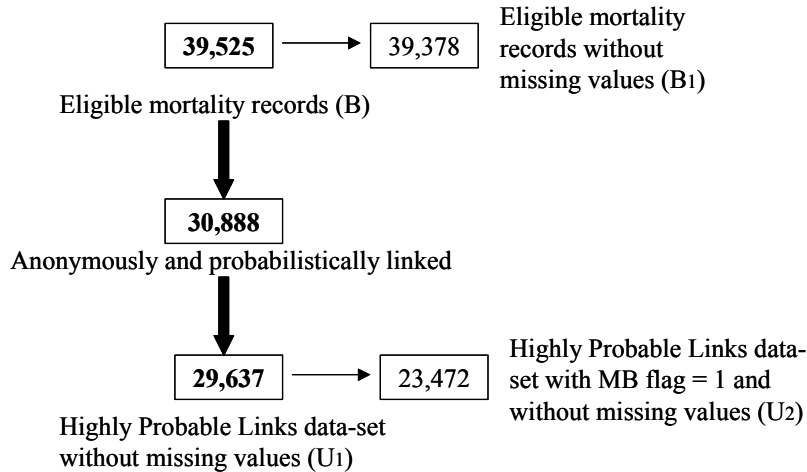
In total, 406 strata were created in all the 3 data-sets and as in previous cohorts, the stratum specific weights, $W_{U1}^i = N_{B1}^i / N_{U1}^i$ and $W_{U2}^i = N_{B1}^i / N_{U2}^i$ were calculated.

2.3.3.2 Step 2: Weighting $n=41,226$ (B_1) data-set by $n=41,310$ (B) data-set (i.e. NZDep91 scores missing)

See section 2.3.1.2.

2.3.4 Weighting for 1996-99 deaths

Figure 14: Data-set selection for 1996-99 analyses



In September 1995, the recording of ethnicity in the death registration form changed to be in line with the 1996 Census question (Te Ropu Rangahau Hauora a Eru Pomare 2000). Extra categories were introduced in the 1996 census question encouraging multi-ethnic responses (see *Appendix 3:*). The cohort included 4 different ethnic groups – Māori, Pacific, Asian, and non-Māori non-Pacific non-Asian. All the ethnic groups were categorised as *Sole* or *Prioritised* on the census and potentially on the NMDS form. The change to recording multiple ethnicity in the NHI file was not made until mid-1996 and the transition has not been fully implemented at the hospital level.¹ The selection of eligible mortality data-sets (B and B_1) and the 2 HPL data-sets (U_1 and U_2) is shown in Figure 14.

2.3.4.1 Step1: Weighting $n = 29,637$ (U_1) and $n = 23,472$ (U_2) data-sets by $n = 39,378$ (B_1) data-set (i.e. NZDep96 scores non missing)

See section 2.3.1.1

¹ As a result the ethnicity data on the NHI file was less accurate than the NMDS in this cohort.

Figure 15: Diagrammatic representation of strata for non-Māori non-Pacific non-Asian (1996-99)

a: Urban

		NON MĀORI NON PACIFIC NON ASIAN - URBAN																			
		0-14 years				15-24 years				25-44 years				45-64 years				65-77 years			
		Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Males	Northern RHA																				
	Midland RHA																				
	Central RHA																				
	Southern RHA																				
Females	Northern RHA																				
	Midland RHA																				
	Central RHA																				
	Southern RHA																				

b: Rural

		NON MĀORI NON PACIFIC NON ASIAN - RURAL																			
		0-14 years				15-24 years				25-44 years				45-64 years				65-77 years			
		Dec 1-4	Dec 5-10	Dec 1-4	Dec 5-10	Dec 1-4	Dec 5-6	Dec 7-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10					
Males	Northern RHA																				
	Midland RHA																				
	Central and Southern RHA																				
Females	Northern RHA																				
	Midland RHA																				
	Central and Southern RHA																				

For urban non-Māori non-Pacific non-Asian decedents, 128 strata (Figure 15a) and for rural, 68 strata (Figure 15b) were created using the 4 demographic variables.

Figure 16: Diagrammatic representation of strata for Māori (1996-99)
a: Urban

		MĀORI - URBAN														
		0-14 years		15-24 years		25-44 years			45-64 years			65-77 years				
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10	Dec 1-4	Dec 5-6	Dec 7-8	Dec 9-10
Males	Northern RHA															
	Midland RHA															
	Central and Southern RHA															
Females	Northern RHA															
	Midland RHA															
	Central and Southern RHA															

B: RURAL

		MĀORI - RURAL									
		0-14 years		15-24 years		25-44 years		45-64 years		65-77 years	
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10
Males	Northern RHA										
	Midland, Central and Southern RHA										
Females	Northern RHA										
	Midland, Central and Southern RHA										

For urban Māori, 82 strata (Figure 16a) and for rural, 26 strata (Figure 16b) were created.

Figure 17: Diagrammatic representation of strata for Pacific people (1996-99)

		PACIFIC PEOPLE												
		0-14 years		15-24 years		25-44 years			45-64 years			65-77 years		
		Dec 1-8	Dec 9-10	Dec 1-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10	Dec 1-6	Dec 7-8	Dec 9-10
Males	Northern RHA													
	Midland, Central and Southern RHA													
Females	Northern RHA													
	Midland, Central and Southern RHA													

For Pacific people 44 strata were created (Figure 17).

Figure 18: Diagrammatic representation of strata for Asian (1996-99)

		ASIAN									
		0-14 years		15-24 years		25-44 years		45-64 years		65-77 years	
		Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10	Dec 1-6	Dec 7-10
Males	Northern and Midland RHA										
	Central and Southern RHA										
Females	Northern and Midland RHA										
	Central and Southern RHA										

Asian were categorised as a separate ethnic group in this cohort and 30 strata could be created (Figure 18).

In total, 378 strata were created in all the 3 data-sets [the 2 HPL (U_1 , U_2) and the mortality (B_1) data-set]. As in the previous census-mortality cohorts, the stratum specific weights, $W_{U_1}^i = N_{B_1}^i / N_{U_1}^i$ and $W_{U_2}^i = N_{B_1}^i / N_{U_2}^i$ were calculated.

2.3.4.2 Step 2: Weighting n=39,378 (B_1) data-set by n=39,525 (B) data-set (i.e. NZDep96 scores missing)

A second weight was calculated in the same way as in the other census-mortality cohorts; by stratifying the full eligible mortality data (B , $n = 39,525$) and the eligible mortality data with an NZDep96 value (B_1 , $n = 39,378$) by [age at death] by [sex] by [NMDS ethnicity]. In this cohort, 40 strata were formed ($5 \times 2 \times 4$). The weight $W_{B_1}^i (= N_{B_1}^i / N_{B_1}^i)$ and the total weight $W_1^i (= W_{U_1}^i \cdot W_{B_1}^i)$, or $W_2^i (= W_{U_2}^i \cdot W_{B_1}^i)$ were calculated as in the earlier cohorts. The weight W_1^i was then assigned to each mortality record in the U_1 data-set ($n = 29,637$) or W_2^i to each mortality record in the U_2 data-set ($n = 23,472$).

2.4 Numerator-denominator bias analyses

The NMDS/NHI register (until September 1995) reported only 1 ethnic group for each person. The censuses coded up to 3 different prioritised ethnic groups per person thereby having *Sole* and *Prioritised* ethnic groups for Māori, Pacific people, Asian (1996) and the remainder assigned as non-Māori non-Pacific (non-Māori non-Pacific non-Asian for 1996). In this report, those who recorded degree of Māori origin as half or more in the 1981 census are categorised as sole Māori and those who recorded any Māori ethnic origin were categorised as prioritised Māori. Although the definitions of sole and prioritised ethnic group used in the 1981 census are different from the rest they form a similar series.

The NMDS in September 1995 and the NHI in July 1996 changed officially to code up to 3 different prioritised ethnic groups per person. As a result there was the ability to record *Sole* and *Prioritised* ethnicities for Māori, Pacific people, Asian, and non-Māori non-Pacific non-Asian in both the census and mortality register.

The numerator-denominator bias was determined by cross classifying census ethnicity by the death registration form ethnicity. Further cross-classification was conducted by strata of sex, age at death, small area deprivation, RHA, rurality, and cause of death, in order to determine heterogeneity of the numerator-denominator bias.

Sole ethnicity was recommended as the standard denominator by the Ministry of Health for all mortality rate calculations up to 1995 (Pomare et al. 1995). In 1996 census, however the *Sole* ethnic group became smaller with changes to the ethnicity question. From 1996 onwards, the Ministry of Health has used the larger 'Māori ethnic group' (*Prioritised*) as the denominator in its publications.

Therefore, the numerator-denominator bias for the sole census ethnicity by death registration ethnicity for 1981-84, 1986-89, and 1991-94 are the most relevant indicators of existing bias in published mortality rates up to 1995. But the prioritised census ethnicity by prioritised NMDS ethnicity for 1996-99 is the most relevant indicator of existing bias in published mortality rates from 1996 on.

All cross-classifications were done with weighted data, thus generating tables with total counts the same as those for the full eligible mortality data-set. The numerator-denominator bias was expressed as the ratio of the estimated census ethnic counts to the actual mortality ethnic counts. For example, in the 1981-84 census-mortality cohort (*Table 9: Census ethnicity by death registration ethnicity (1981-84 census-mortality cohort)*), there were 3,108 Māori deaths out of 44,703 total eligible mortality records. Our numerator-denominator analyses estimated that 3,615 of the 44,703 deaths were recorded as sole Māori on the 1981 census. Thus the adjustment ratio for Māori is 1.16, calculated by dividing census Māori total (n = 3,615) by death registration form Māori total (n = 3,108). Similarly, the number of deaths recorded on the mortality record as Pacific was 354, whereas, the estimated number for sole Pacific on the 1981 census was 552. Thus the adjustment ratio for Pacific is 1.55, calculated by dividing census sole Pacific total (n = 552) by death registration form Pacific total (n = 354).

2.4.1 Calculation of non-Māori ratios

The non-Māori adjustment ratios can easily be calculated by dividing the sum of estimated Pacific and non-Māori non-Pacific deaths on the census by the sum of total Pacific and non-Māori non-Pacific deaths on the mortality records. For example in *Table 9: Census ethnicity by death registration ethnicity (1981-84 census-mortality cohort)*, the estimated number of non-Māori deaths on the census is 41,088 [552 (Pacific) + 40,536 (non-Māori non-Pacific)] and the total number of non-Māori deaths on the mortality record is 41,595 [354 (Pacific) + 41,241 (non-Māori non-Pacific)]. Hence the adjustment ratio for non-Māori is 0.99 (i.e. 41,088 / 41,595).

2.4.2 Calculation of alternative census to mortality ratios

In this report we often just present the NMDS to census sole ratio for 1981-84, 1986-89, and 1991-94. However, the ratios for NMDS to census prioritised for 1981-84, 1986-89, and 1991-94 can easily be calculated by count data in the tables. (We have used these ratios elsewhere to generate a prioritised series of Māori and Pacific mortality rates back to 1980.)

For the 1996-99 period, we have presented NMDS sole to census sole and NMDS prioritised to census prioritised ratios. However, users may occasionally wish to use NMDS prioritised to census sole ratios. This need would arise if they were trying to calculate sole Māori and Pacific mortality rates, but only had the (more readily) available prioritised mortality data counts. It is possible to determine how many sole deaths (relative to the census identification) these NMDS prioritised counts represent by applying [NMDS prioritised] to [census sole] adjustment ratios. These adjustment ratios are not presented in this report, however they can easily be calculated from existing tables by dividing the census sole count (from NMDS sole by census sole tables) by the NMDS prioritised count (from NMDS prioritised by census prioritised tables). For example, the census sole to NMDS prioritised ratio for Māori females can be calculated by dividing the census sole count (from Table 18b) by the NMDS prioritised count (from Table 18a), i.e. $1,971/2,517 = 0.78$.

2.5 Possible misclassification bias in the numerator-denominator analyses

As mentioned in the Methods, two sets of HPL data were created:

U₁ - Records linked at meshblock (MB) and area unit (AU) level

U₂ - Records linked at meshblock (MB) level only.

U₁ data-set included records linked at MB and AU, and was, therefore, more representative of the total mortality records. But as the links at AU level had a lower PPV, there was a possibility of misclassification bias in our numerator-denominator analyses. On the other hand, the U₂ data-set included only those linked at MB level and therefore had a PPV of almost 100%. But the likelihood of selection bias in U₂ was higher as decedents, living in rural or more deprived areas, who were less likely to be assigned a meshblock were not included in this data-set.

In this section we present 3 'sensitivity analyses' to look at the possible misclassification bias in the numerator-denominator analyses using the weighted U₁ data-set to guide a choice between U₁ and U₂. We conducted the sensitivity analyses by making assumptions about the misclassification bias in each set of tables cross-classifying census data by mortality data.

Example 1: 1981-84 census-mortality cohort

Table 1 shows the cross-classification of census ethnicity by death registration ethnicity for *unweighted* number of links at area unit. Let us assume that among records linked at AU, 10% of the links are false positives. Therefore,

- 10% of 405 Māori \simeq 40 Māori are incorrect links and
- 10% of 4,446 non-Māori non-Pacific \simeq 445 non-Māori non-Pacific are incorrect links.

Table 1: Unweighted number of links at AU cross-classified by census and death registration ethnicity (1981-84)

Census <i>Sole</i> ethnic group	Death registration form ethnicity			Total
	Māori	Pacific	non-M non-P	
<i>AU only (MB flag=0)</i>				
Māori	342	-	120	462
Pacific People	-	-	-	-
non-M non-P	63	-	4,317	4,386
Total	405	-	4,446	4,875

Let us assume that in Māori dominated areas the percentage of non-Māori non-Pacific is **50%**, and in non-Māori non-Pacific dominated areas the percentage of Māori is **10%**. Therefore, of the 40 Māori who are misclassified, 20 (50% of 40 = 20) are likely to be misclassified as non-Māori non-Pacific, and of the 445 non-Māori non-Pacific, 45 (10% of 445 = 45) are likely to be misclassified as Māori. These actual linkages received varying weights in our analysis, i.e. 2.5 for Māori and 1.7 for non-Māori. Therefore, on weighting up, 50 Māori according to mortality data (20 x 2.5) are likely to be misclassified as non-Māori non-Pacific on the census data, and 75 non-Māori non-Pacific according to mortality data (45 x 1.7) are likely to be misclassified as Māori on the census data.

Table 2 shows the observed and estimated true adjustment ratios for Māori and non-Māori non-Pacific in the 1981-84 census-mortality cohort.

Table 2: Adjustment ratios for 1981-84 census-mortality cohort using weighted numbers and weighted number further adjusted for possible misclassification bias (the latter in parentheses)

Census <i>Sole</i> ethnic group	Death registration form ethnicity				Census to mortality ratio	
	Māori	Pacific	non-M non-P	Total	Observed ratio	Estimated ratio
<i>MB and AU</i>						
Māori	2,769 (2,819)	-	843 (768)	3,615 (3,590)	1.16	1.16
Pacific People	-	-	-	-	-	-
non-M non-P	327 (277)	-	40,182 (40,257)	40,536 (40,561)	0.98	0.98
Total	3,108	-	41,241	44,703		

The net effect is that Māori count is likely to be overestimated and the non-Māori non-Pacific count underestimated by 25. That is, the number 3,615 (we estimated) should actually be 3,590 (3,615-25) and the estimated true ratio should be 1.16 [3,590/3,108] for

Māori and $0.98 [(40,536+25)/41,241]$ for non-Māori non-Pacific. As seen in the table above, there is no difference between the observed and estimated true ratio; therefore, we estimate that the potential misclassification bias is **not substantial**.

Example 2: 1996-99 census-mortality cohort

Table 3 shows the cross-classification of census ethnicity by death registration ethnicity for *unweighted* number of links at AU. Assuming that 10% of the links are false positives

- 10% of 1,140 Māori \simeq 114 Māori are incorrect links and
- 10% of 4,842 non-Māori non-Pacific non-Asian \simeq 484 non-Māori non-Pacific non-Asian are incorrect links.

Table 3: Unweighted number of links at AU cross-classified by census and death registration ethnicity (1996-99)

Census <i>Sole</i> ethnic group	Death registration form ethnicity					Total
	Māori	Pacific	Asian	non-M non-P non-A		
<i>AU only (MB flag=0)</i>						
Māori	1,071	-	-	144		1,215
Pacific People	-	-	-	-		-
Asian	-	-	-	-		-
non-M non-P non-A	63	-	-	4,671		4,740
Total	1,140	-	-	4,842		6,165

As assumed earlier, in Māori dominated areas the percentage of non-Māori non-Pacific non-Asian is **50%**, and in non-Māori non-Pacific non-Asian dominated areas the percentage of Māori is **10%**, 57 Māori out of the 114 (50% of 114 = 57) are likely to be misclassified as non-Māori non-Pacific non-Asian, and 48 non-Māori non-Pacific non-Asian out of the 484 (10% of 484 = 48) are likely to be misclassified as Māori. On weighting, 85 (57 x 1.5) Māori according to mortality data are likely to be misclassified as non-Māori non-Pacific non-Asian on the census data, and 65 (48 x 1.3) non-Māori non-Pacific non-Asian according to mortality data are likely to be misclassified as Māori on the census data. Table 4 shows the observed and estimated true adjustment ratios for Māori and non-Māori non-Pacific non-Asian in the 1996-99 census-mortality cohort.

Table 4: Adjustment ratios for 1996-99 census-mortality cohort using weighted numbers and weighted number further adjusted for possible misclassification bias (the latter in parentheses)

Census <i>Sole</i> ethnic group	Death registration form ethnicity					Census to mortality ratio	
	Māori	Pacific	Asian	non-M non-P non-A	Total	Observed ratio	Estimated ratio
<i>MB and AU</i>							
Māori	5,739 (5,824)	-	-	750 (685)	6,519 (6,539)	1.07	1.07
Pacific People	-	-	-	-	-	-	-
Asian	-	-	-	-	-	-	-
non-M non-P non-A	351 (266)	-	-	30,321 (30,386)	30,777 (30,757)	0.99	0.99
Total	6,108	-	-	31,188	39,525		

The net effect is that Māori count is likely to be underestimated and non-Māori non-Pacific non-Asian count overestimated by 20. That is, the number 6,519 should actually be 6,539 (6,519+20) and the estimated true ratios should be 1.07 [6,539/6,108] for Māori and 0.99 [(30,777-20)/31,188] for non-Māori non-Pacific non-Asian. As seen in the table above, there is no significant difference between the observed and estimated true ratios; therefore, we estimate the potential effect of misclassification bias is **not substantial**.

Example 3a: 1996-99 census-mortality cohort: Deciles 1-4

There is a marked variation in ethnic composition by level of small area socio-economic deprivation in New Zealand. Therefore, misclassification bias might be problematic for the numerator-denominator analyses by NZDep.

Table 5 shows the cross-classification of census ethnicity by death registration ethnicity for *unweighted* number of links at AU. Assuming that 10% of the links are false positives

- 10% of 114 Māori \simeq 11 Māori belonging to Deciles 1-4 are incorrect links and
- 10% of 1,173 non-Māori non-Pacific non-Asian \simeq 117 non-Māori non-Pacific non-Asian belonging to Deciles 1-4 are incorrect links.

Table 5: Unweighted number of links at AU cross-classified by census and death registration ethnicity (1996-99, Deciles 1-4)

Census <i>Sole</i> ethnic group	Death registration form ethnicity				Total
	Māori	Pacific	Asian	non-M non-P non-A	
<i>AU only (MB flag=0)</i>					
Māori	105	-	-	42	144
Pacific People	-	-	-	-	-
Asian	-	-	-	-	-
non-M non-P non-A	63	-	-	1,719	1,731
Total	114	-	-	1773	1,899

Assuming that in Māori dominated areas the percentage of non-Māori non-Pacific non-Asian is **50%**, and in non-Māori non-Pacific non-Asian dominated areas the percentage of Māori is **10%**, 6 Māori out of the 11 (50% of 11 = 6) are likely to be misclassified as non-Māori non-Pacific non-Asian, and 12 non-Māori non-Pacific non-Asian out of the 117, (10% of 117 = 12) are likely to be misclassified as Māori. On weighting up, 12 (6 x 2.0) Māori according to mortality data are likely to be misclassified as non-Māori non-Pacific non-Asian on the census data, and 16 (12 x 1.3) non-Māori non-Pacific non-Asian according to mortality data are likely to be misclassified as Māori on the census data. Table 6 shows the observed and estimated true adjustment ratios for Māori and non-Māori non-Pacific non-Asian in the 1996-99 census-mortality cohort, Deciles 1-4.

Table 6: Adjustment ratios for 1996-99 census-mortality cohort (Deciles 1-4) using weighted numbers and weighted number further adjusted for possible misclassification bias (the latter in parentheses)

Census <i>Sole</i> ethnic group	Death registration form ethnicity					Census to mortality ratio	
	Māori	Pacific	Asian	non-M non-P non-A	Total	Observed ratio	Estimated ratio
<i>MB and AU</i>							
Māori	546 (558)	-	-	216 (200)	765 (761)	1.24	1.24
Pacific People	-	-	-	-	-	-	-
Asian	-	-	-	-	-	-	-
non-M non-P non-A	66 (54)	-	-	11,457 (11,473)	11,553 (11,558)	0.99	0.99
Total	618	-	-	11,702			

The net effect is that Māori count is likely to be overestimated and non-Māori non-Pacific non-Asian count underestimated by 4. That is, the number 765 should actually be 761 (765-4) and the estimated true ratios should be 1.24 [761/618] for Māori and 0.99 [(11,553+4)/11,702] for non-Māori non-Pacific non-Asian. As seen in the table above, there is not much difference between the observed and estimated true ratios; therefore, the potential effect of misclassification bias is **not substantial**.

Example 3b: 1996-99 census-mortality cohort: Deciles 9-10

Table 7 shows the cross-classification of census ethnicity by death registration ethnicity for *unweighted* number of links at AU. Assuming that 10% of the links are false positives

- 10% of 618 Māori \simeq 62 Māori belonging to Deciles 9-10 are incorrect links and
- 10% of 933 non-Māori non-Pacific non-Asian \simeq 93 non-Māori non-Pacific non-Asian belonging to Deciles 9-10 are incorrect links.

Table 7: Unweighted number of links at AU cross-classified by census and death registration ethnicity (1996-99, Deciles 9-10)

Census Ethnic group	Death registration form ethnicity				
	Māori	Pacific	Asian	non-M non-P non-A	Total
<i>AU only (MB flag=0)</i>					
Māori	591	-	-	36	633
Pacific People	-	-	-	-	-
Asian	-	-	-	-	-
non-M non-P non-A	21	-	-	891	912
Total	618	-	-	933	1,662

For those belonging to lower NZDep, we have to assume that in Māori dominated areas the percentage of non-Māori non-Pacific non-Asian is **25%**, and in non-Māori non-Pacific non-Asian dominated areas the percentage of Māori is **10%**. Therefore, 15 Māori out of the 62 (25% of 62 = 15) are likely to be misclassified as non-Māori non-Pacific non-Asian, and 9 non-Māori non-Pacific non-Asian out of the 93 (10% of 93 = 9) are likely to be misclassified as Māori. On weighting up, 24 (15 x 1.6) Māori according to mortality data are likely to be misclassified as non-Māori non-Pacific non-Asian on the census data, and 12 (9 x 1.3) non-Māori non-Pacific non-Asian according to mortality

data are likely to be misclassified as Māori on the census data. Table 8 shows the observed and estimated true adjustment ratios for Māori and non-Māori non-Pacific non-Asian in the 1996-99 census-mortality cohort, Deciles 9-10.

Table 8 Adjustment ratios for 1996-99 census-mortality cohort (Deciles 9-10) using weighted numbers and weighted number further adjusted for possible misclassification bias (the latter in parentheses)

Census Ethnic group	Death registration form ethnicity					Census to mortality ratio	
	Māori	Pacific	Asian	non-M non-P non-A	Total	Observed ratio	Estimated ratio
<i>MB and AU</i>							
Māori	3,201 (3,225)	-	-	210 (198)	3,432 (3,444)	1.03	1.03
Pacific People	-	-	-	-	-	-	-
Asian	-	-	-	-	-	-	-
non-M non-P non-A	132 (108)	-	-	5,544 (5,556)	5,709 (5,697)	0.99	0.98
Total	3,345	-	-	5,787			

The net effect is that Māori count is likely to be underestimated and non-Māori non-Pacific non-Asian count overestimated by 12. That is, the number 3,432 should actually be 3,444 (3,432+12) and the estimated true ratios should be 1.03 [3,444/3,345] for Māori and 0.98 [(5,709-12)/5,787] for non-Māori non-Pacific non-Asian. As seen in the table above, there is not much difference between the observed and estimated true ratios; therefore, the potential effect of misclassification bias is **not substantial**.

Given that our concerns about introducing misclassification bias in our numerator-denominator analyses by inclusion of AU links did not appear to be substantiated by the above sensitivity analyses, we have used the weighted U₁ data-set (records linked at MB and AU) **for all analyses in this technical report**. Thus, our analyses are less prone to selection bias by inclusion of more links (particularly for rural deaths).

2.6 Possible residual biases in the numerator-denominator analyses

The previous Section suggests that using links at both the AU and MB levels is preferable. This should reduce the potential for selection biases in our analyses. But, as stated on page 11:

“The key assumption for the validity of all the adjustment ratios in this Report is that within each strata of mortality record [ethnicity] by [sex] by [age at death] by [RHA] by [NZDep] by [rurality] the distribution of census self-identified ethnicity was the same for those included in the HPL data-set as it was for all eligible mortality records in the given strata.”

In our previous work focused solely on the 1991-94 census-mortality cohort (Blakely and Atkinson 2001), we conducted extensive analyses about the possibility of a residual bias (whereby the above assumption did not hold). A major reason for suspecting a residual bias in our method was the lack of representativeness of rural decedents. Our sensitivity analyses suggested that our adjustment ratios for Māori might be modestly underestimated. For example, our (then) estimated overall adjustment ratio for Māori was 1.29, but there was a possibility it was actually 1.31 but certainly no higher than 1.35. Interestingly, the expansion this time of our HPL (or ‘unlock’) data-sets to include the AU links *and* to include strata by rurality resulted in an adjustment ratio of 1.32.

Therefore, the best conclusion we can make is that the ratios presented in this report are an improvement, and probably not markedly affected by any further residual selection bias.

Chapter 3: Results

3.1 NMDS death registration ethnicity by census (*Sole* and *Prioritised*) ethnicity ratios, non-stratified

Note: For all tables

- All the numbers are weighted, and then random rounded to a near multiple of three as per Statistics New Zealand protocol. The minimum cell size is 6.
- The ratios are true ratios (calculated without random rounding).
- The census to mortality ratio is the census total divided by the death registration form total. E.g. for Māori sole ethnicity, 1.32 is the correction factor to apply to 1986-89 ethnic specific mortality rates calculated using sole ethnicity as the denominator. (Note: however, that we recommend using age-specific adjustment ratios rather than this 'crude' overall adjustment ratio) An example on how to apply the ratios is presented in Chapter 44 (page 58).

Key findings:

- The overall ratios for the numerator-denominator bias for Māori and Pacific in 1981-84 (Census sole by death registration form) are less than in 1986-89 (Census sole by NMDS) and 1991-94 (Census sole by NMDS) (Table 9 to Table 12b).
- The findings for the 1996-99 cohort suggest that the Census Prioritised to NMDS Prioritised ratio, especially for Māori, is close to one. However, some amount of bias still exists.
- Census Sole to NMDS Sole ratio for 1981-84, 1986-89, and 1991-94 demonstrate that the Māori deaths in this period underestimate sole Māori counts (let alone prioritised Māori counts) (Table 9 to Table 11). On the other hand, sole Māori deaths are over-represented in the mortality data during 1996-99, and the adjustment ratios presented in this report need to be applied (Table 12b).
- Two sets of crude adjustment ratios have been calculated for 1981-84, 1986-89 and 1991-94 cohorts, and 4 sets for the 1996-99 cohort.
- Because of marked variation in the ratios by age (see Section 3.3.2 later in this Report), the use of these crude ratios is limited. Rather, we recommend that age-specific (at least) ratios be used for correcting historical mortality rates. However, the crude ratios presented here are helpful in understanding the overall pattern of the numerator-denominator bias across the 4 cohorts.

Table 9: Census ethnicity by death registration ethnicity (1981-84 census-mortality cohort)

Census Ethnic group	Death registration ethnicity			Total	Census to mortality ratio
	Māori	Pacific	non-M non-P		
<i>Sole</i>					
Māori	2,769	6	843	3,615	1.16
Pacific People	9	330	216	552	1.55
non-M non-P	327	27	40,182	40,536	0.98
Total	3,108	354	41,241	44,703	
<i>Prioritised</i>					
Māori	2,904	6	1,404	4,314	1.39
Pacific People	12	339	246	597	1.67
non-M non-P	189	15	39,588	39,792	0.97
Total	3,108	354	41,241	44,703	

Table 10: Census ethnicity by death registration ethnicity (1986-89 census-mortality cohort)

Census Ethnic group	Death registration ethnicity			Total	Census to mortality ratio
	Māori	Pacific	non-M non-P		
<i>Sole</i>					
Māori	2,568	9	1,332	3,906	1.32
Pacific People	6	393	387	783	1.76
non-M non-P	387	45	39,384	39,816	0.97
Total	2,958	444	41,103	44,505	
<i>Prioritised</i>					
Māori	2,760	15	1,809	4,581	1.55
Pacific People	6	420	462	891	2.0
non-M non-P	192	9	38,829	39,033	0.95
Total	2,958	444	41,103	44,505	

Table 11: Census ethnicity by death registration ethnicity (1991-94 census-mortality cohort)

Census Ethnic group	Death registration ethnicity			Total	Census to mortality ratio
	Māori	Pacific	non-M non-P		
<i>Sole</i>					
Māori	3,117	6	1,449	4,569	1.32
Pacific People	9	621	471	1,101	1.68
non-M non-P	351	30	35,262	35,640	0.96
Total	3,471	657	37,182	41,310	
<i>Prioritised</i>					
Māori	3,288	9	1,839	5,136	1.48
Pacific People	6	639	504	1,149	1.76
non-M non-P	177	9	34,839	35,025	0.94
Total	3,471	657	37,182	41,310	

Table 12: Census ethnicity by death registration ethnicity (1996-99 census-mortality cohort)**a: NMDS prioritised**

Census Ethnic group	Death registration ethnicity (NMDS Prioritised)					Census to mortality ratio
	Māori	Pacific	Asian	non-M non-P non-A	Total	
<i>Sole</i>						
Māori	4,611	6	0	198	4,809	0.79
Pacific People	15	1,350	0	12	1,383	0.85
Asian	0	12	534	12	561	0.94
non-M non-P non-A	1,482	270	63	30,960	32,787	1.05
Total	6,108	1,635	597	31,185	39,525	
<i>Prioritised</i>						
Māori	5,736	33	0	750	6,519	1.07
Pacific People	15	1,527	6	75	1,620	0.99
Asian	6	12	555	39	609	1.02
non-M non-P non-A	351	63	39	30,324	30,777	0.99
Total	6,108	1,635	597	31,185	39,525	

b: NMDS sole

Census Ethnic group	Death registration ethnicity (NMDS Sole)					Census to mortality ratio
	Māori	Pacific	Asian	non-M non-P non-A	Total	
<i>Sole</i>						
Māori	4,470	3	0	336	4,809	0.86
Pacific People	12	1,320	0	51	1,383	0.90
Asian	0	9	516	36	561	1.01
non-M non-P non-A	1,131	198	39	31,407	32,787	1.03
Total	5,613	1,530	555	31,827	39,525	
<i>Prioritised</i>						
Māori	5,349	33	0	1,140	6,519	1.16
Pacific People	15	1,443	6	165	1,620	1.06
Asian	0	9	528	72	609	1.10
non-M non-P non-A	249	48	27	30,453	30,777	0.97
Total	5,613	1,530	555	31,827	39,525	

3.2 Census (Sole and *Prioritised*) ethnicity to NHI file ratios, non-stratified

Note:

The tables presented below (and those henceforth in the report) are summaries of the type presented in Table 9 to Table 12b.

Key points:

- The NHI was introduced in 1988 and includes ethnicity collected from hospital admissions, but the compliance was not good until 1990.
- We assigned mortality records with missing ethnicity on the NHI file as non- Māori non-Pacific to approximate what is normally done for calculation of mortality rates.
- Prior to September 1995, the recording of ethnicity on the NHI file was closer to that on the corresponding census than that on the NMDS. (That is the NHI ethnicity to census sole ratio for 1991-94 is closer to 1.0 than that for the NMDS ethnicity to census sole ratio.)
- Since the changes in the death registrations in September 1995, the NMDS prioritised counts during 1996-99 are closer to the census prioritised counts than the NHI file prioritised counts.

Table 13: Census to NHI file ratios (1991-94 census-mortality cohort)

Ethnic group	NHI file	Census sole	Census prioritised	Census sole to NHI file ratio†	Census prioritised to NHI file ratio†
Māori	4,080	4,569	5,136	1.12	1.26
Pacific People	915	1,101	1,149	1.20	1.26
non-M non-P	36,315	35,640	35,025	0.98	0.96
Total	41,310	41,310	41,310		

Table 14: Census to NHI file ratios (1996-99 census-mortality cohort)

a: NHI prioritised

Ethnic group	NHI prioritised	Census sole	Census prioritised	Census sole to NHI prioritised ratio†	Census prioritised to NHI prioritised ratio†
Māori	4,712	4,803	6,519	1.02	1.38
Pacific People	1,253	1,383	1,620	1.10	1.30
Asian	424	561	609	1.32	1.43
non-M non-P non-A	33,136	32,778	30,777	0.99	0.93
Total	39,525	39,525	39,525		

b: NHI sole

Ethnic group	NHI sole	Census sole	Census prioritised	Census sole to NHI sole ratio†	Census prioritised to NHI sole ratio†
Māori	4,588	4,803	6,519	1.05	1.42
Pacific People	1,213	1,383	1,620	1.14	1.34
Asian	412	561	609	1.36	1.47
non-M non-P non-A	33,312	32,778	30,777	0.98	0.92
Total	39,525	39,525	39,525		

3.3 Census ethnicity to NMDS death registration form ratios, one level of stratification

Note:

The tables in this section just present census sole to NMDS adjustment ratios for 1981-84, 1986-89, and 1991-94. For 1996-99 period *both* census prioritised by NMDS prioritised and census sole by NMDS sole ratios are presented. This follows the precedent of what was usually done in these periods when calculating ethnic mortality rates (see discussion and text box on page 25). The interested reader, however, can calculate alternative ratios given the numbers in the table if they wish (e.g. census prioritised to NMDS ratios for 1981-84 as described in Section 2.4.2, page 26).

3.3.1 Stratification by sex

- There is not much variation in the adjustment ratios by sex, except for Pacific people in the 1981-84 cohort. The Pacific ratios are, however, unstable due to smaller numbers of linked records in the HPL data-set.

Table 15: Stratification by sex (1981-84 census-mortality cohort)

Sex	Ethnic groups	Death reg Form	Census sole	Census prioritised	Census sole to death reg ratio
Males	Māori	1,824	2,160	2,565	1.18
	Pacific People	228	336	363	1.48
	non-M non-P	25,524	25,077	24,648	0.98
	Total	27,576	27,576	27,576	
Females	Māori	1,284	1,455	1,746	1.13
	Pacific People	126	216	234	1.68
	non-M non-P	15,714	15,456	15,147	0.98
	Total	17,127	17,127	17,127	

Table 16: Stratification by sex (1986-89 census-mortality cohort)

Sex	Ethnic groups	Death reg Form	Census sole	Census prioritised	Census sole to death reg ratio
Males	Māori	1,728	2,286	2,685	1.32
	Pacific People	285	507	573	1.78
	non-M non-P	25,269	24,492	24,024	0.97
	Total	27,282	27,282	27,282	
Females	Māori	1,227	1,620	1,899	1.32
	Pacific People	162	276	318	1.73
	non-M non-P	15,834	15,324	15,009	0.97
	Total	17,223	17,223	17,223	

Table 17: Stratification by sex (1991-94 census-mortality cohort)

Sex	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Males	Māori	2,040	2,700	3,036	1.32
	Pacific People	414	675	699	1.64
	non-M non-P	22,773	21,846	21,486	0.96
	Total	25,227	25,227	25,227	
Females	Māori	1,434	1,869	2,100	1.30
	Pacific People	240	423	450	1.75
	non-M non-P	14,409	13,794	13,536	0.96
	Total	16,086	16,086	16,086	

Table 18: Stratification by sex (1996-99 census-mortality cohort)**a: NMDS prioritised by census prioritised**

Sex	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
Males	Māori	3,591	3,861	1.08
	Pacific People	990	984	0.99
	Asian	348	354	1.01
	non-M non-P non-A	19,098	18,828	0.99
	Total	24,024	24,024	
Females	Māori	2,517	2,664	1.06
	Pacific People	645	639	0.99
	Asian	246	255	1.04
	non-M non-P non-A	12,090	11,946	0.99
	Total	15,501	15,501	

b: NMDS sole by census sole

Sex	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
Males	Māori	3,285	2,838	0.86
	Pacific People	921	834	0.91
	Asian	330	330	1.00
	non-M non-P non-A	19,488	20,022	1.03
	Total	24,024	24,024	
Females	Māori	2,331	1,971	0.85
	Pacific People	612	549	0.90
	Asian	225	231	1.03
	non-M non-P non-A	12,336	12,753	1.03
	Total	15,501	15,501	

3.3.2 Stratification by age

- A greater bias at younger ages is observed for Māori in 1981-84, 1986-89, and 1991-94 cohorts. There is little difference by age in the 1996-99 cohort for Māori, and for Pacific in all cohorts.

Table 19: Stratification by age at death (1981-84 census-mortality cohort)

Age at death	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
0-14 years	Māori	114	171	222	1.52
	Pacific People	24	48	54	1.94
	non-M non-P	750	669	612	0.89
	Total	888	888	888	
15-24 years	Māori	231	312	396	1.35
	Pacific People	45	66	69	1.39
	non-M non-P	1,599	1,500	1,413	0.94
	Total	1,878	1,878	1,878	
25-44 years	Māori	489	582	684	1.19
	Pacific People	69	111	114	1.58
	non-M non-P	2,967	2,835	2,730	0.96
	Total	3,528	3,528	3,528	
45-64 years	Māori	1,401	1,575	1,833	1.12
	Pacific People	126	195	216	1.53
	non-M non-P	13,932	13,689	13,413	0.98
	Total	15,462	15,462	15,462	
65-77 years	Māori	873	972	1,182	1.12
	Pacific People	90	135	147	1.53
	non-M non-P	21,993	21,846	21,624	0.99
	Total	22,953	22,953	22,953	

Table 20: Stratification by age at death (1986-89 census-mortality cohort)

Age at death	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
0-14 years	Māori	93	147	219	1.57
	Pacific People	33	48	60	1.48
	non-M non-P	681	615	528	0.90
	Total	807	807	807	
15-24 years	Māori	216	327	438	1.53
	Pacific People	36	60	87	1.76
	non-M non-P	1,740	1,602	1,464	0.92
	Total	1,986	1,986	1,986	
25-44 years	Māori	447	660	768	1.47
	Pacific People	99	174	195	1.77
	non-M non-P	3,348	3,063	2,931	0.92
	Total	3,894	3,894	3,894	
45-64 years	Māori	1,365	1,782	1,995	1.31
	Pacific People	165	321	342	1.95
	non-M non-P	13,251	12,678	12,444	0.96
	Total	14,781	14,781	14,781	
65-77 years	Māori	840	990	1,164	1.18
	Pacific People	117	180	207	1.58
	non-M non-P	22,083	21,861	21,666	0.99
	Total	23,034	23,034	23,034	

Table 21: Stratification by age at death (1991-94 census-mortality cohort)

Age at death	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
0-14 years	Māori	81	147	192	1.80
	Pacific People	42	66	75	1.55
	non-M non-P	570	483	423	0.84
	Total	696	696	696	
15-24 years	Māori	192	300	390	1.55
	Pacific People	45	69	81	1.61
	non-M non-P	1,458	1,326	1,221	0.91
	Total	1,695	1,695	1,695	
25-44 years	Māori	555	750	843	1.35
	Pacific People	111	204	210	1.87
	non-M non-P	3,273	2,985	2,889	0.91
	Total	3,939	3,939	3,939	
45-64 years	Māori	1,617	2,115	2,304	1.31
	Pacific People	255	426	438	1.67
	non-M non-P	11,346	10,680	10,479	0.94
	Total	13,221	13,221	13,221	
65-77 years	Māori	1,020	1,257	1,407	1.23
	Pacific People	204	336	348	1.64
	non-M non-P	20,535	20,169	20,007	0.98
	Total	21,765	21,765	21,765	

**Table 22: Stratification by age at death (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised**

Age at death	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
0-14 years	Māori	234	255	1.08
	Pacific People	54	54	1.01
	Asian	18	18	1.18
	non-M non-P non-A	339	318	0.93
	Total	645	645	
15-24 years	Māori	390	441	1.13
	Pacific People	90	102	1.11
	Asian	45	45	1.05
	non-M non-P non-A	891	825	0.93
	Total	1,413	1,413	
25-44 years	Māori	996	1,089	1.10
	Pacific People	294	315	1.06
	Asian	114	111	0.98
	non-M non-P non-A	2,571	2,460	0.96
	Total	3,975	3,975	
45-64 years	Māori	2,610	2,727	1.05
	Pacific People	642	627	0.98
	Asian	222	234	1.06
	non-M non-P non-A	9,192	9,075	0.99
	Total	12,666	12,666	
65-77 years	Māori	1,875	2,007	1.07
	Pacific People	555	525	0.95
	Asian	201	198	0.98
	non-M non-P non-A	18,195	18,096	0.99
	Total	20,826	20,826	

b: NMDS sole by census sole

Age at death	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
0-14 years	Māori	183	156	0.86
	Pacific People	39	33	0.81
	Asian	9	18	1.56
	non-M non-P non-A	414	441	1.07
	Total	645	645	
15-24 years	Māori	315	246	0.77
	Pacific People	75	69	0.93
	Asian	39	36	0.97
	non-M non-P non-A	981	1,059	1.08
	Total	1,413	1,413	
25-44 years	Māori	915	729	0.80
	Pacific People	273	249	0.92
	Asian	105	105	1.00
	non-M non-P non-A	2,682	2,892	1.08
	Total	3,975	3,975	
45-64 years	Māori	2,472	2,175	0.88
	Pacific People	618	564	0.91
	Asian	210	219	1.05
	non-M non-P non-A	9,363	9,705	1.04
	Total	12,666	12,666	
65-77 years	Māori	1,728	1,506	0.87
	Pacific People	525	468	0.89
	Asian	189	177	0.95
	non-M non-P non-A	18,387	18,675	1.02
	Total	20,826	20,826	

3.3.3 Stratification by small area deprivation

- NZDep96 values were used in the 1981-84 and 1986-89 cohorts, so the interpretation of these results by NZDep must be treated with caution. However, due to broader grouping used (10 deciles grouped into 4 groups), we do not expect large bias in the ratios.
- The adjustment ratios were higher for Māori in the **most** socio-economically deprived small areas in the 1981-84 and 1986-89 cohorts (Table 23 and Table 24), whereas there was probably no pattern for the 191-94 cohort (Table 25). During 1996-99 the pattern of Māori adjusters varied depending on choice of sole by sole or prioritised by prioritised ratios (Table 26a and b).
- Pacific ratios are unstable in the least deprived deciles due to small numbers. Therefore, it is not possible to confidently describe any trends in adjusters by small area deprivation.

Table 23: Stratification by small area deprivation (1981-84 census-mortality cohort)

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Deciles 1-4	Māori	345	372	534	1.07
	Pacific People	42	72	81	1.63
	non-M non-P	13,854	13,803	13,626	1.00
	Total	14,241	14,241	14,241	
Deciles 5-6	Māori	378	435	540	1.15
	Pacific People	42	87	99	2.01
	non-M non-P	8,733	8,631	8,517	0.99
	Total	9,156	9,156	9,156	
Deciles 7-8	Māori	678	771	945	1.13
	Pacific People	54	90	102	1.69
	non-M non-P	9,279	9,156	8,967	0.99
	Total	10,014	10,014	10,014	
Deciles 9-10	Māori	1,704	2,037	2,289	1.20
	Pacific People	216	303	318	1.41
	non-M non-P	9,369	8,949	8,682	0.96
	Total	11,289	11,289	11,289	

Table 24: Stratification by small area deprivation (1986-89 census-mortality cohort)

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Deciles 1-4	Māori	330	369	525	1.11
	Pacific People	60	102	129	1.71
	non-M non-P	13,830	13,752	13,569	0.99
	Total	14,220	14,220	14,220	
Deciles 5-6	Māori	339	456	546	1.35
	Pacific People	75	108	132	1.48
	non-M non-P	8,493	8,337	8,232	0.98
	Total	8,904	8,904	8,904	
Deciles 7-8	Māori	651	846	1,017	1.30
	Pacific People	69	120	135	1.75
	non-M non-P	9,372	9,123	8,940	0.97
	Total	10,092	10,092	10,092	
Deciles 9-10	Māori	1,635	2,232	2,499	1.37
	Pacific People	243	453	498	1.86
	non-M non-P	9,408	8,604	8,289	0.91
	Total	11,286	11,286	11,286	

Table 25: Stratification by small area deprivation (1991-94 census-mortality cohort)

Deciles of NZDep91	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Deciles 1-4	Māori	318	468	567	1.46
	Pacific People	48	75	87	1.55
	non-M non-P	13,320	13,143	13,029	0.99
	Total	13,686	13,686	13,686	
Deciles 5-6	Māori	456	534	639	1.18
	Pacific People	69	120	126	1.76
	non-M non-P	7,527	7,395	7,287	0.98
	Total	8,052	8,052	8,052	
Deciles 7-8	Māori	834	1,092	1,248	1.31
	Pacific People	141	225	243	1.59
	non-M non-P	8,193	7,851	7,677	0.96
	Total	9,168	9,168	9,168	
Deciles 9-10	Māori	1,863	2,475	2,685	1.33
	Pacific People	399	681	693	1.71
	non-M non-P	8,148	7,251	7,029	0.89
	Total	10,407	10,407	10,407	

**Table 26: Stratification by small area deprivation (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised**

Deciles of NZDep96	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
Deciles 1-4	Māori	615	765	1.24
	Pacific People	165	171	1.05
	Asian	249	258	1.02
	non-M non-P non-A	11,715	11,550	0.99
	Total	12,741	12,741	
Deciles 5-6	Māori	693	786	1.13
	Pacific People	210	213	1.01
	Asian	108	108	0.99
	non-M non-P non-A	6,612	6,516	0.99
	Total	7,626	7,626	
Deciles 7-8	Māori	1,452	1,539	1.06
	Pacific People	321	312	0.98
	Asian	135	135	0.99
	non-M non-P non-A	7,077	6,999	0.99
	Total	8,985	8,985	
Deciles 9-10	Māori	3,345	3,429	1.03
	Pacific People	942	927	0.98
	Asian	99	111	1.08
	non-M non-P non-A	5,787	5,709	0.99
	Total	10,173	10,173	

b: NMDS sole by census sole

Deciles of NZDep96	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
Deciles 1-4	Māori	531	435	0.82
	Pacific People	141	117	0.81
	Asian	234	234	0.99
	non-M non-P non-A	11,835	11,958	1.01
	Total	12,741	12,741	
Deciles 5-6	Māori	624	516	0.83
	Pacific People	192	171	0.89
	Asian	108	99	0.94
	non-M non-P non-A	6,705	6,834	1.02
	Total	7,626	7,626	
Deciles 7-8	Māori	1,314	1,107	0.84
	Pacific People	288	243	0.84
	Asian	120	126	1.06
	non-M non-P non-A	7,260	7,506	1.03
	Total	8,985	8,985	
Deciles 9-10	Māori	3,144	2,748	0.88
	Pacific People	909	852	0.94
	Asian	93	102	1.08
	non-M non-P non-A	6,030	6,471	1.07
	Total	10,173	10,173	

3.3.4 Stratification by Regional Health Authority (RHA)

- The numerator-denominator bias is greater for Māori living in the Central and Southern RHA for all cohorts except the 1986-89 cohort, where the bias is greater for Māori living in the Northern RHA.
- It appeared that, for some reason, there was deterioration in recording Māori ethnicity on death registration forms by some funeral directors in the Northern RHA during 1986-89 relative to both the 1981-84 and 1991-94 periods. We found convincing evidence of this possibility. Of the 908 deaths reported in the death registration office in Onehunga in 1981-84, 280 were Māori (approximately 30%). Therefore, the number of Māori deaths reported in 1986-89 in that office should have been approximately 420 (out of a total of 1408), **but only 18 deaths were recorded as Māori**.
- This case example provides dramatic evidence of how a localized problem collecting ethnicity data can severely bias regional statistics.

Table 27: Stratification by Regional Health Authority (3 groups) (1981-84 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Northern	Māori	1,020	1,164	1,392	1.14
	Pacific People	246	387	414	1.58
	non-M non-P	11,556	11,268	11,013	0.98
	Total	12,819	12,819	12,819	
Midland	Māori	1,383	1,509	1,692	1.09
	Pacific People	33	45	48	1.29
	non-M non-P	7,434	7,302	7,113	0.98
	Total	8,853	8,853	8,853	
Central and Southern	Māori	705	942	1,227	1.34
	Pacific People	78	123	135	1.58
	non-M non-P	22,251	21,969	21,669	0.99
	Total	23,031	23,031	23,031	

Table 28: Stratification by Regional Health Authority (3 groups) (1986-89 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Northern	Māori	708	1,206	1,461	1.70
	Pacific People	282	519	597	1.84
	non-M non-P	12,225	11,487	11,157	0.94
	Total	13,215	13,215	13,215	
Midland	Māori	1,458	1,602	1,785	1.10
	Pacific People	27	51	60	1.88
	non-M non-P	7,362	7,194	7,002	0.98
	Total	8,850	8,850	8,850	
Central and Southern	Māori	792	1,098	1,338	1.39
	Pacific People	132	210	228	1.58
	non-M non-P	21,519	21,135	20,874	0.98
	Total	22,443	22,443	22,443	

Table 29: Stratification by Regional Health Authority (3 groups) (1991-94 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Northern	Māori	1,257	1,461	1,632	1.17
	Pacific People	483	807	837	1.68
	non-M non-P	10,620	10,086	9,888	0.95
	Total	12,357	12,357	12,357	
Midland	Māori	1,533	1,809	1,974	1.18
	Pacific People	36	60	63	1.67
	non-M non-P	7,236	6,936	6,768	0.96
	Total	8,805	8,805	8,805	
Central and Southern	Māori	687	1,299	1,533	1.90
	Pacific People	138	231	252	1.68
	non-M non-P	19,326	18,618	18,369	0.96
	Total	20,151	20,151	20,151	

Table 30: Stratification by Regional Health Authority (3 groups) (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised

RHA	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
Northern	Māori	2,004	2,142	1.07
	Pacific People	1,170	1,140	0.98
	Asian	351	351	1.00
	non-M non-P non-A	8,583	8,475	0.99
	Total	12,108	12,108	
Midland	Māori	2,373	2,427	1.02
	Pacific People	99	111	1.15
	Asian	45	54	1.14
	non-M non-P non-A	6,072	5,994	0.99
	Total	8,586	8,586	
Central and Southern	Māori	1,728	1,953	1.13
	Pacific People	372	372	1.00
	Asian	198	207	1.04
	non-M non-P non-A	16,533	16,305	0.99
	Total	18,831	18,831	

b: NMDS sole by census sole

RHA	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
Northern	Māori	1,824	1,554	0.85
	Pacific People	1,095	990	0.91
	Asian	333	336	1.01
	non-M non-P non-A	8,859	9,231	1.04
	Total	12,108	12,108	
Midland	Māori	2,217	1,890	0.85
	Pacific People	87	84	0.97
	Asian	45	42	0.97
	non-M non-P non-A	6,237	6,570	1.05
	Total	8,586	8,586	
Central and Southern	Māori	1,572	1,365	0.87
	Pacific People	354	309	0.88
	Asian	180	183	1.02
	non-M non-P non-A	16,728	16,974	1.02
	Total	18,831	18,831	

3.3.5 Stratification by rurality

- The adjustment ratio for Māori in urban areas is higher than in rural areas for all except 1981-84 cohort.
- Because of less number of Pacific (and Asian) deaths in the rural areas, ratios are given for only Māori and non-Māori in rural areas.

Table 31: Stratification by rurality (1981-84 census-mortality cohort)

Rurality	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Urban	Māori	2,292	2,673	3,285	1.17
	Pacific People	348	543	585	1.57
	non-M non-P	36,657	36,081	35,427	0.98
	Total	39,297	39,297	39,297	
Rural	Māori	813	942	1,026	1.16
	non-M	4,593	4,464	4,377	0.97
	Total	5,406	5,406	5,406	

Table 32: Stratification by rurality (1986-89 census-mortality cohort)

Rurality	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Urban	Māori	2,229	3,072	3,657	1.38
	Pacific People	441	771	873	1.75
	non-M non-P	36,645	35,469	34,782	0.97
	Total	39,315	39,315	39,315	
Rural	Māori	729	834	927	1.15
	non-M	4,461	4,356	4,266	0.98
	Total	5,190	5,190	5,190	

Table 33: Stratification by rurality (1991-94 census-mortality cohort)

Rurality	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Urban	Māori	2,613	3,540	4,014	1.36
	Pacific People	654	1,092	1,140	1.66
	non-M non-P	32,913	31,551	31,026	0.96
	Total	36,180	36,180	36,180	
Rural	Māori	861	1,029	1,122	1.20
	non-M	4,269	4,098	4,005	0.96
	Total	5,130	5,130	5,130	

Table 34: Stratification by rurality (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised

Rurality	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
Urban	Māori	4,896	5,268	1.08
	Pacific People	1,623	1,596	0.98
	Asian	588	597	1.02
	non-M non-P non-A	27,681	27,324	0.99
	Total	34,785	34,785	
Rural	Māori	1,212	1,254	1.03
	non-M	3,528	3,486	0.99
	Total	4,740	4,740	

b: NMDS sole by census sole

Rurality	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
Urban	Māori	4,473	3,852	0.86
	Pacific People	1,521	1,371	0.90
	Asian	546	555	1.01
	non-M non-P non-A	28,245	29,010	1.03
	Total	34,785	34,785	
Rural	Māori	1,140	957	0.84
	non-M	3,597	3,783	1.05
	Total	4,740	4,740	

3.3.6 Stratification by cause of death

- For Māori, the numerator-denominator bias is greater for Injury/Suicide than for any other cause of death. The pattern persists in all four cohorts, though the bias is less in the 1996-99 cohort compared to the other three.
- This difference in the bias may be due to various reasons such as being more reliant on the coroner's report, or the effect of age (i.e. majority of deaths due to Injury/Suicide occur in younger Māori and the numerator-denominator bias is greater for younger ages). Subsequent results in the *Appendix 1:* of this Report (for age at death by cause of death, Table 59 to Table 62, page 103 to 106) support age being the main reason for varying adjustment ratios by cause of death.
- The numerator-denominator bias is greater for Pacific people than any other ethnic group, for all the causes of death.

Table 35: Stratification by cause of death (1981-84 census-mortality cohort)

Cause of death	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Cancer	Māori	759	852	1,050	1.12
	Pacific People	78	129	141	1.63
	non-M non-P	12,483	12,342	12,129	0.99
	Total	13,320	13,320	13,320	
CVD	Māori	1,245	1,434	1,677	1.15
	Pacific People	141	204	222	1.44
	non-M non-P	18,492	18,243	17,982	0.99
	Total	19,881	19,881	19,881	
Injury/Suicide	Māori	408	522	642	1.26
	Pacific People	69	99	102	1.35
	non-M non-P	3,594	3,459	3,327	0.96
	Total	4,071	4,071	4,071	
Other	Māori	693	810	942	1.17
	Pacific People	66	120	132	1.92
	non-M non-P	6,666	6,492	6,354	0.97
	Total	7,428	7,428	7,428	

Table 36: Stratification by cause of death (1986-89 census-mortality cohort)

Cause of death	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Cancer	Māori	753	951	1,161	1.26
	Pacific People	123	213	231	1.73
	non-M non-P	13,305	13,020	12,795	0.98
	Total	14,184	14,184	14,187	
CVD	Māori	1,086	1,413	1,602	1.30
	Pacific People	150	267	294	1.78
	non-M non-P	16,734	16,290	16,071	0.97
	Total	17,967	17,967	17,967	
Injury/Suicide	Māori	423	639	798	1.51
	Pacific People	63	105	141	1.65
	non-M non-P	4,089	3,831	3,636	0.94
	Total	4,575	4,575	4,575	
Other	Māori	696	906	1,023	1.30
	Pacific People	108	198	219	1.85
	non-M non-P	6,972	6,672	6,534	0.96
	Total	7,779	7,779	7,779	

Table 37: Stratification by cause of death (1991-94 census-mortality cohort)

Cause of death	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
Cancer	Māori	957	1,230	1,380	1.29
	Pacific People	147	273	279	1.89
	non-M non-P	13,419	13,017	12,861	0.97
	Total	14,520	14,520	14,520	
CVD	Māori	1,260	1,659	1,818	1.32
	Pacific People	258	423	441	1.64
	non-M non-P	13,917	13,353	13,173	0.96
	Total	15,435	15,435	15,435	
Injury/Suicide	Māori	417	612	756	1.46
	Pacific People	96	141	156	1.51
	non-M non-P	3,606	3,363	3,210	0.93
	Total	4,119	4,119	4,119	
Other	Māori	840	1,074	1,185	1.28
	Pacific People	156	261	270	1.66
	non-M non-P	6,240	5,907	5,781	0.95
	Total	7,236	7,236	7,236	

**Table 38: Stratification by cause of death (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised**

Cause of death	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
Cancer	Māori	1,776	1,896	1.07
	Pacific People	471	441	0.94
	Asian	186	204	1.08
	non-M non-P non-A	12,465	12,357	0.99
	Total	14,898	14,898	
CVD	Māori	2,055	2,166	1.06
	Pacific People	597	597	1.00
	Asian	180	180	1.00
	non-M non-P non-A	10,065	9,951	0.99
	Total	12,894	12,894	
Injury/Suicide	Māori	849	936	1.10
	Pacific People	156	177	1.16
	Asian	96	96	1.02
	non-M non-P non-A	2,727	2,619	0.96
	Total	3,828	3,828	
Other	Māori	1,425	1,524	1.07
	Pacific People	414	405	0.98
	Asian	132	132	0.97
	non-M non-P non-A	5,928	5,844	0.99
	Total	7,905	7,905	

b: NMDS sole by census sole

Cause of death	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
Cancer	Māori	1,644	1,392	0.85
	Pacific People	426	369	0.86
	Asian	174	180	1.04
	non-M non-P non-A	12,651	12,954	1.02
	Total	14,898	14,898	
CVD	Māori	1,920	1,695	0.88
	Pacific People	573	531	0.93
	Asian	171	171	0.99
	non-M non-P non-A	10,230	10,497	1.03
	Total	12,894	12,894	
Injury/Suicide	Māori	741	537	0.73
	Pacific People	135	126	0.93
	Asian	84	84	1.00
	non-M non-P non-A	2,868	3,084	1.07
	Total	3,828	3,828	
Other	Māori	1,314	1,185	0.90
	Pacific People	399	354	0.90
	Asian	123	126	1.01
	non-M non-P non-A	6,072	6,237	1.03
	Total	7,905	7,905	

Chapter 4: Conclusions

General findings

- The crude overall census sole to death registration ethnicity ratio was lower for the 1981-84 cohort than the 1986-89 and 1991-94 cohorts. The census prioritised to NMDS prioritised ratio for the 1996-99 cohort was closer to 1.0.
- However, due to marked variation in the overall ratios by age, we do not recommend general use of the crude ratios. Rather, we recommend that age-specific (at least) ratios be used for correcting ethnic-specific mortality rates. An example of how to apply the adjustment ratios is presented at the end of this section.
- The ethnic groups on the NHI file for 1991-94 were closer to the 1991 sole census ethnicity counts than were the 1996-99 NHI file data compared to the 1996 prioritised census counts.
- The adjustment ratios do not differ markedly by sex.
- For the first three cohorts the Māori unlock ratios were notably greater in younger age groups. However, for the 1996-99 cohort the Māori ratios did not differ notably by age. There was no evidence of systemic varying ratios by age for Pacific people.
- Usually, the Māori adjustment ratios were greater in Central and Southern RHAs than Midland and Northern RHAs. The exception to this pattern was 1986-89 where localized problems with ethnicity recording in Onehunga (and some improvement in recording in Wellington region) altered the pattern.
- Greater Māori numerator-denominator bias was observed in urban dwellers across all four cohorts.
- The Māori ratio for numerator-denominator bias was greater for Injury/Suicide than any other cause of death. This pattern was observed across all the four cohorts. However, stratifying by age did remove most of the differences between Injury/Suicide deaths and deaths due to other causes. Therefore, adjustment ratios by strata of age can be used across causes of death *without the need to generate ratios by specific cause of death*.
- Overall, the undercounting of Pacific deaths prior to 1995 was more severe than the undercounting of Māori deaths.

Bias considerations

- Our initial concerns about introducing misclassification bias in our numerator-denominator analyses by inclusion of area unit links (in addition to meshblock links) did not appear to be substantiated. Therefore, the results in this report for 1991-94 superseded those previously published (Blakely and Atkinson 2001; Blakely et al. 2002).
- Inclusion of rural deaths (by inclusion of area unit links) meant that our analyses were less prone to selection bias.

Applying the unlock ratios

The choice of adjustment ratios for use in adjusting ethnic-specific mortality rates depends on the data being analysed (especially post 1995/1996). For example, if one is

trying to estimate the mortality experience of sole Māori then sole census ratios should be used. However, problems arise in that the *meaning* of sole and prioritised ethnic groups according to census data change over time. (That is, the large decrease in sole Māori on the 1996 census relative to the 1991 census is a function of the census question change – not real trends.) We will pursue this issue in future work and publications.

Example of applying adjustment ratios

Assume that there were 50,000 15-24 year-old Māori and 200,000 non-Māori recorded on the 1991 census. In 1991-92, assume that 15 Māori deaths and 40 non-Māori deaths were recorded on the death registration form due to road traffic crashes. Accordingly, the *unadjusted* Māori mortality rate for road traffic crashes in 1991-92 is 30 per 100,000 and for non-Māori is 20 per 100,000. The observed or *unadjusted* rate ratio for Māori compared to non-Māori is **1.5**.

The adjustment ratios for 15-24 year old Māori and non-Māori in the 1991-94 cohort were 1.55 and 0.93 respectively (Table 21) (page 42; $0.93 = [69+1,326]/[45+1,458]$). Therefore, the *adjusted*:

- Māori road traffic crash mortality rate is $30 \times 1.55 = 47$ per 100,000
- Non-Māori road traffic crash mortality rate is $20 \times 0.93 = 19$ per 100,000
- Māori to non-Māori rate ratio is $1.5 \times [1.55/0.93] = \mathbf{2.5}$.

Note: We will be presenting ethnic mortality rates adjusted for the numerator-denominator bias for the 1980s and 1990s in a subsequent report to this one. In that report, we will present rates of mortality:

- for Māori, Pacific and non-Māori non-Pacific
- for both sole and prioritised definitions of these ethnic groups
- and rates stratified by sex, age and cause of death.

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Appendix 1: Census ethnicity to NMDS death registration form ratios, two levels of stratification

- The two levels of stratification ratios on one hand are more accurate as they include the effect of sex or age or both, but on the other hand may be unstable because of finer stratification and thus, fewer numbers.
- Accordingly, we recommend their use with caution.
- We intend to pursue elsewhere the possibility of using ‘smoothed’ adjustment ratios to allow for instability at two or more levels of stratification.

Table 39: Stratification by sex and age at death (1981-84 census-mortality cohort)

Age at death	Ethnic groups	Death reg form		Census sole		Census prioritised		Census sole to death reg ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	Unweighted n	Weighted n	
<i>Males</i>								
0-14 years	Māori	36	66	57	102	75	126	1.57
	Pacific	9	15	21	33	24	36	2.45
	nMnP	288	444	252	390	231	360	0.87
	Total	330	522	330	522	330	522	
15-24 years	Māori	60	156	96	225	123	279	1.44
	Pacific	12	30	15	39	18	36	1.27
	nMnP	627	1,188	588	1,110	558	1,053	0.94
	Total	699	1,371	699	1,371	699	1,371	
25-44 years	Māori	120	291	159	354	189	414	1.22
	Pacific	15	45	24	63	24	63	1.43
	nMnP	1,050	1,875	1,005	1,797	972	1,734	0.96
	Total	1,185	2,211	1,185	2,211	1,185	2,211	
45-64 years	Māori	348	822	444	942	537	1,098	1.14
	Pacific	36	81	60	120	69	129	1.47
	nMnP	5,973	8,871	5,853	8,715	5,754	8,550	0.98
	Total	6,357	9,777	6,357	9,777	6,357	9,777	
65-77 years	Māori	174	489	222	537	291	651	1.10
	Pacific	27	60	42	84	48	90	1.41
	nMnP	9,003	13,143	8,940	13,071	8,862	12,954	0.99
	Total	9,201	13,692	9,201	13,692	9,201	13,692	

†† The Census to death registration form ratio was calculated using the weighted numbers.

(contd)

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Age at death	Ethnic groups	Death reg form		Census sole		Census prioritised		Census sole to death reg ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	Unweighted n	Weighted n	
<i>Females</i>								
0-14 years	Māori	33	48	45	69	60	93	1.46
	Pacific	6	12	9	15	9	18	1.36
	nMnP	192	306	177	279	162	252	0.92
	Total	231	366	231	366	231	366	
15-24 years	Māori	30	78	39	90	51	117	1.16
	Pacific	9	15	15	24	18	27	1.63
	nMnP	210	411	198	390	180	360	0.95
	Total	252	504	252	504	252	504	
25-44 years	Māori	90	201	111	228	132	270	1.15
	Pacific	6	24	18	45	21	48	1.87
	nMnP	660	1,089	627	1,038	600	993	0.95
	Total	753	1,314	753	1,314	753	1,314	
45-64 years	Māori	237	579	285	630	342	732	1.10
	Pacific	24	48	42	78	45	84	1.62
	nMnP	3,378	5,058	3,312	4,974	3,249	4,869	0.98
	Total	3,636	5,685	3,636	5,685	3,636	5,685	
65-77 years	Māori	147	381	192	435	246	531	1.14
	Pacific	12	27	27	51	30	54	1.79
	nMnP	5,667	8,850	5,607	8,772	5,550	8,673	0.99
	Total	5,829	9,258	5,829	9,258	5,829	9,258	

†† The Census to death registration form ratio was calculated using the weighted numbers.

Table 40: Stratification by sex and age at death (1986-89 census-mortality cohort)

Age at death	Ethnic groups	Death reg form		Census sole		Census prioritised		Census sole to death reg ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	Unweighted n	Weighted n	
Males								
0-14 years	Māori	36	60	60	93	90	138	1.57
	Pacific	12	15	18	27	27	39	1.58
	nMnP	279	405	252	363	213	312	0.89
	Total	330	483	330	483	330	483	
15-24 years	Māori	72	147	117	225	165	306	1.52
	Pacific	9	18	24	42	33	63	2.10
	nMnP	768	1,314	708	1,215	651	1,110	0.93
	Total	849	1,482	849	1,482	849	1,482	
25-44 years	Māori	132	288	207	411	243	477	1.43
	Pacific	30	66	60	120	66	132	1.85
	nMnP	1,278	2,175	1,173	1,998	1,134	1,923	0.92
	Total	1,443	2,529	1,443	2,529	1,443	2,529	
45-64 years	Māori	411	780	594	1,032	672	1,152	1.32
	Pacific	51	108	117	204	126	219	1.90
	nMnP	6,015	8,385	5,763	8,037	5,676	7,902	0.96
	Total	6,474	9,273	6,474	9,273	6,474	9,273	
65-77 years	Māori	216	453	288	525	345	618	1.16
	Pacific	27	75	57	111	63	126	1.51
	nMnP	9,675	12,987	9,573	12,876	9,510	12,777	0.99
	Total	9,921	13,515	9,921	13,515	9,921	13,515	

†† The Census to death registration form ratio was calculated using the weighted numbers.

(contd)

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Age at death	Ethnic groups	Death reg form		Census sole		Census prioritised		Census sole to death reg ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	Unweighted n	Weighted n	
Females								
0-14 years	Māori	21	33	36	51	54	81	1.58
	Pacific	9	15	12	24	12	24	1.36
	nMnP	195	273	180	249	156	219	0.91
	Total	225	324	225	324	225	324	
15-24 years	Māori	27	66	45	102	60	132	1.54
	Pacific	6	15	9	18	12	21	1.28
	nMnP	234	423	213	387	195	354	0.91
	Total	264	507	264	507	264	507	
25-44 years	Māori	87	159	138	246	165	291	1.55
	Pacific	18	33	30	54	39	66	1.61
	nMnP	735	1,173	669	1,068	636	1,011	0.91
	Total	837	1,368	837	1,368	837	1,368	
45-64 years	Māori	306	582	435	753	498	846	1.29
	Pacific	36	57	75	117	81	123	2.02
	nMnP	3,540	4,869	3,372	4,638	3,306	4,536	0.95
	Total	3,882	5,508	3,882	5,508	3,882	5,508	
65-77 years	Māori	177	387	246	468	297	549	1.21
	Pacific	15	39	36	66	45	81	1.72
	nMnP	6,468	9,090	6,378	8,982	6,321	8,892	0.99
	Total	6,663	9,516	6,663	9,516	6,663	9,516	

†† The Census to death registration form ratio was calculated using the weighted numbers.

Table 41: Stratification by sex and age at death (1991-94 census-mortality cohort)

Age at death	Ethnic groups	Death reg form		Census sole		Census prioritised		Census sole to death reg ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	Unweighted n	Weighted n	
<i>Males</i>								
0-14 years	Māori	27	51	54	84	72	108	1.69
	Pacific	18	27	27	45	30	45	1.59
	nMnP	228	330	192	279	174	255	0.85
	Total	276	408	276	408	276	408	
15-24 years	Māori	69	153	108	222	144	294	1.48
	Pacific	9	30	21	51	21	60	1.78
	nMnP	588	1,083	537	984	498	906	0.91
	Total	666	1,263	666	1,263	666	1,263	
25-44 years	Māori	174	357	261	489	294	552	1.38
	Pacific	27	72	51	111	54	114	1.56
	nMnP	1,293	2,142	1,185	1,968	1,149	1,902	0.92
	Total	1,494	2,568	1,494	2,568	1,494	2,568	
45-64 years	Māori	537	897	759	1,185	834	1,290	1.32
	Pacific	84	159	174	282	177	288	1.78
	nMnP	5,343	6,993	5,031	6,588	4,953	6,477	0.94
	Total	5,964	8,055	5,964	8,055	5,964	8,055	
65-77 years	Māori	324	585	450	720	504	792	1.23
	Pacific	54	123	105	183	111	195	1.48
	nMnP	9,846	12,225	9,669	12,033	9,612	11,946	0.98
	Total	10,227	12,933	10,227	12,933	10,227	12,933	

†† The Census to death registration form ratio was calculated using the weighted numbers.

(contd)

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Age at death	Ethnic groups	Death reg form		Census sole		Census prioritised		Census sole to death reg ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	Unweighted n	Weighted n	
Females								
0-14 years	Māori	21	30	39	63	54	84	1.97
	Pacific	9	15	15	21	18	30	1.50
	nMnP	162	240	138	201	120	171	0.84
	Total	195	285	195	285	195	285	
15-24 years	Māori	27	42	45	75	57	96	1.84
	Pacific	6	15	9	15	12	21	1.20
	nMnP	225	375	204	339	189	315	0.90
	Total	261	432	261	432	261	432	
25-44 years	Māori	117	201	162	261	183	288	1.29
	Pacific	15	39	51	93	54	96	2.47
	nMnP	804	1,131	726	1,017	702	984	0.90
	Total	939	1,371	939	1,371	939	1,371	
45-64 years	Māori	465	720	636	930	696	1,014	1.29
	Pacific	48	96	81	144	87	147	1.49
	nMnP	3,423	4,350	3,219	4,095	3,153	4,005	0.94
	Total	3,936	5,169	3,936	5,169	3,936	5,169	
65-77 years	Māori	249	438	336	540	390	612	1.23
	Pacific	39	81	96	150	99	153	1.88
	nMnP	6,546	8,310	6,405	8,139	6,345	8,061	0.98
	Total	6,834	8,829	6,834	8,829	6,834	8,829	

†† The Census to death registration form ratio was calculated using the weighted numbers.

**Table 42: Stratification by sex and age at death (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised**

Age at death	Ethnic groups	NMDS prioritised		Census prioritised		Census prioritised to NMDS prioritised ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	
Males						
0-14 years	Māori	81	141	90	147	1.04
	Pacific People	21	30	18	30	0.99
	Asian	6	9	9	12	1.19
	non-M non-P non-A	144	189	135	183	0.96
	Total	252	369	252	369	
15-24 years	Māori	120	279	144	315	1.13
	Pacific People	39	72	42	84	1.13
	Asian	18	27	15	24	0.94
	non-M non-P non-A	360	645	336	600	0.93
	Total	534	1,023	534	1,023	
25-44 years	Māori	294	642	345	717	1.12
	Pacific People	84	162	90	177	1.09
	Asian	30	63	30	60	0.95
	non-M non-P non-A	1,026	1,710	966	1,623	0.95
	Total	1,434	2,577	1,434	2,577	
45-64 years	Māori	954	1,524	1,023	1,599	1.05
	Pacific People	243	399	243	393	0.98
	Asian	81	141	87	147	1.05
	non-M non-P non-A	4,305	5,505	4,230	5,430	0.99
	Total	5,580	7,569	5,580	7,569	
65-77 years	Māori	666	1,002	741	1,080	1.08
	Pacific People	174	324	162	303	0.93
	Asian	63	111	66	108	1.00
	non-M non-P non-A	9,006	11,049	8,940	10,995	1.00
	Total	9,909	12,486	9,909	12,486	

†† The Census to death registration form ratio was calculated using the weighted numbers.

(contd)

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Age at death	Ethnic groups	NMDS prioritised		Census prioritised		Census prioritised to NMDS prioritised ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	
<i>Females</i>						
0-14 years	Māori	63	96	69	108	1.15
	Pacific People	12	21	12	24	1.04
	Asian	6	9	6	9	1.17
	non-M non-P non-A	114	153	105	138	0.90
	Total	189	276	189	276	
15-24 years	Māori	54	111	66	126	1.15
	Pacific People	15	18	15	18	1.00
	Asian	12	18	15	21	1.22
	non-M non-P non-A	159	243	147	222	0.92
	Total	240	390	240	390	
25-44 years	Māori	225	354	243	375	1.05
	Pacific People	81	132	81	135	1.03
	Asian	30	48	33	51	1.02
	non-M non-P non-A	654	864	630	840	0.97
	Total	987	1,398	987	1,398	
45-64 years	Māori	702	1,083	744	1,125	1.04
	Pacific People	147	246	141	237	0.97
	Asian	54	81	60	87	1.08
	non-M non-P non-A	3,030	3,687	2,988	3,648	0.99
	Total	3,933	5,097	3,933	5,097	
65-77 years	Māori	549	873	606	927	1.06
	Pacific People	138	228	135	225	0.98
	Asian	54	90	54	87	0.96
	non-M non-P non-A	5,841	7,146	5,784	7,101	0.99
	Total	6,579	8,340	6,579	8,340	

†† The Census to death registration form ratio was calculated using the weighted numbers.

b: NMDS sole by census sole

Age at death	Ethnic groups	NMDS sole		Census sole		Census sole to NMDS sole ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	
Males						
0-14 years	Māori	66	108	54	93	0.86
	Pacific People	12	18	9	15	0.72
	Asian	6	9	6	9	1.18
	non-M non-P non-A	168	234	180	249	1.08
	Total	252	369	252	369	
15-24 years	Māori	99	228	75	171	0.74
	Pacific People	33	60	30	54	0.90
	Asian	15	24	15	24	1.00
	non-M non-P non-A	390	708	417	774	1.09
	Total	534	1,023	534	1,023	
25-44 years	Māori	273	600	231	492	0.83
	Pacific People	78	159	72	144	0.92
	Asian	30	54	30	60	1.06
	non-M non-P non-A	1,053	1,764	1,101	1,878	1.06
	Total	1,434	2,577	1,434	2,577	
45-64 years	Māori	894	1,434	816	1,299	0.91
	Pacific People	234	378	216	354	0.93
	Asian	75	132	81	135	1.03
	non-M non-P non-A	4,377	5,625	4,467	5,781	1.03
	Total	5,580	7,569	5,580	7,569	
65-77 years	Māori	609	915	528	780	0.85
	Pacific People	162	306	144	270	0.88
	Asian	63	108	57	102	0.93
	non-M non-P non-A	9,075	11,160	9,180	11,337	1.02
	Total	9,909	12,486	9,909	12,486	

†† The Census to death registration form ratio was calculated using the weighted numbers.

(contd)

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Age at death	Ethnic groups	NMDS sole		Census sole		Census sole to NMDS sole ratio ††
		Unweighted n	Weighted n	Unweighted n	Weighted n	
Females						
0-14 years	Māori	45	72	39	60	0.84
	Pacific People	9	21	9	18	0.90
	Asian	6	6	6	9	2.63
	non-M non-P non-A	135	180	138	189	1.05
	Total	189	276	189	276	
15-24 years	Māori	42	87	36	72	0.85
	Pacific People	12	15	12	15	1.08
	Asian	9	15	9	15	0.92
	non-M non-P non-A	177	273	183	285	1.05
	Total	240	390	240	390	
25-44 years	Māori	201	318	150	234	0.74
	Pacific People	69	117	66	105	0.91
	Asian	33	51	30	48	0.93
	non-M non-P non-A	684	915	741	1,014	1.11
	Total	987	1,398	987	1,398	
45-64 years	Māori	675	1,041	573	879	0.85
	Pacific People	144	240	126	210	0.87
	Asian	51	78	57	84	1.10
	non-M non-P non-A	3,060	3,738	3,177	3,924	1.05
	Total	3,933	5,097	3,933	5,097	
65-77 years	Māori	513	816	465	726	0.89
	Pacific People	132	219	117	198	0.90
	Asian	48	81	48	78	0.97
	non-M non-P non-A	5,889	7,227	5,949	7,338	1.02
	Total	6,579	8,340	6,579	8,340	

†† The Census to death registration form ratio was calculated using the weighted numbers.

Table 43: Stratification by sex and small area deprivation (1981-84 census-mortality cohort)

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>Males</i>					
Deciles 1-4	Māori	207	228	321	1.10
	Pacific People	24	42	48	1.59
	non-M non-P	8,601	8,565	8,463	1.00
	Total	8,832	8,832	8,832	
Deciles 5-6	Māori	222	255	321	1.14
	Pacific People	33	60	63	1.78
	non-M non-P	5,340	5,283	5,211	0.99
	Total	5,595	5,595	5,595	
Deciles 7-8	Māori	411	474	579	1.15
	Pacific People	36	54	60	1.56
	non-M non-P	5,718	5,640	5,526	0.99
	Total	6,165	6,165	6,165	
Deciles 9-10	Māori	981	1,203	1,348	1.23
	Pacific People	135	183	186	1.36
	non-M non-P	5,865	5,592	5,445	0.95
	Total	6,981	6,981	6,981	
<i>Females</i>					
Deciles 1-4	Māori	138	141	213	1.03
	Pacific People	18	30	33	1.68
	non-M non-P	5,253	5,238	5,163	1.00
	Total	5,409	5,409	5,409	
Deciles 5-6	Māori	159	180	222	1.16
	Pacific People	9	27	33	2.77
	non-M non-P	3,393	3,351	3,306	0.99
	Total	3,558	3,558	3,558	
Deciles 7-8	Māori	267	297	369	1.11
	Pacific People	18	39	42	1.90
	non-M non-P	3,564	3,519	3,441	0.99
	Total	3,852	3,852	3,852	
Deciles 9-10	Māori	720	831	945	1.16
	Pacific People	81	117	126	1.49
	non-M non-P	3,504	3,354	3,237	0.96
	Total	4,305	4,305	4,305	

Table 44: Stratification by sex and small area deprivation (1986-89 census-mortality cohort)

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>Males</i>					
Deciles 1-4	Māori	204	228	327	1.12
	Pacific People	36	66	81	1.74
	non-M non-P	8,478	8,427	8,313	0.99
	Total	8,721	8,721	8,721	
Deciles 5-6	Māori	195	273	324	1.40
	Pacific People	54	69	87	1.33
	non-M non-P	5,277	5,178	5,115	0.98
	Total	5,523	5,523	5,523	
Deciles 7-8	Māori	375	483	582	1.28
	Pacific People	42	84	93	2.02
	non-M non-P	5,694	5,544	5,436	0.97
	Total	6,108	6,108	6,108	
Deciles 9-10	Māori	954	1,305	1,455	1.37
	Pacific People	150	285	315	1.88
	non-M non-P	5,820	5,337	5,160	0.92
	Total	6,930	6,930	6,930	
<i>Females</i>					
Deciles 1-4	Māori	126	144	201	1.11
	Pacific People	21	36	45	1.67
	non-M non-P	5,352	5,322	5,256	1.00
	Total	5,502	5,502	5,502	
Deciles 5-6	Māori	147	183	222	1.28
	Pacific People	21	39	45	1.85
	non-M non-P	3,216	3,156	3,117	0.98
	Total	3,381	3,381	3,381	
Deciles 7-8	Māori	276	366	435	1.33
	Pacific People	27	36	45	1.35
	non-M non-P	3,678	3,579	3,504	0.97
	Total	3,984	3,984	3,984	
Deciles 9-10	Māori	681	927	1,041	1.37
	Pacific People	90	168	183	1.83
	non-M non-P	3,585	3,264	3,132	0.91
	Total	4,356	4,356	4,356	

Table 45: Stratification by sex and small area deprivation (1991-94 census-mortality cohort)

Deciles of NZDep91	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>Males</i>					
Deciles 1-4	Māori	201	276	336	1.37
	Pacific People	27	48	51	1.75
	non-M non-P	8,181	8,088	8,022	0.99
	Total	8,409	8,409	8,409	
Deciles 5-6	Māori	288	342	408	1.19
	Pacific People	39	66	63	1.55
	non-M non-P	4,620	4,542	4,476	0.98
	Total	4,950	4,950	4,950	
Deciles 7-8	Māori	501	651	741	1.29
	Pacific People	99	147	159	1.53
	non-M non-P	4,980	4,782	4,674	0.96
	Total	5,577	5,577	5,577	
Deciles 9-10	Māori	1,050	1,434	1,551	1.37
	Pacific People	249	417	423	1.68
	non-M non-P	4,992	4,440	4,314	0.89
	Total	6,291	6,291	6,291	
<i>Females</i>					
Deciles 1-4	Māori	120	192	237	1.62
	Pacific People	24	27	33	1.29
	non-M non-P	5,139	5,058	5,010	0.99
	Total	5,277	5,277	5,277	
Deciles 5-6	Māori	168	195	231	1.15
	Pacific People	27	57	63	2.08
	non-M non-P	2,907	2,853	2,811	0.98
	Total	3,102	3,102	3,102	
Deciles 7-8	Māori	333	441	504	1.33
	Pacific People	45	75	84	1.73
	non-M non-P	3,210	3,072	3,003	0.96
	Total	3,591	3,591	3,591	
Deciles 9-10	Māori	813	1,041	1,131	1.28
	Pacific People	150	261	267	1.77
	non-M non-P	3,153	2,811	2,715	0.89
	Total	4,116	4,116	4,116	

**Table 46: Stratification by sex and small area deprivation (1996-99 census-mortality cohort)
a: NMDS prioritised by census prioritised**

Deciles of NZDep96	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
<i>Males</i>				
Deciles 1-4	Māori	390	480	1.23
	Pacific People	87	96	1.10
	Asian	147	153	1.03
	non-M non-P non-A	7,182	7,080	0.99
	Total	7,806	7,806	
Deciles 5-6	Māori	426	471	1.11
	Pacific People	138	141	1.03
	Asian	60	60	0.98
	non-M non-P non-A	3,966	3,918	0.99
	Total	4,590	4,590	
Deciles 7-8	Māori	846	912	1.08
	Pacific People	189	183	0.97
	Asian	81	78	0.97
	non-M non-P non-A	4,368	4,311	0.99
	Total	5,484	5,481	
Deciles 9-10	Māori	1,929	1,998	1.04
	Pacific People	576	567	0.98
	Asian	60	63	1.04
	non-M non-P non-A	3,579	3,519	0.98
	Total	6,144	6,144	
<i>Females</i>				
Deciles 1-4	Māori	225	285	1.28
	Pacific People	78	78	1.00
	Asian	105	105	1.01
	non-M non-P non-A	4,533	4,470	0.99
	Total	4,935	4,935	
Deciles 5-6	Māori	267	315	1.18
	Pacific People	72	69	0.98
	Asian	48	51	0.99
	non-M non-P non-A	2,646	2,598	0.98
	Total	3,036	3,036	
Deciles 7-8	Māori	609	627	1.03
	Pacific People	132	132	0.99
	Asian	54	54	1.03
	non-M non-P non-A	2,706	2,688	0.99
	Total	3,501	3,501	
Deciles 9-10	Māori	1,416	1,434	1.01
	Pacific People	366	363	0.99
	Asian	39	45	1.15
	non-M non-P non-A	2,205	2,187	0.99
	Total	4,029	4,029	

b: NMDS sole by census sole

Deciles of NZDep96	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
<i>Males</i>				
Deciles 1-4	Māori	333	267	0.81
	Pacific People	72	60	0.84
	Asian	141	144	1.03
	non-M non-P non-A	7,260	7,332	1.01
	Total	7,806	7,806	
Deciles 5-6	Māori	378	315	0.83
	Pacific People	126	117	0.94
	Asian	60	54	0.94
	non-M non-P non-A	4,026	4,107	1.02
	Total	4,590	4,590	
Deciles 7-8	Māori	765	666	0.87
	Pacific People	168	138	0.83
	Asian	75	72	0.98
	non-M non-P non-A	4,476	4,605	1.03
	Total	5,484	5,484	
Deciles 9-10	Māori	1,809	1,587	0.88
	Pacific People	555	519	0.93
	Asian	57	60	1.03
	non-M non-P non-A	3,726	3,981	1.07
	Total	6,144	6,144	
<i>Females</i>				
Deciles 1-4	Māori	198	165	0.83
	Pacific People	72	57	0.78
	Asian	96	87	0.94
	non-M non-P non-A	4,572	4,629	1.01
	Total	4,935	4,935	
Deciles 5-6	Māori	243	204	0.84
	Pacific People	69	57	0.82
	Asian	48	45	0.94
	non-M non-P non-A	2,676	2,733	1.02
	Total	3,036	3,036	
Deciles 7-8	Māori	552	441	0.80
	Pacific People	120	105	0.86
	Asian	45	54	1.20
	non-M non-P non-A	2,784	2,898	1.04
	Total	3,501	3,501	
Deciles 9-10	Māori	1,335	1,161	0.87
	Pacific People	354	333	0.94
	Asian	36	42	1.16
	non-M non-P non-A	2,307	2,493	1.08
	Total	4,029	4,029	

Table 47: Stratification by sex and Regional Health Authority (3 groups) (1981-84 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>Males</i>					
Northern	Māori	609	699	834	1.15
	Pacific People	168	255	270	1.52
	non-M non-P	7,011	6,834	6,690	0.97
	Total	7,791	7,791	7,791	
Midland	Māori	792	867	957	1.09
	Pacific People	27	30	33	1.16
	non-M non-P	4,737	4,662	4,566	0.98
	Total	5,556	5,556	5,556	
Central and Southern	Māori	420	591	777	1.41
	Pacific People	33	51	60	1.54
	non-M non-P	13,773	13,584	13,392	0.99
	Total	14,229	14,229	14,229	
<i>Females</i>					
Northern	Māori	411	462	564	1.13
	Pacific People	75	132	147	1.73
	non-M non-P	4,542	4,434	4,320	0.98
	Total	5,028	5,028	5,028	
Midland	Māori	588	639	732	1.09
	Pacific People	9	12	15	1.61
	non-M non-P	2,697	2,640	2,550	0.98
	Total	3,294	3,294	3,294	
Central and Southern	Māori	285	351	456	1.23
	Pacific People	42	69	75	1.62
	non-M non-P	8,475	8,382	8,274	0.99
	Total	8,802	8,802	8,802	

Table 48: Stratification by sex and Regional Health Authority (3 groups) (1986-89 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>Males</i>					
Northern	Māori	408	690	843	1.68
	Pacific People	171	336	381	1.96
	non-M non-P	7,461	7,017	6,822	0.94
	Total	8,043	8,043	8,043	
Midland	Māori	846	927	1,029	1.10
	Pacific People	21	30	36	1.60
	non-M non-P	4,584	4,488	4,380	0.98
	Total	5,451	5,451	5,451	
Central and Southern	Māori	471	669	813	1.42
	Pacific People	93	138	159	1.48
	non-M non-P	13,224	12,984	12,822	0.98
	Total	13,788	13,788	13,788	
<i>Females</i>					
Northern	Māori	300	519	615	1.74
	Pacific People	111	186	219	1.65
	non-M non-P	4,761	4,467	4,335	0.94
	Total	5,172	5,172	5,172	
Midland	Māori	612	675	756	1.10
	Pacific People	9	21	24	2.55
	non-M non-P	2,778	2,703	2,622	0.97
	Total	3,399	3,399	3,399	
Central and Southern	Māori	321	429	525	1.34
	Pacific People	42	72	72	1.78
	non-M non-P	8,292	8,154	8,055	0.98
	Total	8,652	8,652	8,652	

Table 49: Stratification by sex and Regional Health Authority (3 groups) (1991-94 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>Males</i>					
Northern	Māori	753	879	975	1.17
	Pacific People	309	489	507	1.59
	non-M non-P	6,450	6,141	6,027	0.95
	Total	7,509	7,509	7,509	
Midland	Māori	870	1,026	1,131	1.18
	Pacific People	18	39	39	2.12
	non-M non-P	4,497	4,320	4,212	0.96
	Total	5,385	5,385	5,385	
Central and Southern	Māori	420	795	930	1.90
	Pacific People	84	147	156	1.70
	non-M non-P	11,823	11,388	11,247	0.96
	Total	12,333	12,333	12,333	
<i>Females</i>					
Northern	Māori	504	585	657	1.16
	Pacific People	171	315	333	1.84
	non-M non-P	4,170	3,948	3,858	0.95
	Total	4,848	4,848	4,848	
Midland	Māori	663	780	840	1.18
	Pacific People	15	21	24	1.16
	non-M non-P	2,739	2,619	2,556	0.96
	Total	3,420	3,420	3,420	
Central and Southern	Māori	267	501	603	1.89
	Pacific People	51	87	93	1.66
	non-M non-P	7,500	7,227	7,122	0.96
	Total	7,818	7,818	7,818	

Table 50: Stratification by sex and Regional Health Authority (3 groups) (1996-99 census-mortality cohort)**a: NMDS prioritised by census prioritised**

RHA	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
<i>Males</i>				
Northern	Māori	1,137	1,242	1.09
	Pacific People	702	681	0.97
	Asian	210	201	0.97
	non-M non-P non-A	5,304	5,223	0.99
	Total	7,350	7,350	
Midland	Māori	1,407	1,443	1.02
	Pacific People	69	81	1.15
	Asian	24	30	1.14
	non-M non-P non-A	3,741	3,693	0.99
	Total	5,247	5,247	
Central and Southern	Māori	1,041	1,176	1.13
	Pacific People	216	219	1.01
	Asian	114	120	1.06
	non-M non-P non-A	10,053	9,912	0.99
	Total	11,427	11,427	
<i>Females</i>				
Northern	Māori	870	903	1.04
	Pacific People	465	459	0.98
	Asian	141	150	1.04
	non-M non-P non-A	3,279	3,252	0.99
	Total	4,758	4,758	
Midland	Māori	963	984	1.02
	Pacific People	24	30	1.17
	Asian	21	24	1.13
	non-M non-P non-A	2,328	2,304	0.99
	Total	3,339	3,339	
Central and Southern	Māori	684	774	1.13
	Pacific People	153	153	0.98
	Asian	84	84	1.01
	non-M non-P non-A	6,480	6,393	0.99
	Total	7,404	7,404	

b: NMDS sole by census sole

RHA	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
<i>Males</i>				
Northern	Māori	1,038	897	0.86
	Pacific People	651	591	0.91
	Asian	201	198	0.99
	non-M non-P non-A	5,457	5,664	1.04
	Total	7,350	7,350	
Midland	Māori	1,308	1,119	0.86
	Pacific People	66	60	0.93
	Asian	24	27	1.00
	non-M non-P non-A	3,849	4,041	1.05
	Total	5,247	5,247	
Central and Southern	Māori	939	822	0.88
	Pacific People	201	183	0.90
	Asian	105	108	1.03
	non-M non-P non-A	10,179	10,317	1.01
	Total	11,427	11,427	
<i>Females</i>				
Northern	Māori	783	657	0.84
	Pacific People	441	399	0.91
	Asian	132	138	1.04
	non-M non-P non-A	3,405	3,564	1.05
	Total	4,758	4,758	
Midland	Māori	912	771	0.85
	Pacific People	21	24	1.07
	Asian	18	18	0.93
	non-M non-P non-A	2,388	2,526	1.06
	Total	3,339	3,339	
Central and Southern	Māori	633	543	0.86
	Pacific People	150	126	0.84
	Asian	75	78	1.02
	non-M non-P non-A	6,546	6,663	1.02
	Total	7,404	7,404	

Table 51: Stratification by age at death and small area deprivation (3 groups) (1981-84 census-mortality cohort)

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>0-14 years</i>					
Deciles 1-6	Māori	21	33	57	1.54
	Pacific People	9	15	18	1.85
	non-M non-P	405	384	360	0.96
	Total	432	432	432	
Deciles 7-8	Māori	18	21	33	1.14
	Pacific People	6	9	12	3.08
	non-M non-P	144	132	117	0.93
	Total	162	162	162	
Deciles 9-10	Māori	75	117	129	1.61
	Pacific People	12	24	27	1.69
	non-M non-P	204	150	135	0.73
	Total	291	291	291	
<i>15-24 years</i>					
Deciles 1-6	Māori	60	57	93	0.98
	Pacific People	9	18	15	1.69
	non-M non-P	909	906	870	0.99
	Total	978	978	978	
Deciles 7-8	Māori	51	84	108	1.71
	Pacific People	6	15	15	2.33
	non-M non-P	363	324	300	0.88
	Total	420	420	420	
Deciles 9-10	Māori	123	171	195	1.37
	Pacific People	30	36	39	1.13
	non-M non-P	327	273	246	0.85
	Total	480	480	480	

(contd)

Unlocking the Numerator-Denominator Bias for the 1980s and 1990s

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
25-44 years					
Deciles 1-6	Māori	129	138	168	1.07
	Pacific People	18	33	33	1.93
	non-M non-P	1,653	1,629	1,593	0.99
	Total	1,797	1,797	1,797	
Deciles 7-8	Māori	96	123	150	1.26
	Pacific People	18	21	18	1.12
	non-M non-P	618	591	564	0.96
	Total	732	732	732	
Deciles 9-10	Māori	264	324	366	1.22
	Pacific People	36	60	63	1.63
	non-M non-P	696	615	573	0.88
	Total	999	999	999	
45-64 years					
Deciles 1-6	Māori	321	345	441	1.08
	Pacific People	30	51	63	1.72
	non-M non-P	7,584	7,536	7,431	0.99
	Total	7,935	7,935	7,935	
Deciles 7-8	Māori	318	342	402	1.09
	Pacific People	18	27	36	1.54
	non-M non-P	3,063	3,030	2,964	0.99
	Total	3,399	3,399	3,399	
Deciles 9-10	Māori	762	882	990	1.16
	Pacific People	78	117	114	1.45
	non-M non-P	3,282	3,123	3,021	0.95
	Total	4,125	4,125	4,125	
65-77 years					
Deciles 1-6	Māori	195	231	318	1.19
	Pacific People	24	45	48	1.92
	non-M non-P	12,036	11,979	11,886	1.00
	Total	12,255	12,255	12,255	
Deciles 7-8	Māori	198	201	255	1.01
	Pacific People	6	18	21	2.06
	non-M non-P	5,094	5,082	5,025	1.00
	Total	5,301	5,301	5,301	
Deciles 9-10	Māori	477	543	609	1.14
	Pacific People	54	72	75	1.29
	non-M non-P	4,863	4,782	4,716	0.98
	Total	5,397	5,397	5,397	

Table 52: Stratification by age at death and small area deprivation (3 groups) (1986-89 census-mortality cohort)

Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>0-14 years</i>					
Deciles 1-6	Māori	18	24	45	1.29
	Pacific People	6	6	15	0.88
	non-M non-P	336	330	303	0.99
	Total	363	363	363	
Deciles 7-8	Māori	15	33	48	1.97
	Pacific People	6	9	12	5.28
	non-M non-P	159	135	117	0.84
	Total	177	177	177	
Deciles 9-10	Māori	54	87	126	1.55
	Pacific People	24	33	33	1.33
	non-M non-P	186	147	108	0.79
	Total	267	267	267	
<i>15-24 years</i>					
Deciles 1-6	Māori	39	48	84	1.24
	Pacific People	6	15	21	2.95
	non-M non-P	927	909	867	0.98
	Total	972	972	972	
Deciles 7-8	Māori	57	81	102	1.41
	Pacific People	6	6	12	1.13
	non-M non-P	387	360	336	0.94
	Total	447	447	447	
Deciles 9-10	Māori	117	201	252	1.68
	Pacific People	21	36	51	1.68
	non-M non-P	423	330	261	0.78
	Total	567	567	567	

(contd)

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Deciles of NZDep96	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
25-44 years					
Deciles 1-6	Māori	102	132	171	1.32
	Pacific People	33	42	54	1.21
	non-M non-P	1,767	1,725	1,674	0.98
	Total	1,902	1,902	1,902	
Deciles 7-8	Māori	93	150	168	1.61
	Pacific People	15	33	33	1.97
	non-M non-P	729	654	636	0.90
	Total	837	837	837	
Deciles 9-10	Māori	252	375	423	1.48
	Pacific People	48	99	108	2.09
	non-M non-P	855	681	624	0.80
	Total	1,155	1,155	1,155	
45-64 years					
Deciles 1-6	Māori	321	402	486	1.25
	Pacific People	45	87	99	1.94
	non-M non-P	7,293	7,170	7,077	0.98
	Total	7,659	7,659	7,659	
Deciles 7-8	Māori	300	366	435	1.21
	Pacific People	33	51	54	1.61
	non-M non-P	2,844	2,760	2,688	0.97
	Total	3,177	3,177	3,177	
Deciles 9-10	Māori	741	1,020	1,077	1.37
	Pacific People	87	183	192	2.07
	non-M non-P	3,117	2,745	2,676	0.88
	Total	3,945	3,945	3,945	
65-77 years					
Deciles 1-6	Māori	192	222	282	1.15
	Pacific People	42	60	66	1.44
	non-M non-P	11,997	11,949	11,883	1.00
	Total	12,228	12,228	12,228	
Deciles 7-8	Māori	183	219	264	1.19
	Pacific People	12	18	24	1.61
	non-M non-P	5,256	5,217	5,166	0.99
	Total	5,454	5,454	5,454	
Deciles 9-10	Māori	465	555	621	1.19
	Pacific People	60	102	114	1.67
	non-M non-P	4,824	4,695	4,620	0.97
	Total	5,352	5,352	5,352	

Table 53: Stratification by age at death and small area deprivation (3 groups) (1991-94 census-mortality cohort)

Deciles of NZDep91	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>0-14 years</i>					
Deciles 1-6	Māori	6	18	27	3.05
	Pacific People	6	6	6	1.00
	non-M non-P	276	264	252	0.96
	Total	288	285	288	
Deciles 7-8	Māori	21	33	45	1.42
	Pacific People	6	6	9	0.95
	non-M non-P	117	108	90	0.92
	Total	147	147	147	
Deciles 9-10	Māori	54	93	120	1.83
	Pacific People	33	57	57	1.75
	non-M non-P	177	111	81	0.62
	Total	261	261	261	
<i>15-24 years</i>					
Deciles 1-6	Māori	33	63	93	1.86
	Pacific People	6	6	6	1.00
	non-M non-P	801	768	738	0.96
	Total	840	840	840	
Deciles 7-8	Māori	54	78	102	1.44
	Pacific People	18	18	24	1.09
	non-M non-P	321	297	267	0.92
	Total	393	393	393	
Deciles 9-10	Māori	108	162	192	1.51
	Pacific People	21	45	51	2.18
	non-M non-P	333	255	219	0.76
	Total	462	462	462	

(contd)

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Deciles of NZDep91	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
25-44 years					
Deciles 1-6	Māori	111	147	177	1.31
	Pacific People	27	33	36	1.25
	non-M non-P	1,803	1,764	1,728	0.98
	Total	1,941	1,941	1,941	
Deciles 7-8	Māori	144	204	219	1.39
	Pacific People	18	39	39	1.94
	non-M non-P	693	621	600	0.89
	Total	858	858	858	
Deciles 9-10	Māori	297	402	441	1.34
	Pacific People	63	132	135	2.09
	non-M non-P	774	603	561	0.78
	Total	1,140	1,140	1,140	
45-64 years					
Deciles 1-6	Māori	369	486	564	1.32
	Pacific People	45	90	99	2.05
	non-M non-P	6,396	6,231	6,144	0.97
	Total	6,807	6,807	6,807	
Deciles 7-8	Māori	360	462	513	1.28
	Pacific People	57	90	93	1.64
	non-M non-P	2,346	2,205	2,160	0.94
	Total	2,760	2,760	2,760	
Deciles 9-10	Māori	888	1,167	1,230	1.31
	Pacific People	153	240	243	1.57
	non-M non-P	2,607	2,244	2,178	0.86
	Total	3,654	3,654	3,654	
65-77 years					
Deciles 1-6	Māori	255	288	342	1.13
	Pacific People	36	60	63	1.69
	non-M non-P	11,571	11,514	11,454	1.00
	Total	11,862	11,862	11,862	
Deciles 7-8	Māori	249	318	369	1.27
	Pacific People	42	72	78	1.67
	non-M non-P	4,713	4,617	4,560	0.98
	Total	5,007	5,007	5,007	
Deciles 9-10	Māori	516	648	696	1.26
	Pacific People	126	204	207	1.61
	non-M non-P	4,251	4,041	3,990	0.95
	Total	4,896	4,896	4,896	

Table 54: Stratification by age at death and small area deprivation (3 groups) (1996-99 census-mortality cohort)**a: NMDS prioritised by census prioritised**

Deciles of NZDep96	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
<i>0-14 years</i>				
Deciles 1-6	Māori	36	39	1.09
	Pacific People	15	18	1.18
	Asian	12	12	1.18
	non-M non-P non-A	204	195	0.96
	Total	264	264	
Deciles 7-8	Māori	72	78	1.09
	Pacific People	6	6	1.00
	Asian	6	6	1.28
	non-M non-P non-A	81	72	0.91
	Total	162	162	
Deciles 9-10	Māori	129	141	1.08
	Pacific People	33	33	0.94
	Asian	6	6	1.00
	non-M non-P non-A	54	48	0.85
	Total	219	219	
<i>15-24 years</i>				
Deciles 1-6	Māori	75	111	1.48
	Pacific People	24	27	1.16
	Asian	27	33	1.13
	non-M non-P non-A	552	507	0.92
	Total	675	675	
Deciles 7-8	Māori	81	90	1.10
	Pacific People	12	15	1.15
	Asian	9	9	0.88
	non-M non-P non-A	168	162	0.95
	Total	273	273	
Deciles 9-10	Māori	234	243	1.04
	Pacific People	57	60	1.07
	Asian	6	6	1.00
	non-M non-P non-A	171	156	0.93
	Total	465	465	

(contd)

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Deciles of NZDep96	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
25-44 years				
Deciles 1-6	Māori	225	267	1.20
	Pacific People	57	69	1.23
	Asian	57	57	0.99
	non-M non-P non-A	1,512	1,452	0.96
	Total	1,848	1,848	
Deciles 7-8	Māori	240	264	1.10
	Pacific People	66	66	1.02
	Asian	36	30	0.91
	non-M non-P non-A	600	579	0.96
	Total	945	945	
Deciles 9-10	Māori	531	558	1.05
	Pacific People	171	174	1.03
	Asian	21	21	1.07
	non-M non-P non-A	459	426	0.93
	Total	1,182	1,182	
45-64 years				
Deciles 1-6	Māori	561	642	1.14
	Pacific People	144	144	0.99
	Asian	138	144	1.06
	non-M non-P non-A	5,613	5,526	0.99
	Total	6,456	6,456	
Deciles 7-8	Māori	606	633	1.04
	Pacific People	132	126	0.96
	Asian	45	48	1.04
	non-M non-P non-A	1,974	1,953	0.99
	Total	2,757	2,757	
Deciles 9-10	Māori	1,443	1,455	1.01
	Pacific People	366	360	0.98
	Asian	39	42	1.08
	non-M non-P non-A	1,605	1,596	0.99
	Total	3,453	3,453	

(contd)

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Deciles of NZDep96	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
65-77 years				
Deciles 1-6	Māori	411	495	1.20
	Pacific People	135	126	0.94
	Asian	129	117	0.93
	non-M non-P non-A	10,449	10,383	0.99
	Total	11,124	11,124	
Deciles 7-8	Māori	453	474	1.05
	Pacific People	105	99	0.95
	Asian	39	39	1.02
	non-M non-P non-A	4,251	4,230	1.00
	Total	4,848	4,848	
Deciles 9-10	Māori	1,008	1,035	1.03
	Pacific People	315	300	0.95
	Asian	33	36	1.11
	non-M non-P non-A	3,498	3,480	1.00
	Total	4,854	4,854	

b: NMDS sole by census sole

Deciles of NZDep96	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
<i>0-14 years</i>				
Deciles 1-6	Māori	27	18	0.68
	Pacific People	6	6	1.00
	Asian	9	12	1.17
	non-M non-P non-A	222	228	1.03
	Total	264	264	
Deciles 7-8	Māori	48	42	0.88
	Pacific People	6	6	0.43
	Asian	6	6	2.00
	non-M non-P non-A	108	111	1.05
	Total	162	162	
Deciles 9-10	Māori	105	93	0.89
	Pacific People	30	24	0.83
	Asian	6	6	
	non-M non-P non-A	81	96	1.18
	Total	219	219	
<i>15-24 years</i>				
Deciles 1-6	Māori	48	36	0.75
	Pacific People	15	12	0.80
	Asian	24	21	1.00
	non-M non-P non-A	585	603	1.03
	Total	675	675	
Deciles 7-8	Māori	63	51	0.75
	Pacific People	9	6	0.50
	Asian	9	9	0.88
	non-M non-P non-A	192	213	1.11
	Total	273	273	
Deciles 9-10	Māori	204	159	0.79
	Pacific People	48	51	1.05
	Asian	6	6	1.00
	non-M non-P non-A	204	243	1.20
	Total	465	465	

(contd)

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Deciles of NZDep96	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
25-44 years				
Deciles 1-6	Māori	204	144	0.71
	Pacific People	51	48	1.00
	Asian	54	51	0.91
	non-M non-P non-A	1,539	1,602	1.04
	Total	1,848	1,848	
Deciles 7-8	Māori	213	180	0.84
	Pacific People	60	45	0.75
	Asian	30	30	1.05
	non-M non-P non-A	642	687	1.07
	Total	945	945	
Deciles 9-10	Māori	495	402	0.81
	Pacific People	165	156	0.96
	Asian	18	21	1.17
	non-M non-P non-A	504	603	1.19
	Total	1,182	1,182	
45-64 years				
Deciles 1-6	Māori	510	450	0.88
	Pacific People	135	120	0.87
	Asian	132	141	1.06
	non-M non-P non-A	5,676	5,748	1.01
	Total	6,456	6,456	
Deciles 7-8	Māori	576	480	0.83
	Pacific People	120	108	0.89
	Asian	42	42	1.06
	non-M non-P non-A	2,016	2,124	1.05
	Total	2,757	2,757	
Deciles 9-10	Māori	1,386	1,245	0.90
	Pacific People	360	339	0.93
	Asian	39	36	1.01
	non-M non-P non-A	1,665	1,833	1.10
	Total	3,453	3,453	

(contd)

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Deciles of NZDep96	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
65-77 years				
Deciles 1-6	Māori	366	303	0.83
	Pacific People	126	99	0.80
	Asian	123	108	0.89
	non-M non-P non-A	10,512	10,611	1.01
	Total	11,124	11,124	
Deciles 7-8	Māori	411	357	0.87
	Pacific People	96	84	0.89
	Asian	36	39	1.05
	non-M non-P non-A	4,302	4,365	1.02
	Total	4,848	4,848	
Deciles 9-10	Māori	951	846	0.89
	Pacific People	303	282	0.93
	Asian	30	33	1.04
	non-M non-P non-A	3,573	3,696	1.04
	Total	4,854	4,854	

Table 55: Stratification by age at death and Regional Health Authority (2 groups) (1981-84 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>0-14 years</i>					
Northern and Midland	Māori	84	114	141	1.35
	Pacific People	15	30	33	1.78
	non-M non-P	360	318	288	0.88
	Total	462	462	462	
Central and Southern	Māori	30	60	78	1.98
	Pacific People	6	18	21	2.26
	non-M non-P	390	351	327	0.90
	Total	429	429	429	
<i>15-24 years</i>					
Northern and Midland	Māori	183	222	273	1.22
	Pacific People	39	51	54	1.37
	non-M non-P	783	726	675	0.93
	Total	1,002	1,002	1,002	
Central and Southern	Māori	48	90	123	1.82
	Pacific People	9	12	15	1.50
	non-M non-P	816	774	741	0.95
	Total	876	876	876	
<i>25-44 years</i>					
Northern and Midland	Māori	366	420	477	1.14
	Pacific People	48	75	78	1.54
	non-M non-P	1,416	1,338	1,278	0.95
	Total	1,833	1,833	1,833	
Central and Southern	Māori	123	162	210	1.34
	Pacific People	18	36	36	1.69
	non-M non-P	1,557	1,494	1,452	0.97
	Total	1,695	1,695	1,695	

(contd)

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RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>45-64 years</i>					
Northern and Midland	Māori	1,077	1,176	1,329	1.09
	Pacific People	105	174	186	1.63
	non-M non-P	6,429	6,267	6,099	0.98
	Total	7,614	7,614	7,614	
Central and Southern	Māori	324	402	501	1.24
	Pacific People	24	24	27	1.06
	non-M non-P	7,500	7,422	7,320	0.99
	Total	7,845	7,845	7,845	
<i>65-77 years</i>					
Northern and Midland	Māori	690	744	864	1.08
	Pacific People	69	102	108	1.45
	non-M non-P	10,002	9,918	9,792	0.99
	Total	10,764	10,764	10,764	
Central and Southern	Māori	183	231	321	1.28
	Pacific People	18	30	36	1.87
	non-M non-P	11,991	11,928	11,832	1.00
	Total	12,189	12,189	12,189	

Table 56: Stratification by age at death and Regional Health Authority (2 groups) (1986-89 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>0-14 years</i>					
Northern and Midland	Māori	69	102	144	1.48
	Pacific People	12	36	42	2.50
	non-M non-P	342	288	240	0.84
	Total	426	426	426	
Central and Southern	Māori	21	45	72	1.85
	Pacific People	18	15	18	0.70
	non-M non-P	339	324	291	0.96
	Total	381	381	381	
<i>15-24 years</i>					
Northern and Midland	Māori	165	240	312	1.45
	Pacific People	21	39	57	1.68
	non-M non-P	873	780	693	0.90
	Total	1,059	1,059	1,059	
Central and Southern	Māori	48	87	126	1.80
	Pacific People	12	21	30	1.95
	non-M non-P	867	819	771	0.94
	Total	927	927	927	
<i>25-44 years</i>					
Northern and Midland	Māori	318	477	552	1.50
	Pacific People	72	129	144	1.77
	non-M non-P	1,680	1,470	1,374	0.87
	Total	2,070	2,070	2,070	
Central and Southern	Māori	129	183	216	1.40
	Pacific People	27	48	51	1.76
	non-M non-P	1,668	1,596	1,554	0.96
	Total	1,824	1,824	1,824	

(contd)

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RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>45-64 years</i>					
Northern and Midland	Māori	972	1,254	1,389	1.29
	Pacific People	117	237	258	2.04
	non-M non-P	6,387	5,985	5,826	0.94
	Total	7,476	7,476	7,476	
Central and Southern	Māori	390	531	606	1.35
	Pacific People	48	84	84	1.73
	non-M non-P	6,864	6,690	6,615	0.98
	Total	7,305	7,305	7,305	
<i>65-77 years</i>					
Northern and Midland	Māori	639	735	843	1.15
	Pacific People	84	135	156	1.58
	non-M non-P	10,302	10,155	10,026	0.99
	Total	11,025	11,025	11,025	
Central and Southern	Māori	201	258	318	1.29
	Pacific People	27	48	48	1.58
	non-M non-P	11,781	11,706	11,643	0.99
	Total	12,009	12,009	12,009	

Table 57: Stratification by age at death and Regional Health Authority (2 groups) (1991-94 census-mortality cohort)

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>0-14 years</i>					
Northern and Midland	Māori	57	96	114	1.62
	Pacific People	39	57	63	1.46
	non-M non-P	300	249	222	0.82
	Total	396	396	396	
Central and Southern	Māori	24	51	78	2.27
	Pacific People	6	12	15	2.27
	non-M non-P	270	234	204	0.87
	Total	300	300	300	
<i>15-24 years</i>					
Northern and Midland	Māori	150	192	240	1.28
	Pacific People	27	57	57	1.98
	non-M non-P	693	624	576	0.90
	Total	873	873	873	
Central and Southern	Māori	45	108	150	2.49
	Pacific People	15	15	21	0.89
	non-M non-P	762	702	648	0.92
	Total	822	822	822	
<i>25-44 years</i>					
Northern and Midland	Māori	441	525	600	1.20
	Pacific People	96	165	171	1.75
	non-M non-P	1,698	1,542	1,461	0.91
	Total	2,232	2,232	2,232	
Central and Southern	Māori	120	225	243	1.91
	Pacific People	15	39	36	2.64
	non-M non-P	1,575	1,446	1,428	0.92
	Total	1,707	1,707	1,707	

(contd)

Unlocking the Numerator-Denominator Bias for the 1980s and 1990s

RHA	Ethnic groups	Death reg form	Census sole	Census prioritised	Census sole to death reg ratio
<i>45-64 years</i>					
Northern and Midland	Māori	1,317	1,551	1,662	1.18
	Pacific People	186	315	324	1.69
	non-M non-P	5,544	5,184	5,064	0.94
	Total	7,050	7,050	7,050	
Central and Southern	Māori	300	564	645	1.87
	Pacific People	69	111	108	1.61
	non-M non-P	5,799	5,493	5,415	0.95
	Total	6,171	6,171	6,171	
<i>65-77 years</i>					
Northern and Midland	Māori	825	912	993	1.11
	Pacific People	168	273	282	1.63
	non-M non-P	9,621	9,426	9,333	0.98
	Total	10,611	10,611	10,611	
Central and Southern	Māori	198	348	414	1.75
	Pacific People	39	60	66	1.67
	non-M non-P	10,917	10,743	10,674	0.98
	Total	11,154	11,154	11,154	

Table 58: Stratification by age at death and Regional Health Authority (2 groups) (1996-99 census-mortality cohort)**a: NMDS prioritised by census prioritised**

RHA	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
<i>0-14 years</i>				
Northern and Midland	Māori	174	192	1.09
	Pacific People	39	42	1.08
	Asian	12	15	1.09
	non-M non-P non-A	171	150	0.88
	Total	402	402	
Central and Southern	Māori	57	63	1.05
	Pacific People	15	9	0.79
	Asian	6	6	1.63
	non-M non-P non-A	171	168	0.99
	Total	243	243	
<i>15-24 years</i>				
Northern and Midland	Māori	270	300	1.12
	Pacific People	75	84	1.11
	Asian	24	24	1.03
	non-M non-P non-A	426	387	0.91
	Total	795	795	
Central and Southern	Māori	117	141	1.17
	Pacific People	15	18	1.10
	Asian	21	21	1.07
	non-M non-P non-A	462	438	0.95
	Total	618	618	
<i>25-44 years</i>				
Northern and Midland	Māori	705	753	1.07
	Pacific People	228	237	1.05
	Asian	78	78	1.01
	non-M non-P non-A	1,227	1,170	0.95
	Total	2,235	2,235	
Central and Southern	Māori	291	342	1.16
	Pacific People	69	75	1.11
	Asian	36	33	0.92
	non-M non-P non-A	1,341	1,290	0.96
	Total	1,740	1,740	

(contd)

Unlocking the Numerator-Denominator Bias for the 1980s and 1990s

RHA	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
<i>45-64 years</i>				
Northern and Midland	Māori	1,851	1,896	1.02
	Pacific People	483	474	0.98
	Asian	150	159	1.06
	non-M non-P non-A	4,380	4,335	0.99
	Total	6,864	6,864	
Central and Southern	Māori	759	831	1.09
	Pacific People	162	156	0.97
	Asian	69	75	1.06
	non-M non-P non-A	4,812	4,740	0.99
	Total	5,802	5,802	
<i>65-77 years</i>				
Northern and Midland	Māori	1,377	1,428	1.04
	Pacific People	444	417	0.94
	Asian	132	126	0.95
	non-M non-P non-A	8,445	8,424	1.00
	Total	10,398	10,398	
Central and Southern	Māori	498	579	1.16
	Pacific People	111	111	0.97
	Asian	66	72	1.04
	non-M non-P non-A	9,750	9,669	0.99
	Total	10,428	10,428	

b: NMDS sole by census sole

RHA	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
<i>0-14 years</i>				
Northern and Midland	Māori	132	120	0.89
	Pacific People	33	27	0.83
	Asian	9	15	1.49
	non-M non-P non-A	228	243	1.07
	Total	402	402	
Central and Southern	Māori	48	36	0.75
	Pacific People	9	6	0.76
	Asian	6	6	2.00
	non-M non-P non-A	186	198	1.07
	Total	243	243	
<i>15-24 years</i>				
Northern and Midland	Māori	225	165	0.73
	Pacific People	60	60	1.01
	Asian	21	21	0.94
	non-M non-P non-A	486	549	1.13
	Total	795	795	
Central and Southern	Māori	90	78	0.88
	Pacific People	15	9	0.64
	Asian	18	18	1.00
	non-M non-P non-A	492	510	1.03
	Total	618	618	
<i>25-44 years</i>				
Northern and Midland	Māori	642	516	0.81
	Pacific People	207	192	0.91
	Asian	72	75	1.05
	non-M non-P non-A	1,314	1,452	1.11
	Total	2,235	2,235	
Central and Southern	Māori	276	213	0.77
	Pacific People	63	60	0.96
	Asian	33	30	0.90
	non-M non-P non-A	1,371	1,440	1.05
	Total	1,740	1,740	

(contd)

Unlocking the Numerator-Denominator Bias for the 1980s and 1990s

RHA	Ethnic groups	NMDS sole	Census sole	Census sole to NMDS sole ratio
<i>45-64 years</i>				
Northern and Midland	Māori	1,755	1,536	0.87
	Pacific People	462	423	0.92
	Asian	147	153	1.04
	non-M non-P non-A	4,497	4,752	1.06
	Total	6,864	6,864	
Central and Southern	Māori	717	642	0.90
	Pacific People	159	138	0.88
	Asian	63	69	1.08
	non-M non-P non-A	4,863	4,953	1.02
	Total	5,802	5,802	
<i>65-77 years</i>				
Northern and Midland	Māori	1,284	1,107	0.86
	Pacific People	417	375	0.90
	Asian	126	114	0.91
	non-M non-P non-A	8,571	8,805	1.03
	Total	10,398	10,398	
Central and Southern	Māori	444	399	0.90
	Pacific People	108	93	0.86
	Asian	63	63	1.02
	non-M non-P non-A	9,816	9,873	1.01
	Total	10,428	10,428	

Table 59: Stratification by age at death and cause of death (2 groups) (1981-84 census-mortality cohort)

Cause of death	Ethnic groups	Death reg form	Census Sole	Census Sole to death reg ratio
<i>0-14 years</i>				
Injury/Suicide	Māori	54	78	1.45
	non-M	324	303	0.93
	Total	378	378	
Non Injury/Suicide	Māori	57	93	1.58
	non-M	450	414	0.92
	Total	510	510	
<i>15-24 years</i>				
Injury/Suicide	Māori	159	204	1.28
	non-M	1,161	1116	0.96
	Total	1,320	1,320	
Non Injury/Suicide	Māori	75	108	1.49
	non-M	483	450	0.93
	Total	558	558	
<i>25-44 years</i>				
Injury/Suicide	Māori	132	159	1.21
	non-M	966	942	0.97
	Total	1,098	1,098	
Non Injury/Suicide	Māori	360	423	1.18
	non-M	2,067	2,004	0.97
	Total	2,427	2,427	
<i>45-64 years</i>				
Injury/Suicide	Māori	57	66	1.17
	non-M	690	681	0.99
	Total	747	747	
Non Injury/Suicide	Māori	1,347	1,512	1.12
	non-M	13,365	13,203	0.99
	Total	14,712	14,712	
<i>65-77 years</i>				
Injury/Suicide	Māori	12	18	1.22
	non-M	519	519	0.99
	Total	531	531	
Non Injury/Suicide	Māori	858	957	1.12
	non-M	21,561	21,462	1.00
	Total	22,419	22,419	

Table 60: Stratification by age at death and cause of death (2 groups) (1986-89 census-mortality cohort)

Cause of death	Ethnic groups	Death reg form	Census Sole	Census Sole to death reg ratio
<i>0-14 years</i>				
Injury/Suicide	Māori	42	78	1.89
	non-M	270	234	0.86
	Total	312	312	
Non Injury/Suicide	Māori	51	66	1.31
	non-M	444	429	0.96
	Total	495	495	
<i>15-24 years</i>				
Injury/Suicide	Māori	177	258	1.48
	non-M	1,311	1,230	0.94
	Total	1,488	1,488	
Non Injury/Suicide	Māori	42	69	1.74
	non-M	462	432	0.94
	Total	501	501	
<i>25-44 years</i>				
Injury/Suicide	Māori	150	225	1.49
	non-M	1,344	1,272	0.95
	Total	1,497	1,497	
Non Injury/Suicide	Māori	297	432	1.46
	non-M	2,103	1,965	0.94
	Total	2,400	2,400	
<i>45-64 years</i>				
Injury/Suicide	Māori	45	66	1.44
	non-M	783	762	0.98
	Total	828	828	
Non Injury/Suicide	Māori	1,317	1,719	1.30
	non-M	12,636	12,234	0.97
	Total	13,953	13,953	
<i>65-77 years</i>				
Injury/Suicide	Māori	9	12	1.20
	non-M	444	441	1.00
	Total	453	453	
Non Injury/Suicide	Māori	831	978	1.18
	non-M	21,753	21,603	0.99
	Total	22,584	22,584	

Table 61: Stratification by age at death and cause of death (2 groups) (1991-94 census-mortality cohort)

Cause of death	Ethnic groups	Death reg form	Census Sole	Census Sole to death reg ratio
<i>0-14 years</i>				
Injury/Suicide	Māori	36	69	1.98
	non-M	240	204	0.86
	Total	273	273	
Non Injury/Suicide	Māori	48	75	1.66
	non-M	375	345	0.92
	Total	420	420	
<i>15-24 years</i>				
Injury/Suicide	Māori	144	216	1.52
	non-M	1,149	1,077	0.94
	Total	1,293	1,293	
Non Injury/Suicide	Māori	48	84	1.65
	non-M	351	318	0.91
	Total	402	402	
<i>25-44 years</i>				
Injury/Suicide	Māori	159	228	1.45
	non-M	1,302	1,227	0.95
	Total	1,458	1,458	
Non Injury/Suicide	Māori	399	522	1.31
	non-M	2,082	1,959	0.94
	Total	2,481	2,481	
<i>45-64 years</i>				
Injury/Suicide	Māori	60	69	1.12
	non-M	633	627	0.99
	Total	693	693	
Non Injury/Suicide	Māori	1,557	2,046	1.31
	non-M	10,968	10,482	0.96
	Total	12,525	12,525	
<i>65-77 years</i>				
Injury/Suicide	Māori	21	24	1.24
	non-M	378	375	0.99
	Total	399	399	
Non Injury/Suicide	Māori	1,002	1,230	1.23
	non-M	20,361	20,133	0.99
	Total	21,363	21,363	

Table 62: Stratification by age at death and cause of death (2 groups) (1996-99 census-mortality cohort)

Cause of death	Ethnic groups	NMDS prioritised	Census prioritised	Census prioritised to NMDS prioritised ratio
<i>0-14 years</i>				
Injury/Suicide	Māori	117	123	1.06
	non-M	156	150	0.96
	Total	273	273	
Non Injury/Suicide	Māori	117	132	1.11
	non-M	255	240	0.95
	Total	372	372	
<i>15-24 years</i>				
Injury/Suicide	Māori	291	333	1.13
	non-M	750	714	0.95
	Total	1,044	1,044	
Non Injury/Suicide	Māori	96	111	1.14
	non-M	273	258	0.95
	Total	369	369	
<i>25-44 years</i>				
Injury/Suicide	Māori	330	357	1.08
	non-M	1,086	1,059	0.97
	Total	1,416	1,416	
Non Injury/Suicide	Māori	666	732	1.10
	non-M	1,893	1,827	0.97
	Total	2,559	2,559	
<i>45-64 years</i>				
Injury/Suicide	Māori	96	108	1.11
	non-M	603	591	0.98
	Total	699	699	
Non Injury/Suicide	Māori	2,514	2,619	1.04
	non-M	9,450	9,345	0.99
	Total	11,964	11,964	
<i>65-77 years</i>				
Injury/Suicide	Māori	15	15	1.08
	non-M	378	378	1.00
	Total	393	393	
Non Injury/Suicide	Māori	1,860	1,992	1.07
	non-M	18,573	18,441	0.99
	Total	20,433	20,433	

Appendix 2: Table of variables used in the HPL data-set

Variable Name	Original Var Name	81	86	91	96	Format	Description
AgeAtDeath	AgeAtDeath	+	+	+	+	faged.	Age at Death (NMDS)
CauseDeath	CauseDeath	+	+	+	+	f4dth.	Cause of Death (4 groups)
CenYear	CenYear	+	+	+	+	81,86,91,96	Year of Census
CntryPA	CntryPA	-	+	+	+	fctyPA.	Country of Birth (PI/Asia)
EthCenCh5		+	-	-	-	\$f3eth.	Ethnicity (Census)
EthCenCh5_A	EthnicityA	-	+	+	+	\$f3eth.	Ethnicity (Census) -A
EthCenCh5_B	EthnicityB	-	+	+	+	\$f3eth.	Ethnicity (Census) -B
EthCenCh5_C	EthnicityC	-	+	+	+	\$f3eth.	Ethnicity (Census) -C
EthCenGp4	eth_nmds	+	-	-	-	f4eth.	Ethnicity (Census)
EthCenGp5	c_ethnic	+	-	-	-	f4eth.	Ethnicity (Census)
EthCenPr4	EthCPr	-	-	+	-	f4eth.	Ethnicity (Census) -Prior
EthCenSol4	EthCSol	-	-	+	-	f4eth.	Ethnicity (Census) -Sole
EthNHICH5	EthNHI	-	+	+	-	\$f3eth.	Ethnicity (NHI)
EthNHICH5_A	ethnhi1	-	-	-	+	\$f3eth.	Ethnicity (NHI) -A
EthNHICH5_B	ethnhi2	-	-	-	+	\$f3eth.	Ethnicity (NHI) -B
EthNHICH5_C	ethnhi3	-	-	-	+	\$f3eth.	Ethnicity (NHI) -C
EthNMDSCh3	EthNMDS	-	+	+	-	\$f3eth.	Ethnicity (NMDS)
EthNMDSCh5_A	ethnmds1	-	-	-	+	\$f3eth.	Ethnicity (NMDS) -A
EthNMDSCh5_B	ethnmds2	-	-	-	+	\$f3eth.	Ethnicity (NMDS) -A
EthNMDSCh5_C	ethnmds3	-	-	-	+	\$f3eth.	Ethnicity (NMDS) -A
EthNMDSGp3	eth_nmds_3	+	-	+	-	f4eth.	Ethnicity (NMDS)
G_RHA	rha89mb96_c	+	+	+	+	frha.	Regional Health Authority (1989 AHB) (Census)
G_Rurality	RI96mb96_c	+	+	+	+	frural.	Rurality Indicator (Census)
ID_Unlock	ID_Unlock	+	+	+	+	[Unnnnnnn]	Unique Unlock Id
MaoriAnc	mdesc	-	-	+	+	f91Maor.; f96Maor.	Māori Ancestry Indicator
MaoriDes	Maori	+	+	-	-	f81Maor.; f86Maor.	Māori Descent Indicator
MBFlag	MBFlag	+	+	+	+	fLMB.	Linked on Meshblock Pass

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Variable Name	Original Var Name	81	86	91	96	Format	Description
NMDSFlag	NMDSFlag	+	+	+	+	fNMDSF.	Data exact for NMDS variables
NZDepFour	NZDepFour	+	+	+	+	fdep4g.	NZ Deprivation 1996 scale (4 groups);NZ Deprivation 1991 scale (4 groups);NZ Deprivation 1996 scale (4 groups)
PerFolUP	PeriodofFollowup	+	+	+	+	fPFU.	Period of Follow-Up years after census
Sex	sex	+	+	+	+	fvsex.	Sex (Census)

Appendix 3: Ethnicity question on the census and death registration form

A. CENSUS

Figure 19: Ethnicity question on the 1981 census

12. ETHNIC ORIGIN(*):

EITHER (A) IF OF ONLY ONE (FULL) ORIGIN, TICK BOX WHICH APPLIES:

Full European, or full Caucasian	<input type="checkbox"/>	Full N.Z. Māori	<input type="checkbox"/>	Full Samoan	<input type="checkbox"/>	Full Cook Is. Māori	<input type="checkbox"/>	Full Chinese	<input type="checkbox"/>	Full Indian	<input type="checkbox"/>
Full Niuean	<input type="checkbox"/>	Full Tongan	<input type="checkbox"/>	Other Full origin	<input type="checkbox"/>	→ SPECIFY:					

(e.g. Tokelauan, Japanese, Vietnamese)

OR (B) IF MORE THAN ONE ORIGIN, GIVE PARTICULARS:

.....

(e.g. 7/8 European+1/8 N.Z. Māori; 3/4 N.Z. Māori+1/4 Niuean; 1/2 Chinese+1/4 European + 1/4 Samoan)

Figure 20: Ethnicity question on the 1986 census

9 What is your ethnic origin?

Tick the box or boxes which apply to you

1 European

2 New Zealand Māori

3 Samoan

4 Cook Island Māori

5 Niuean

6 Tongan

7 Chinese

8 Indian

9 Other (such as Fijian, Tokelauan)

↓

Please state

Figure 21: Ethnicity question on the 1991 census

7 Which ethnic group do you belong to?

Tick the box or boxes which apply to you

15 New Zealand European

16 New Zealand Māori

17 Samoan

18 Cook Island Māori

19 Tongan

20 Niuean

21 Chinese

22 Indian

23 Other (such as Dutch, Japanese, Tokelauan)

Please state

Figure 22: Ethnicity question on the 1996 census

10 Tick as many circles as you need to show which ethnic group(s) you belong to.

N.Z. Māori

NZ European, or Pākehā

other European → Which of these groups?

Samoan

Cook Island Māori

Tongan

Niuean

Chinese

Indian

Other (such as FIJIAN, → Print your ethnic group(s)
KOREAN)

English

Dutch

Australian

Scottish

Irish

other

B. DEATH REGISTRATION FORM

Figure 23: Ethnicity question on the death registration form (prior to September 1995)

22. Father: Degree of	{	Maori blood and tribe (if any) of father of deceased:
		Pacific island blood –state which island):
23. Mother: Degree of	{	Maori blood and tribe (if any) of mother of deceased:
		Pacific island blood –state which island):

Figure 24: Ethnicity question on the death registration form (post September 1995)

14	<p>Ethnic group(s) Tick as many circles as needed to show which ethnic group(s) deceased belonged to</p> <p> <input type="radio"/> N.Z. Māori <input type="radio"/> NZ European, or Pākehā <input type="radio"/> other European <input type="radio"/> Samoan <input type="radio"/> Cook Island Māori <input type="radio"/> Tongan <input type="radio"/> Niuean <input type="radio"/> Chinese <input type="radio"/> Indian <input type="radio"/> Other (such as <i>Fijian, Vietnamese</i>) </p> <p>Print other ethnic group(s) here <input style="width: 150px; height: 15px;" type="text"/></p>	<p>Which of these groups?</p> <p> <input type="radio"/> Dutch <input type="radio"/> English <input type="radio"/> Australian <input type="radio"/> Scottish <input type="radio"/> other <input type="radio"/> Irish </p>
<p>Was the deceased descended from a New Zealand Māori <input type="radio"/> No <input type="radio"/> Don't know <input type="radio"/> Yes</p>		